Educational Communications and Technology:
Issues and Innovations

Brad Hokanson · Marisa Exter
Amy Grincewicz · Matthew Schmidt
Andrew A. Tawfik *Editors*

Learning: Design, Engagement and Definition

Interdisciplinarity and learning

AECT
ASSOCIATION FOR EDUCATIONAL COMMUNICATIONS & TECHNOLOGY

Springer

Educational Communications and Technology: Issues and Innovations

This book series, published collaboratively between the AECT (Association for Educational Communications and Technology) and Springer, represents the best and most cutting edge research in the field of educational communications and technology. The mission of the series is to document scholarship and best practices in the creation, use, and management of technologies for effective teaching and learning in a wide range of settings. The publication goal is the rapid dissemination of the latest and best research and development findings in the broad area of educational information science and technology. As such, the volumes will be representative of the latest research findings and developments in the field. Volumes will be published on a variety of topics, including:

- Learning Analytics
- Distance Education
- Mobile Learning Technologies
- Formative Feedback for Complex Learning
- Personalized Learning and Instruction
- Instructional Design
- Virtual tutoring

Additionally, the series will publish the bi-annual AECT symposium volumes, the Educational Media and Technology Yearbooks, and the extremely prestigious and well known, Handbook of Research on Educational Communications and Technology. Currently in its 4th volume, this large and well respected Handbook will serve as an anchor for the series and a completely updated version is anticipated to publish once every 5 years.

The intended audience for Educational Communications and Technology: Issues and Innovations is researchers, graduate students and professional practitioners working in the general area of educational information science and technology; this includes but is not limited to academics in colleges of education and information studies, educational researchers, instructional designers, media specialists, teachers, technology coordinators and integrators, and training professionals.

More information about this series at http://www.link.springer.com/series/11824

Brad Hokanson • Marisa Exter
Amy Grincewicz • Matthew Schmidt
Andrew A. Tawfik
Editors

Learning: Design, Engagement and Definition

Interdisciplinarity and learning

Springer

AECT
ASSOCIATION FOR EDUCATIONAL COMMUNICATIONS & TECHNOLOGY

Editors
Brad Hokanson
College of Design
University of Minnesota
Saint Paul, MN, USA

Marisa Exter
Learning Design and Technology
Purdue University
West Lafayette, IN, USA

Amy Grincewicz
Graduate Programs Office
Kent State University
Kent, OH, USA

Matthew Schmidt
University of Florida
Gainesville, FL, USA

Andrew A. Tawfik
Instruction Curriculum Leadership
University of Memphis
Memphis, TN, USA

ISSN 2625-0004 ISSN 2625-0012 (electronic)
Educational Communications and Technology: Issues and Innovations
ISBN 978-3-030-85077-7 ISBN 978-3-030-85078-4 (eBook)
https://doi.org/10.1007/978-3-030-85078-4

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Introduction

Even the world of instructional design and educational technology has been substantially changed due the COVID-19 virus, as it forced the Summer Research Symposium to be hosted completely online and to make numerous changes in the event. Connections were not as directly personal, and dinners were significantly less exotic and opportune. Not all the changes were negative however, as the online format of the symposium encouraged many more people to attend, allowed participation from home environments and locations, and still spurred engaging and interesting conversations among authors, participants, and graduate students.

Twenty-three authors presented and discussed their writing in the two-day event. The formal topic for this year's symposium was *Learning: Design, engagement and definition.* "Learning" is a widely discussed and broad topic. Exploring what we mean by learning and how that definition is applied can help us be better as practitioners and educators.

Chapter topics ranged from virtual reality interventions for people with autism, to investigating and presenting material culture, to working internationally in design. After other peer reviews and edits, the developed chapters are included in this book.

The founding task of the Summer Research Symposium is the broad examination of a given topic by a wide range of practitioners. This diversity is one of the most salient aspects of the symposium, mixing participants from all areas of education. Again this year, the participants valued highly the different disciplines and ideas presented. The discussion and interaction all built off the diverse capabilities of those present, within and without the traditional field of educational technology.

The symposium is held each summer on a topic of broad interest to those in educational technology and instructional design. Those fields, loosely defined, provide ample connection with researchers as well as educators of all stripes. The 2020 session attracted a wide breadth of participants to a structure that is significantly different from other professional venues.

As opposed to the traditional stand-and-present model of most academic conferences, the SRS seeks to engage all participants, presenters and attendees in conversations about the ideas presented. Sessions are all in a round table format, with multiple sessions leading to an improved written product. Non-authors engage with the authors, hearing and comparing different viewpoints and presentations. Every author is able to work with 10 to 20 other participants on their own writing, helping build and complete the work of a chapter.

Proposals, that is, *ideas*, for the symposium are anonymously selected from brief writings. Revised and expanded drafts are then invited providing the content of the symposium. These initial drafts are finished well before the symposium and all symposium participants, authors and discussants alike, are expected to read and be ready to comment on these chapters. This year, due to the number of accepted papers, all participants in the symposium were able to request preferred authors for the discussion sessions.

This illustrates a process that is different from most journals and conferences. There is much more engagement in the process with symposium attendees and with the editorial team. Among authors, this is ongoing discussion and sharing. Of course, most times, this in-person, live review is not part of a regular publication structure.

The symposium has also led to diverse forms of authorship, with teams, individuals, and student-faculty teams participating. Senior faculty participate both as individuals and as student mentors; new scholars complement those more established in the field. And one year's participants collaborate to author together in later years.

The methodology of the symposium is to discuss each chapter in small groups on multiple occasions. The author presents, and other participants, having read the work, off criticism and suggestions. Written comments from others are also accepted by the author. Lasting about a half an hour, this is an intense conversation with professional colleagues. After a brief break, the author is met with new discussants, offering additional comments and advice. Over the length of the symposium, each writing is critiqued through conversation with other authors as well as non-writing participants. This gives authors the opportunity to work closely with other people in the development of their work. A goal of the symposium is to develop everyone by improving the final product. It is the joint development of the finished book.

An important aspect of the symposium is the involvement of a broad range of those active in the field; non-authors, spectators, and beginning scholars that are seeking a stimulating and involved event. Those who wish to participate have access to all the first-draft papers, and by their involvement, should engage in discussions on the work. Beyond a role as spectator, they are an important part of the symposium process, commenting and questioning around the same table as the authors.

This process is derived from the "Pro-Action" café, a component of the Art of Hosting, which is a collection of methods of discussion, conversation, and convening. Here the process is being used to encourage meaningful discussion within the field of education.

After the live symposium, participants were asked to improve and develop a second draft of their article. Authors were paired for reviewing this next draft, and new revisions and changes were suggested. The original author completes the revision for submission as a final draft. It was then reviewed by the editorial team two additional times before it is submitted for publication. Of course, each chapter is also reviewed by the symposium editorial group as well.

Each year, the symposium has a different topic. Topics vary from year to year, addressing new and current themes of the profession. These topics are developed to allow a broad range of proposals while encouraging a general focus for the event. Previous years have looked at design, learning environments, and storytelling in education.

Within this volume, we sought to encourage examination of the act of learning: the definition, the planning, the process, and all the other aspects that join together in the educational process. Articles could focus on research practices, learning across disciplines, and on different educational levels.

Proposal Reviewers

A special thanks is offered to the reviewers for the 2020 Summer Research Symposium. They include:

Jill Stefaniak	Matthew Schmidt
Angelica Pazurek	Bruce Duboff
Jason MacDonald	Noah Glaser
Wendy Friedlander	Colin Gray
Ilene Dawn Alexander	Amie Norden
Jody Nyboer	Greg Clinton
Marisa Exter	Phil Harris
Andrew A. Tawfik	

AECT Staff

The symposium has grown with the active support of the Board and administration of AECT. Thanks go to Larry Vernon and Terri Lawson for their work and assistance with operating the event. Dr. Phil Harris, as AECT Executive Director, has continued to support, participate, run a boom mike, and guide the symposium. Stephen Peters has continued to provide outside editorial support with humor and grace.

Minneapolis, MN, USA Brad Hokanson

Contents

A Framework for Scholarship on Instructed Learning

Michael H. Molenda

Need for a Conceptual Framework

Most fields of science and social science have widely accepted theoretical frameworks—such as the periodic table provides for chemistry and Newtonian theory provides for traditional physics. These theoretical structures show “where things fit” within the big picture. They provide targets for other theories to try to undermine or supplant. As Robert K. Merton, the pioneer of theory in sociology, put it: the “notion of directed research implies that, in part, empirical inquiry is so organized that if and when empirical uniformities are discovered, they have direct consequences for a theoretic system” (1957, pp. 150–151). In other words, research questions should show some connection with some grand framework: What variables are you dealing with, and where do they fit in the big picture? If this is done, chances are good that the findings can confirm or cast doubt on constructs and principles of which the theory is composed. If research projects are not linked to some larger theory, how can they be contributing to the advancement of understanding?

Furthermore, the development of theory requires not only a theoretical framework, but also a set of constructs that have meanings shared by scholars. If the

This chapter is based on Chapter 2 in: Michael H. Molenda and Deepak Prem Subramony, *The Elements of Instruction: A Framework for the Age of Emerging Technologies*, published by Routledge (2021).
The author acknowledges the exceptionally valuable contributions of Victoria L. Lowell and Marisa Exter of Learning Design and Technology, Purdue University, for their insightful and constructive critiques.

M. H. Molenda (✉)
Department of Instructional Systems Technology, Indiana University, Bloomington, IN, USA
e-mail: molenda@indiana.edu

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*,
Educational Communications and Technology: Issues and Innovations,
https://doi.org/10.1007/978-3-030-85078-4_1

words used in scholarly discourse are used with different meanings by different authors, there is no hope of clear communication, much less contribution to theory-building.

The field of pedagogy lacks any such agreed-upon framework and also agreed-upon meanings for key constructs, such as instruction, learning, method, and media. There are some of what Hans Zetterberg (1962) calls "miniature theories," theories pertaining to how two or three variables are related to each other, but few grand theories and fewer conceptual frameworks. This lack has been noticed by a number of other scholars. For one example, Reigeluth and Carr-Chellman (2009) have attempted to construct a definitional schema around "instruction." For another, Merrill (2013) proposed an extensive set of terms and definitions pertinent to instructional design. For a third example, Frick (2019) proposed a new set of terms around the concept of "educology." However, these authors do not agree among themselves on the definitions of key constructs, nor do any of them propose a comprehensive verbal–visual framework within which to place their terms and concepts. Merrill's verbal–visual framework for his "first principles" (2002), for example, is an example of a "miniature theory." It proposes that instructional design can be guided by a handful of principles, represented by the terms *problem*, *activation*, *demonstration*, *application*, and *integration*. All of these principles relate to the larger construct of Instruction, but they are not connected to the other factors surrounding Instruction, such as learner aptitude, learner motivation, teachers' abilities and motivations, peer influences, or the impact of different aspects of the classroom, school, or cultural environment.

Creating a Conceptual Framework

Finding an appropriate conceptual framework was the first step of the authors' project to establish some foundational concepts and terminology for the field of pedagogy. To do this, the authors needed a framework in which to place these concepts, a framework that would depict the major variables in the instructional process and the relationships among them. Such a framework should specify which factors *directly* affect learning (proximal) and also the factors that *indirectly* influence the success or failure of instructional interventions (distal).

Previous Attempts at a Framework

In our search through the literature for an appropriate framework, we discovered a number of attempts to depict visually the relationships among several factors associated with academic achievement, usually referred to as "models." The most widely discussed "models"—including those proposed by Carroll, Proctor, Cruickshank, and Gage and Berliner—are presented and compared by the William G. Huitt team

(McIlrath & Huitt, 1995). Each of these "models" identifies a number of variables linked to successful learning. However, each only accounts for only a small number of the variables found to be critical in subsequent research.

Our review uncovered one conceptual framework that was derived from a major meta-analysis of research on the factors associated with academic achievement. It emerged from the work of Herbert J. Walberg and associates, based on their meta-analysis of nearly 3000 quantitative studies of factors associated with successful achievement (Walberg, 1984). They produced a flow diagram of causative factors, shown in Fig. 1. Walberg's research group continued to publish reports on educational productivity (Fraser et al., 1987; Monk et al., 2001) but did not alter the 1984 verbal–visual model. We, therefore, take the 1984 diagram to be the operative visual summary of the Walberg group's research syntheses.

The Walberg diagram was helpful in identifying the factors most directly related to academic achievement—Aptitude, Instruction, and Environment—providing a place to start in imagining a more comprehensive framework. It was also useful in providing a basket of factors that needed to be included in any comprehensive framework—the nine numbered subfactors shown in Fig. 1—Ability, Development, Motivation, Amount of Instruction, Quality of Instruction, Home, Classroom, Peers, and Media. However, it was less informative about where those factors fit in relation to each other. Which were causes and which were effects? Finally, the Walberg diagram was silent about the many other factors that influence learning beyond those "top 9," including, for example, locus-of-control, self-efficacy, personal interest,

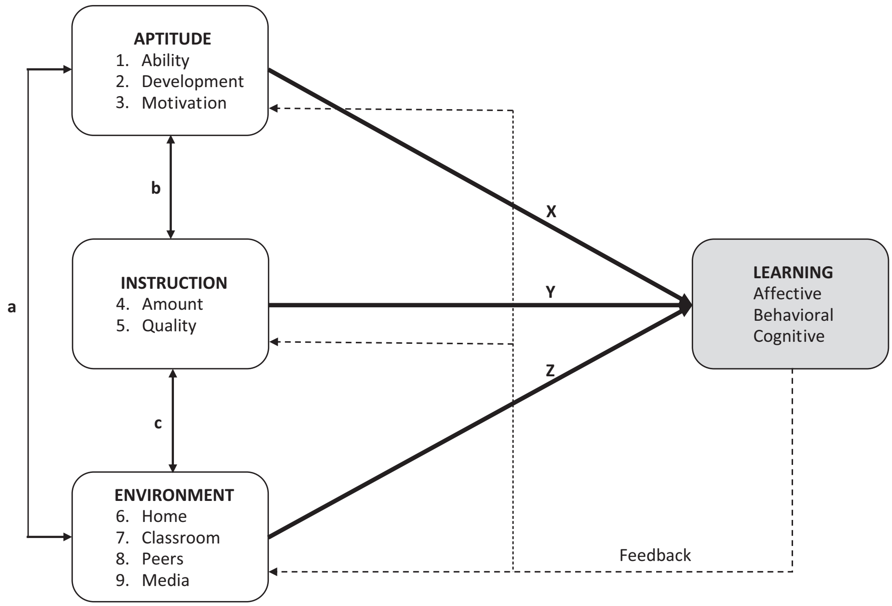


Fig. 1 Walberg's framework

and socioeconomic status—all of which numerous other researchers have found to be critical factors.

The National Research Council supported two major efforts to synthesize research on human learning: *How People Learn* (National Research Council, 2000) and *How People Learn II* (National Academies of Sciences, 2018). Neither study offered a visual model or framework of the learning process, but both described the role of motivation and teaching–learning strategies on effective learning, and both acknowledged that learning was affected by the culture that surrounds it, especially *How People Learn II* (henceforth abbreviated as HPLII). The sociocultural dimension emphasized by HPLII was particularly lacking in the models analyzed by the Huitt group and the framework proposed by the Walberg group.

The Huitt group eventually developed a systems-based "framework" in 2009 (Huitt et al., 2009; see Fig. 2). The major contribution of the Huitt framework is to indicate that the factors affecting the instructional process are layered into several echelons, including the sociocultural environment emphasized in HPLII. Some factors play out at the classroom level, but the classroom is a subsystem of the school, and the school is a subsystem of the surrounding social system; further, the home environment, another subsystem of the larger society, also influences learner success or failure. The Huitt framework, through its boxes and arrows, indicates how these echelons interact. However, the factors inside the boxes represent the salient factors only crudely and partially.

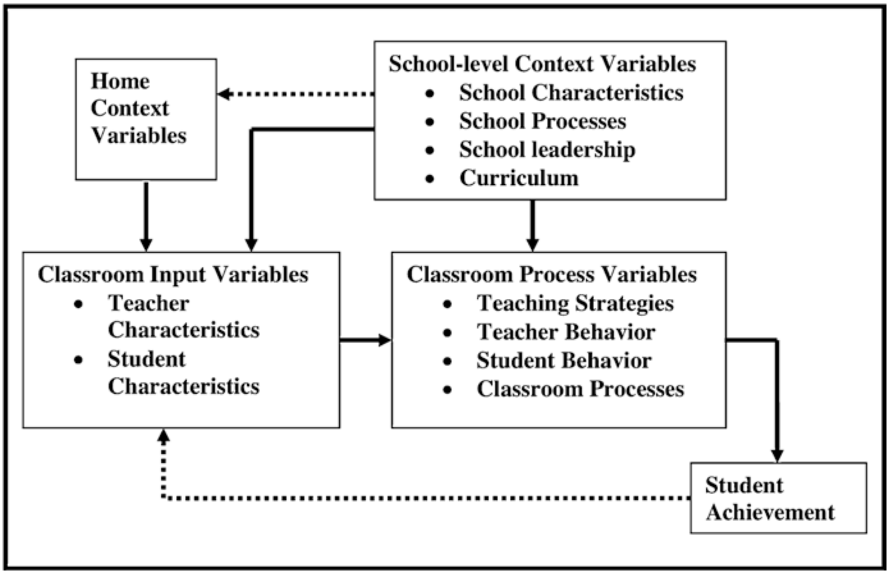


Fig. 2 Systemic framework of Huitt et al.

Synthesizing a New Framework

The authors concluded that previous attempts at a comprehensive framework all fell short, although all incorporated features that ought to be represented in a broader, more detailed framework. We built upon Huitt's systemic analysis, carrying it two steps further: (1) exploiting prior meta-analyses of instructional variables to identify those factors most prominently associated with achievement, and (2) distinguishing those factors that directly affect achievement from those that are increasingly distant from this central point of impact—the proximal and the more and more distal factors.

The Objective of the Framework for: Instructed Learning

As we began to develop our own framework, another issue arose—specifying clearly what phenomenon we were trying to frame. As we proceeded, it became apparent that the term *learning* was not sufficiently precise to specify the object(s) being studied in various types of educational research. Theorists working from different perspectives seemed to have different understandings of what it means "to learn," how to categorize different types of learning, and how to measure different learning outcomes. In order to satisfy the need for greater clarity, we undertook a review of the current status of different perspectives on human learning.

Perspectives on Human Learning

As complex a phenomenon as human learning is, it is not surprising that scholars have approached it from many different perspectives. In the literature of pedagogy, among the most widely recognized are the behaviorist, cognitivist, constructivist, and social-learning perspectives. More recently, cognitive neuroscience has emerged as a method of examining the physiological bases of all different perspectives. The following comments are meant to provide a thumbnail sketch of the distinguishing features of these diverse perspectives.

Behaviorist Perspective Behaviorists attempt to draw inferences based on external observation of the behavior of organisms. Skinner (1953) drew a distinction between the sorts of reflex behavior studied by Pavlov, governed by the principles of what Skinner termed classical conditioning, and the larger category of voluntary responses exhibited by humans in everyday life, governed by the principles of what Skinner termed operant conditioning—reinforcing a behavior in the presence of a particular stimulus.

Cognitive Perspective Cognitivists rely on both behavioral experiments and verbal reports to draw inferences about the learner's mental processes. An early, basic concern was understanding how information moves from perception to working memory to long-term memory and how mental structures are built up as people strive to impose meaning on the stimuli around them (Neisser, 1967). Schema theory suggests that long-term storage and retrieval depend greatly on how well the new information is integrated into the learner's mental structure (Rumelhart, 1980). According to dual-coding theory (Paivio, 1971), visual and auditory information appears to be processed in working memory, and later stored, through different neural channels. At the working memory stage, where conscious thought takes place, capacity is very limited, leading to research on the problems of overloading the processing capacities of learners—cognitive load theory (Paas & Sweller, 2014).

Constructivist Perspective A variation of the cognitivist perspective known as constructivism emerged in the 1990s. It arose from a more radically subjectivist philosophy, positing that each person's internal construction of reality, while idiosyncratic, was equally valid as any other person's construction. A mutually acceptable interpretation of reality could be achieved through social negotiation with other people. Thus, the various schools of thought under the constructivist umbrella agree that appropriate conditions for learning include complex, realistic problem environments, social negotiation of meanings, encouragement of multiple perspectives, and mindful reflection (Driscoll, 2005, p. 391).

Social Cognitive Perspective Social learning theory (later known as social cognitive theory), as proposed by Albert Bandura (1977), addresses the question: How do humans rapidly acquire novel skills that are more complex than just knowledge of facts, without any noticeable practice of component skills? Bandura demonstrated that humans frequently acquire new skills by merely observing another person performing the target behavior or even just being told how to do it. This body of theory supports learning by observation, with behavior modeling as a primary instructional strategy.

Confirmation from Cognitive Neuroscience

Neuroscience research has generally confirmed the validity of the various perspectives being discussed here. For example, Kandel (2006, p. 204) discovered the physiological basis of the classical conditioning and operant conditioning studied by Skinner—that synaptic connections can be strengthened or weakened through the simplest sorts of learning processes—habituation, sensitization, and classical conditioning. Independently, other neuroscience researchers discovered *mirror neurons*, neurons that fire both when an organism acts and when that organism observes the same action being performed by another (Rizzolatti & Sinigaglia, 2008). By this means, various primates (including humans) have been shown to be able to learn directly by imitation, without prompting, practice, or reinforcement, thus revealing the physiological basis of social learning theory.

Synthesizing Perspectives into an Eclectic Whole

Each of these perspectives has validity within the context specified by its authors. These theories do not contradict each other; they merely focus on different types of human learning, which are acquired, stored, and retrieved through different mechanisms. Each depicts one part of the tapestry, but none depicts the complete tapestry of human learning. Thus, we support an eclectic approach, such as that proposed by Honebein and Sink (2012), in which instructional designers select instructional strategies that fit the specific audience, objectives, and conditions in front of them, regardless of the provenance of those strategies (pp. 28–29). Therefore, the framework proposed here intends to be eclectic, not reflective of any one theory of learning.

Additional Insights from Neuroscience

Implicit vs. Explicit Memory Systems

In addition to confirming existing theories, cognitive neuroscience research has revealed some additional insights made possible by advances in microscopy and neuroimaging. As mentioned above, Kandel (2006) found that classical conditioning and perceptual and motor learning in general had an unconscious, automatic, and reflexive quality, which he labeled *implicit memory* (p. 132). However, a second broad type of learning process deals with conscious behaviors—such as the recall of people, places, facts, and events, and the ability to use this knowledge to solve problems. This type of learning—referred to as *explicit memory*—typically can be expressed in words or pictures (p. 132). Explicit learning tasks require more complex neural circuitry than implicit learnings, with many more possible storage sites than implicit learnings (p. 280). This finding lends support to the arguments raised in the 1960s by cognitivists against behaviorism's claim to explain all types of human learning. Clearly, a different set of principles governs certain types of human learning, including those dealing with language and abstract concepts.

Biologically Primary vs. Secondary Learning

Meanwhile, an evolutionary perspective on human learning reveals another important distinction. Geary (2008), drawing on the work of neuroscience researchers such as Kandel, cited above, drew the distinction between biologically primary and biologically secondary types of learning, overlapping largely with Kandel's implicit and explicit categories. Biologically *primary* learnings include such *implicit* skills as reflexive motor skills, interpreting human emotion in faces, understanding and speaking a mother tongue, and performing basic problem-solving. Most humans acquire such skills quickly and easily, without conscious effort. By contrast, biologically *secondary* learnings include knowledge and skills that are needed for successful navigation of the everyday world of complex human society but are not an inborn part of neurological development. As Geake (2009) put it: "School learning relies on appropriating brain functions which originally evolved for other purposes" (p. 53).

These distinctions demand that educationists take care in labeling the processes they deal with as the two broad types of human learning appear to have different causations and different neural pathways. Much of school learning would follow the pathways of *explicit* or *biologically secondary* learning. Notably, these include the skills of reading and writing since written languages are codes constructed by humans to symbolize the sounds of the spoken language. As such, they are artificial, arbitrary codes, as are the symbol systems of mathematics. Humans are not born understanding written alphabets or numeral systems.

Conclusion of the Search for the Objective of the Framework

At the end of our review of the literature on human learning, we realized that the processes of implicit and explicit learning could not be depicted within the same conceptual framework. Simply put, implicit learning depends much more on informal encounters in real-world settings while explicit learning relies on careful structuring of proper conditions for attainment. Thus, we decided that the framework developed in this project should focus clearly on the outcomes of what Kandel would label as *explicit* learning.

However, we were still searching for the proper label for this construct. While Kandel's distinction between different types of learning is compelling, his labels are not ideal. The dictionary meanings for *explicit* and *implicit* have to do with "being expressly stated," which has nothing to do with the properties that actually distinguish the two types. In searching for alternative labels, we discovered that the term *instructed learning* already was being used in certain venues. The term came into common use in the 1990s in the field of second-language learning; see, for example, Ellis's book title, *Instructed Second Language Acquisition: Learning in the Classroom* (1990). The term *instructed* second-language learning draws the distinction between the learning of one's mother tongue, which happens automatically and without conscious effort—which we could call *spontaneous* learning—and the planned, effortful, conscious process of second-language learning. Indeed, Ellis' term has become the accepted label for that field and the name of its journal, *Instructed Second Language Acquisition*. The term *instructed learning* has also become an accepted technical term in neuroscience. It is used in The Phelps Lab at New York University, which focuses on the intersection of emotion and human learning (Phelps, 2006, p. 31). The Cole Neurocognition Lab at Rutgers University has adopted the term in naming the object of their study—"rapid *instructed* task learning (RITL)." Like the Phelps team, the Cole team is focused on learning prompted by communication rather than by reinforcement (Cole et al., 2013).

Thus, the framework presented here is specifically meant to describe the process of acquisition of *instructed* learning. Other types of learning pursued in educational settings—for example, those represented by the current interest in "social and emotional learning" (Shriver & Weissberg, 2020)—would fit under the label of *spontaneous learning*. Those social and emotional types of learning would require a different conceptual framework since they result not from Instruction but from the conditions and reinforcers found in the environment—the classroom environment, the home environment, the peer environment, and the general societal environment. This will be the subject of a future project for the authors.

The Molenda–Subramony Framework for Instructed Learning

The conceptual framework proposed here is a structural framework rather than a process model. It intends to portray the hierarchy of factors that influence instructed learning, as opposed to showing how a system operates and changes over time. A structural framework aims to identify key factors related to the desired outcome (in this case, instructed learning) to indicate which factors act upon which other factors, and to suggest how various environmental forces come into play around those factors. It allows hypotheses to be made and tested regarding possible connections between causes and effects (Ravitch & Riggan, 2017).

As discussed above, this framework incorporates factors found to be significant in several major meta-analyses (Walberg, 1984; Monk et al., 2001; National Research Council, 2000; National Academies of Sciences, 2018), most of which are based on analyses of comparison studies that used test scores as the measures of learning outcomes. Thus, it is limited to findings of research on *instructed learning*, learning occurring under instructional conditions (whether the settings are considered formal or informal, face-to-face, or distance). Another limitation is that the research upon which it is based was conducted largely with elementary–secondary school populations. A third, and very important, limitation is that all of these research studies relied on quantitative scores on artificial assessments—as opposed to performance-based or authentic assessments—as the measure of success. This is arguably not the optimal way to determine the success of human teaching–learning encounters, but it is the standard followed by researchers employing quantitative measures.

Proximal Factors

The proximal factors, the ones directly responsible for success or failure of instructed learning, are *Aptitude* (which subsumes general intelligence and prior acquired knowledge), *Effort*, and *Instruction*, as shown in Fig. 3.

This portion of the framework could be summarized as: Successful instructed learning requires the combination of a learner ready and able to learn (Aptitude), Effort expended by the learner, and appropriate Instruction—methods and resources that channel that Effort toward the desired objective. Hence, at least one of the proximal factors—Instruction—is largely within the control of instructors and others who design instructional interventions. Another—Effort—is partly controllable by instructors, as can be seen if we zoom out to examine the *distal* factors affecting instructed learning, discussed next.

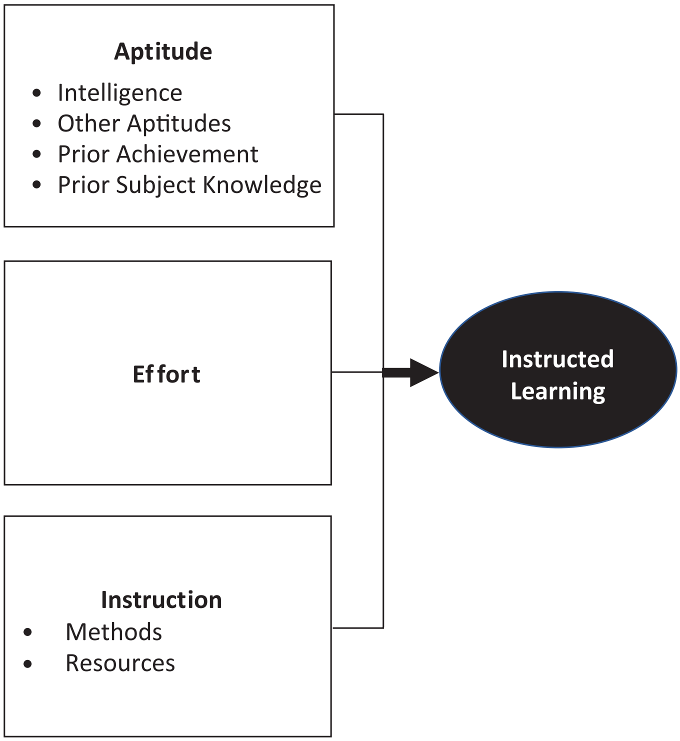


Fig. 3 Proximal factors

First-Level Distal Factors

Figure 4 represents a zooming out to include the first-level distal factors—those that most directly affect the proximal factors. We find three clusters of factors that influence Aptitude, Effort, and Instruction.

The first cluster consists of the learner's Psychological Traits. These are aspects of personality that are relatively stable over time; key aspects are *self-efficacy*, *locus-of-control*, *maturational level*, and *personal interests*. Although a more positive sense of self-efficacy and a more internal locus-of-control can be fostered by the right conditions, they are generally traits that learners bring into the classroom, for better or for worse. *Maturational level*, of course, refers to the learner's stage of mental and physical development; again, not a factor under the control of the facilitator or the designer. The same is true for *personal interests*; this term refers to enduring preferences, such as sports—even particular teams—rather than reading,

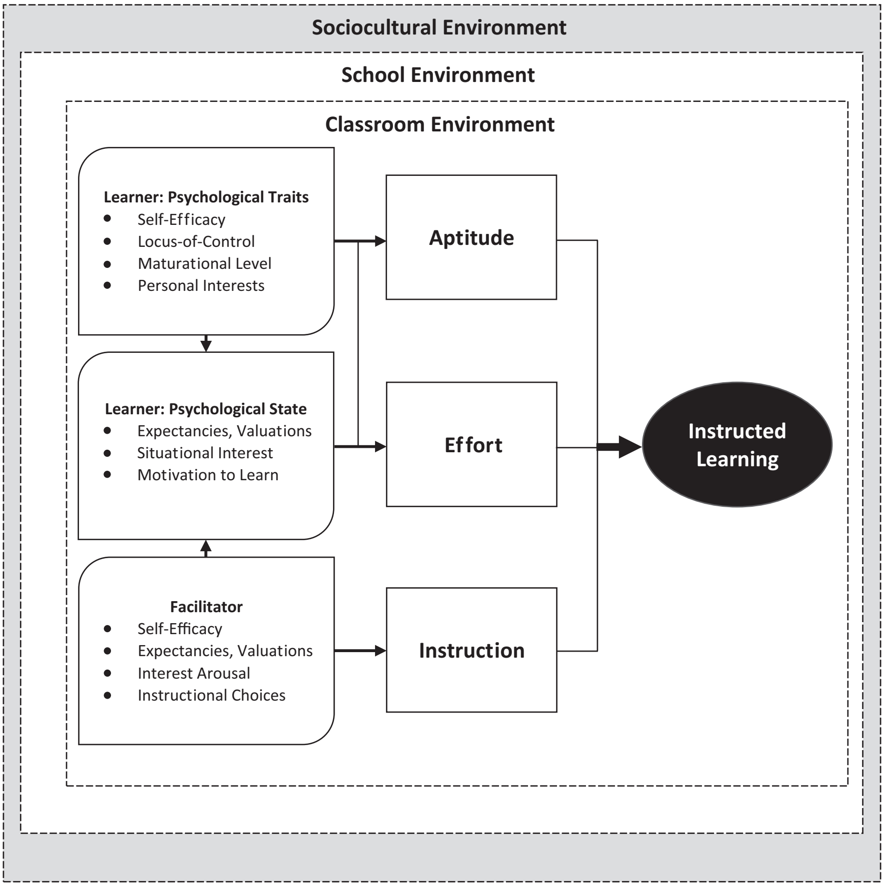


Fig. 4 First-level distal factors

or classical music rather than dancing. These interests are enduring in the sense that they are exhibited in a variety of situations, in and out of the classroom. These factors have a strong influence over whether or not a learner will choose to invest Effort in a given instructional task; they also can have some influence over whether learners will activate what Aptitude they possess.

The second cluster of first-level distal factors comprises the learner's *Psychological State*, feelings and proclivities that are more transitory, such as *expectancies*, *valuations*, *situational interest*, and *motivation to learn*. These can be summed up by asking whether the individual expects to be able to handle a given learning task successfully, whether they see any value in acquiring the new knowledge or skill, whether the task stimulates their curiosity, and whether they care to invest effort to master the new material.

The third cluster comprises the *Facilitator's* own characteristics. Teachers, as well as learners, have a sense of *self-efficacy*; those who believe they can reach all students tend to do so. They also have their own *expectancies* and *valuations*: "Adolescents respond to teachers who communicate a sense of excitement, a contagious intellectual thrill. When excitement is present, learning becomes a pleasure instead of a chore" (Csikszentmihalyi & McCormack, 1986, p. 418). Of course, the most consequential aspect of the Facilitator is their role in selecting and implementing resources and methods with learners, the function represented by the *Instruction* box in the "proximal factors" part of the framework.

Classroom Environment

Facilitators, learners, and instructional activities proceed within a specific space, whether a self-contained elementary classroom, a training room, a sports field, or a music studio, which we term the *Classroom Environment*. Simply put, that environment should provide a cohesive and supportive atmosphere—one in which "the class members like one another, that they have a clear idea of the classroom goals, and that the lessons are matched to their abilities and interests" (Walberg, 2006, p. 110).

School Environment

The Classroom Environment is constrained by the *School Environment*, the organizational structure surrounding it. Examples of policies at the school level include admission standards, curriculum choices, grading policies, grouping by ability, and the like. Decisions made and policies enforced at the school or school–district level constrain whatever individual choices teachers or students would prefer to make.

Second-Level Distal Factors

Figure 5 zooms all the way out to show the complete Molenda–Subramony Framework of Instructed Learning, including the *Sociocultural Environment* surrounding the school.

The Sociocultural Environment includes many hidden influences, some acquired at birth and others acquired through living in a particular social setting. These include cultural capital and habitus, self-identity, privilege, and intersectionality—all of which combine to influence learners' self-efficacy, locus-of-control, maturational level, personal interests, expectancies and valuations, situational interest, and motivation to learn (which subsequently determine the Effort they put into learning).

Two second-level distal factors—*Peer Influences* and *Home/Family Influences*—also have an impact on the "downstream" factors (especially Learner Psychological State). Whether in school, college, or workplace training, as social beings, humans are affected by the attitudes, values, and behaviors of the people around them. Walberg's meta-analyses (1984, 2006) show *Peer Influences* as one of the nine factors most influential in productive learning. Learners of all ages have been observed tackling challenging academic goals after seeing peers do so.

Awareness of the contribution of the *Home/Family Environment* to academic success escalated after publication of the famous Coleman Report (Coleman, 1966), whose overall conclusion was that the socioeconomic background of students'

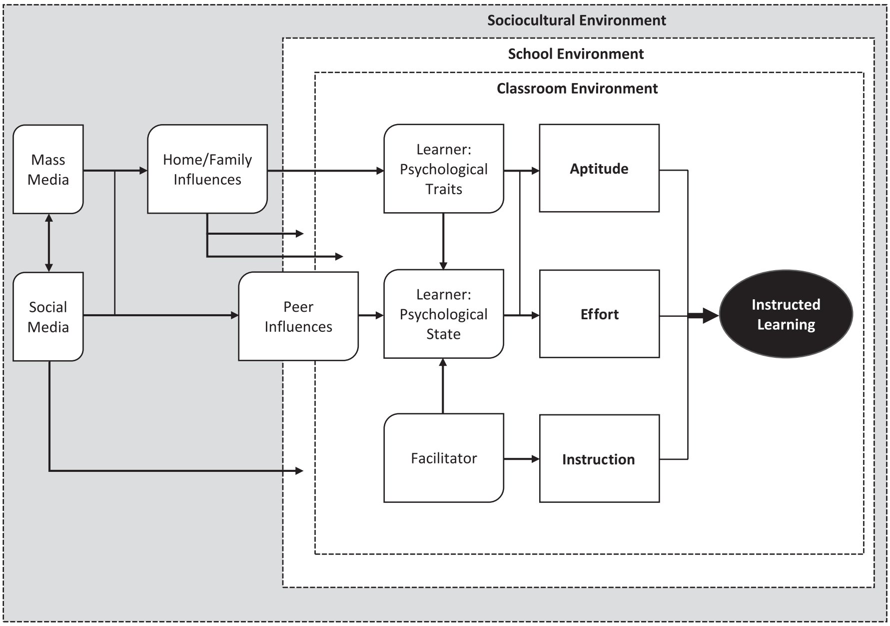


Fig. 5 Molenda-Subramony framework of instructed learning

families was more highly correlated with academic achievement than any differences in schools, such as facilities or staffing.

Third-Level Distal Factors

Two factors—*Mass Media* and *Social Media*, although they are several levels removed from the front lines, nevertheless are recognized by Walberg and other analysts as "top 9" factors influencing success or failure of instructed learning. In Fig. 5, they are located within the *Sociocultural Environment* in that they are cultural forces, both helping to shape the larger culture and mirroring that larger culture. They may support or inhibit the pro-social attitudes and behaviors that comprise *Peer Influences*, *School Environment*, and *Classroom Environment*.

A more complete description of the factors in this framework and a discussion of their implications are found in Chapter 2 of *The Elements of Instruction* (Molenda & Subramony, 2021).

Discussion

A robust conceptual framework is a hallmark of a science or any other organized field of study—in this case, the field of pedagogy. It enables the generating of hypotheses about which factors cause or influence others. Research should serve to test those hypotheses, confirming their strength or questioning their validity. At a minimum, it provides a menu of topics worthy of exploration. The purpose of the Molenda–Subramony framework presented here is to lay out a map of the factors most closely associated with success or failure in instructed learning. The factors closest to *Instructed Learning* are those indicated by research to be proximal causes: Aptitude, Effort, and Instruction; each of which, in turn, has more distal causes. With the framework in front of us, it is easier to understand judgments such as, "As important as the home and family environment (or peer influences or motivation to learn) is to academic success, it exerts influence only through mediating factors such as psychological state and effort."

In an applied field such as pedagogy, instructors are faced with myriad decisions hourly and daily. When faced with a new class of learners, perhaps under novel conditions, such as teaching online during a pandemic, which concerns should be dealt with first? A conceptual framework can provide a checklist of factors that are usually taken for granted but that are salient today. For example, what is the psychological state of my learners? Are they anxious, confused, perhaps even absent? If they are not ready to learn, what can be done? Looking at the framework from the perspective of the Control–Influence–Accept model (Thompson & Thompson, 2008), instructors can decide which factors they have control over, which they can influence, and which they must accept and adapt themselves to.

References

Bandura, A. (1977). *Social learning theory*. Prentice-Hall.

Cole, M. W., Laurent, P., & Stocco, A. (2013). Rapid instructed task learning: A new window into the human brain's unique capacity for flexible cognitive control. *Cognitive, Affective, & Behavioral Neuroscience, 13*(1), 1–22.

Coleman, J. S. (1966). *Equality of educational opportunity*. Office of Education/U.S. Department of Health, Education, and Welfare/U.S. Government Printing Office.

Csikszentmihalyi, M., & McCormack, J. (1986, February). The influence of teachers. *Phi Delta Kappan, 67*(6), 415–419.

Driscoll, M. P. (2005). *Psychology of learning for instruction* (3rd ed.). Pearson Allyn and Bacon.

Ellis, R. (1990). *Instructed second language acquisition: Learning in the classroom*. Basil Blackwell.

Fraser, B. J., Walberg, H. J., Welch, W. W., & Hattie, J. A. (1987). Syntheses of educational productivity research. *International Journal of Educational Research, 11*(2), 145–252.

Frick, T. W. (2019). Importance of educology for improving educational systems. In J. M. Spector, B. B. Lockee, & M. D. Childress (Eds.), *Learning, design, and technology: An international compendium of theory, research, practice and policy: Systems thinking and change*. Springer. https://doi.org/10.1007/978-3-319-17727-4

Geake, J. G. (2009). *The brain at school: Educational neuroscience in the classroom*. Open University Press/McGraw-Hill.

Geary, D. C. (2008). An evolutionarily informed education science. *Educational Psychologist, 43*(4), 179–195.

Honebein, P. C., & Sink, D. L. (2012, November/December). The practice of eclectic instructional design. *Performance Improvement, 51*(10), 26-31.

Huitt, W. G., Huitt, M. A., Monetti, D. M., & Hummel, J. H. (2009, October 16–19). *A systems-based synthesis of research related to improving students' academic performance.* Retrieved October 8, 2019, from *Educational Psychology Interactive*. http://www.edpsycinteractive.org/papers/improving-school-achievement.pdf

Kandel, E. R. (2006). *In search of memory*. W. W. Norton.

McIlrath, D. A., & Huitt, W. G. (1995, December). *The teaching-learning process: A discussion of models.* Retrieved October 3, 2019, from *Educational Psychology Interactive* http://edpsycinteractive.org/papers/modeltch.html

Merrill, M. D. (2002). First principles of instruction. *Educational Technology Research and Development, 50*(3), 43–59.

Merrill, M. D. (2013). *First principles of instruction*. Pfeiffer.

Merton, R. K. (1957). *Social theory and social structure*. Free Press.

Molenda, M. H., & Subramony, D. P. (2021). *The elements of instruction: A framework for an era of emerging technologies*. Routledge/Taylor & Francis.

Monk, D. H., Walberg, H. J., & Wang, M. C. (Eds.). (2001). *Improving educational productivity*. Information Age.

National Academies of Sciences. (2018). *How people learn II: Learners, contexts, and cultures*. The National Academies Press.

National Research Council. (2000). *How people learn: Brain, mind, experience, and school* (Expanded ed.). The National Academies Press. https://doi.org/10.17226/9853

Neisser, U. (1967). *Cognitive psychology*. Prentice-Hall.

Paas, F., & Sweller, J. (2014). Implications of cognitive load theory for multimedia learning. In R. E. Mayer (Ed.), *The Cambridge handbook of multimedia learning* (2nd ed., pp. 27–42). Cambridge University Press.

Paivio, A. (1971). *Imagery and verbal processes*. Holt, Rinehart & Winston.

Phelps, E. A. (2006). Emotion and cognition: Insights from studies of the human amygdala. *Annual Review of Psychology, 57*, 27–53.

Ravitch, S. M., & Riggan, M. (2017). *Reason & rigor: How conceptual frameworks guide research* (2nd ed.). SAGE.

Reigeluth, C. M., & Carr-Chellman, A. A. (Eds.). (2009). *Instructional-design theories and models: Building a common knowledge base* (Vol. III). Routledge.

Rizzolatti, G., & Sinigaglia, C. (2008). *Mirrors in the brain: How our minds share actions, emotions, and experience*. Oxford University Press.

Rumelhart, D. E. (1980). Schemata: The building blocks of cognition. In R. J. Spiro, B. C. Bruce, & W. F. Brewer (Eds.), *Theoretical issues in reading comprehension* (pp. 33–58). Lawrence Erlbaum Associates.

Shriver, T. P., & Weissberg, R. P. (2020, April). A response to constructive criticism of social and emotional learning. *Phi Delta Kappan, 101*(7), 52–57.

Skinner, B. (1953). *Science and human behavior*. The Free Press.

Thompson, S., & Thompson, N. (2008). *The critically reflective practitioner*. Palgrave Macmillan.

Walberg, H. J. (1984, May). Improving the productivity of America's schools. *Educational Leadership, 41*(8), 19–27.

Walberg, H. J. (2006). Improving educational productivity: An assessment of extant research. In R. F. Subotnik & H. J. Walberg (Eds.), *The scientific basis of educational productivity* (pp. 103–159). Information Age Publishing.

Zetterberg, H. L. (1962). *On theory and verification in sociology*. Bedminster Press.

Making Decisions About Asynchronous and Synchronous Engagement Strategies: Access and Inclusion

Jessica Lantz, Eric Stauffer, Jamie Calcagno-Roach, Andrea Adams, Kristen Shuyler, Aaron Noland, and Juhong Christie Liu

Introduction

The spring semester of 2020 introduced many challenges for universities as educational technology professionals and leaders scrambled to quickly support the pivot of an unprecedented number of courses to online learning due to the COVID-19 pandemic. Primary challenges included limited time and personnel resources to support faculty as they transitioned their course content and activities into an online environment. Additionally, both faculty and students were limited in their access to high-speed Internet, specific software packages, and hardware such as laptops, microphones, and web-cameras. These challenges were also contextualized in the remote working conditions for faculty and learning support personnel who tactically relied on both asynchronous and synchronous means to explain and demonstrate technologies for teaching and learning. Based on these situational factors and limitations, the authors, consisting of instructional designers, educational technologists, and library leaders at a large public university in the mid-Atlantic region, worked tirelessly to make decisions about instructional methods and modalities, appropriate technology recommendations, and support pathways. This chapter provides a review of current literature and shares context and examples of the decision-making and online learning support strategies the authors employed early in the pandemic.

During this pivot, the authors prioritized shared leadership in decision-making related to online learning. They focused on providing a caring response to user and faculty needs, and provided support for empowerment. Educational technology, instructional designers, and leaders weighed instructional factors including faculty

J. Lantz (✉) · E. Stauffer · J. Calcagno-Roach · A. Adams · K. Shuyler · A. Noland · J. C. Liu
James Madison University, Harrisonburg, Virginia, USA
e-mail: lantzjl@jmu.edu

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*, Educational Communications and Technology: Issues and Innovations,
https://doi.org/10.1007/978-3-030-85078-4_2

and staff readiness and online teaching/learning efficacy, student needs, learning theory, surveillance/monitoring, and environmental factors of socioeconomic status (SES), as well as situational factors such as access to technology, Internet connectivity, accessibility, and preparation time while making decisions about course instruction and delivery modality. When making decisions about online learning, the authors recommend leaders take a servant leadership approach that centers ethics of care with shared decision-making approaches.

Traditional forms of leadership including directive (Kahai et al., 2004), trait (Judge et al., 2002), and transformational (Stone et al., 2004) position the leader as setting direction with limited consideration or involvement of others. Servant leadership, on the other hand, centers others. Leaders following this approach to leadership center others through four core behaviors, including empowerment, stewardship, authenticity, and providing direction (Van Dierendonck and Patterson, 2015).

Empowerment encourages people to leverage their skills and expertise to creatively solve problems with organizational resources. Stewardship emphasizes care and concern for individuals and the organization over time. Leaders exemplifying stewardship take shared responsibility for people's well-being (Spears, 1995). Authenticity requires leader openness, integrity, self-awareness, and an ethical approach. Leader authenticity fosters an open, transparent working environment that can improve commitment to mission (Peterson et al., 2012). Servant leaders provide direction by establishing goals and clarifying expectations. Importantly, listening and careful consideration of multiple perspectives is central to goal setting, distinguishing servant leadership from more traditional approaches that rely on the leader articulating an established vision (Van Dierendonck and Patterson, 2015).

Synchronous or asynchronous modalities at an unusual, historic time had to fundamentally rely on technology-enabled connections. Leaders making decisions must empathetically center faculty and student needs and provide informed directions with inclusive input from instructional design and learning technology support personnel, using an inductive approach. Servant leadership (van Dierendonck & Nuitjen, 2010) that centers ethics of care is well positioned to provide effective leadership in these situations by democratizing information gathering and decision-making (Reynolds, 2011). This approach encourages leaders to take "responsibilities for listening attentively to the voices of others" (Robinson, 2011). Doing so decentralizes decision-making and results in more inclusive perspectives that are all equally valued, ultimately increasing decision-making effectiveness (Hall and Davis, 2007). This shared approach to decision-making relies on the expertise of faculty and instructional designers in making decisions that consider a wide range of contextual factors to best support student learning.

The four core behaviors of a servant leadership approach—empowerment, stewardship, authenticity, and providing directions with community-shared value—can be helpful in supporting engagement among students taking courses online. Engagement in online learning has been defined as "a qualitative level of interaction with content, activities, and people that involves students' interests, curiosity, and passion. Engagement requires students to use their own ideas, understandings, and emotions in tasks that are meaningful to them and can result in powerful generative learning" (Hummel et al., 2018, p. 484). These interactions can take place effectively only when *all* members are included and have *full access to* representation modes online, *asynchronously* and *synchronously*. For this to be possible, shared decision-making with respect to technology affordances, people involved, and contextual factors plays a crucial role in planning and implementing student-centered engagement strategies.

Access to content and the learning community is fundamental to online educational settings. Inclusion provides differentiated instructional measures and learning conditions that meet the needs of learners who may face physical, social, or emotional challenges (Sansosti and Sansosti, 2012). Asynchronous and synchronous online tools and techniques have coexisted to support and engage student learning inclusively, but effective use requires intentional selection strategies and adapted online teaching pedagogy (Bonk, 2020; Wallace, 2003). Generally, asynchronous modes of learning can happen flexibly in terms of time and location of participation, when designed with inclusive considerations of learners' activities to fulfill outcomes with optimal access (Liu et al., 2018; Liu and Kaye, 2016; 2020). Synchronous modes of learning can maximize communication at a distance, such as facial expressions, tones, and instantaneity facilitated with mediated audio and video technologies, which evidently invites an elevated level of coordinating technology evaluation, training, and pedagogical selections (Bonk, 2020; Correia et al., 2020; Liu and Alexander, 2017). In a properly designed online learning environment, synchronous modes used alongside asynchronous delivery may optimally achieve the fulfillment of presence and interactivity, as well as being more engaging and inclusive.

Decision-Making in Context

When considering learning engagement strategies with asynchronous and synchronous modalities, complexity can include affordances of technologies, infrastructure in an education organization, and bandwidth of support. Decision-making related to synchronous and asynchronous engagement strategies needs to utilize shared approaches to technology selection choices and building human resource capacities, with a servant approach to leadership (Van Dierendonck and Nuijten, 2010; Spears, 2010). This shared approach to decision-making relies on the expertise of faculty and instructional designers in making decisions that consider a wide range of contextual factors to best support student learning and fit exponentially evolving technology-facilitated learning environments.

In educational environments enabled with technologies, many contextual elements can affect the engagement of learners, faculty, and support resources. *Time* may be the primary factor. For instance, in the extreme instance of porting face-to-face courses to online contexts when minimal time is allowed for design and development, the question of selecting asynchronous versus synchronous modes to engage and include all students presents a variety of confounding factors. As a starting point, it has been previously demonstrated that the task of generating new materials or adjusting materials from face-to-face classes to an online setting can be a challenging endeavor for faculty (Li and Irby, 2008) because the majority of on-campus teaching faculty are used to the natural audio, visual, physical, and facial expressions of teaching in an in-person brick-and-mortar classroom. Accelerated by the pandemic, retaining the audio/visual cues made the quick transition to online instruction a mandatory assumption. Therefore, there was an intensified reliance on synchronous video conferencing technologies (Bonk, 2020; Correia et al., 2020). In addition, the previously adjusted normalcy of inclusion caused emerging challenges of readjustment to ensure equity in a home office or classroom (Roberts and McCluney, 2020). Beyond the critical challenges inherent to the process of designing and developing new learning materials for remote instruction, limited development time and technology efficacy may also create a collaborative opportunity for faculty, instructional designers, librarians, and technologists to work together, share ideas, and develop best practices for the rapid transition from one mode to another. In this light, ensuring that both faculty and students can easily communicate and access learning materials becomes one of the highest priorities when quickly moving courses online.

In making decisions about synchronous and asynchronous modalities, faculty and student needs must be centered. When making decisions about modality, online learning leadership should consider faculty and student readiness and online teaching/learning efficacy, access to technology and connectivity, accessibility, and data privacy. Leadership will function more effectively when taking a servant approach that centers caring ethics (Spears, 2010), in working collaboratively to highlight strategies to support faculty in transitioning online including tool selection and use, use of asynchronous and synchronous methods for training and consultations, as well as providing a degree of empathy for those in need of support.

Understanding Asynchronous and Synchronous Methods in Decision-Making

Complementary features of asynchronous and synchronous technologies can be utilized to increase engagement during times of rapid transition to online learning for a broad intersection of audiences. Research suggests that instructors who have to quickly decide what strategies to employ for instructional and collaborative tasks are more successful in increasing student engagement when they employ synchronous strategies for communication and asynchronous strategies for course materials and discussion boards with properly designed prompts and operated feedback. Lin, Hung, Kinshuk, and Chen (2019) reported that students who viewed more prerecorded video lectures tended to more actively participate in synchronous learning activities and achieved higher grades. Martin and Bollinger (2018) surveyed 150 students on engagement strategies in the online environment and found that strategies such as working collaboratively while using online communication tools, sending regular announcements or email reminders, providing rubrics, working on real-world projects, and having structured or guided discussions increased engagement. Petzold (2020) has reported that research-based strategies for quickly moving laboratory classes online while still achieving learning objectives can include recycling raw data, implementing virtual simulations, and using case studies. These laboratory strategies could be complemented by synchronous time for questions and deeper discussion (Lin et al., 2019).

The unique features of asynchronous technologies for online learning may afford more freedom and flexibility for self-paced learning and allow increased time and flexibility for reflection and synthesis prior to responding to a comment or assignment prompt (Dailey-Hebert, 2018). The ability to implement this type of instruction through more user-friendly courseware management has enabled online delivery of course materials to students outside of face-to-face classrooms, untethered by the restraint of time and location, with self-paced flexibility (Jiang et al., 2019). Within the platforms used for hosting courses, faculty have asynchronous technologies to choose from that can facilitate learning in an online course. These include online discussion posts, asynchronous video tools, and recorded lectures.

Online discussion boards in particular can be used to asynchronously engage students with one another and with the course content. Jacobi (2017) explored the perspectives of students regarding the effectiveness of the ways that asynchronous discussions were structured in an upper-level online organizational communication course. Specifically, 67% of the students perceived online discussions as more effective than live discussions largely because everyone participated. Discussion boards provide more time for thoughtful posts and more reflection and synthesis of material (Dailey-Hebert, 2018). In addition to the engagement benefits shared in the research, the authors recommended asynchronous discussions as a learning activity that could be completed using limited Internet bandwidth and computing power, on a flexible schedule, resulting in an inclusive learning experience for students.

As a contrast to text-based discussion boards, which may become repetitive through the duration of a semester, VoiceThread is an asynchronous, cloud-based, audio–video recording platform that can be used for asynchronous communication approaches. In one study of the use of VoiceThread in an online course, results indicated that VoiceThread was effective in helping students engage with classmates and professors, learn course content, and improve presentation skills in a more multimodal way than using text-based discussion boards (Joiner and Patterson, 2019). The authors referred to Joiner and Patterson's research (2019) when deciding to promote Flipgrid, a similar, no-cost asynchronous audio–video recording discussion platform. The authors recommended Flipgrid as an accessible and inclusive tool, offering automatic captioning and the ability to record offline for later uploading. The authors also recommended using the media recording and uploading tool within the university LMS for an easily accessible video and audio discussion response option as an alternative to text-based discussion boards.

Asynchronous technologies can also allow students opportunities for self-paced learning in online courses. Jiang et al. (2019) conducted a qualitative study exploring perceptions of doctoral students in an online graduate statistics course to see if online course instructional strategies and course design helped them learn statistics. Most participants considered PowerPoint with lectures as the most effective instructional strategy. In the author's institution, Techsmith Knowmia was available to all faculty as an asynchronous lecture capture tool. Students were able to view videos at times that suited their personal schedule. The opportunity for self-paced learning may make the course more accessible to people who have caregiving responsibilities or other things that may limit their access/availability for synchronous learning. This tool also offered automatic and editable captioning for accessibility and allowed users with limited Internet accessibility to download videos to watch offline.

As both a contrast and complement to asynchronous tools, synchronous technologies for online learning have been shown to offer the opportunity to simulate, replicate, and even enhance aspects of the traditional classroom (Martin & Bollinger, 2018). However, successfully using synchronous technologies can be labor-intensive work and requires technical skills that many instructors may not have developed. Pedagogical redesign needs the foundation of both technological efficacy and conceptual readjustment (Bonk, 2020). Moreover, student access to technology can vary widely (Hale, 2019). These concerns and realities may reinforce the need to support faculty in making their own decision about using synchronous tools in their online courses (Hale, 2019). This strategy was used in decision-making at the author's own institution, based on the collective evaluation of the utility and value of technologies (Kutsch and Hall, 2005; Simon, 1959). When time is the primary variable in deciding between synchronous and asynchronous strategies, faculty face a steep learning curve and must quickly decide on their comfort level, current abilities, and personal desire to learn and use synchronous tools to support engagement in their courses (Hale, 2019; Martin & Bollinger, 2018).

Recent research on synchronous technology focuses on tools available within most learning management systems (LMS) that can be used to facilitate communication and collaboration. Tools such as video conferencing, text-based chat, breakout rooms (Henriksen et al., 2020), and virtual whiteboards (Erickson et al., 2020) are cited throughout the literature. In practice, these tools are used for tasks such as real-time interactive lecture and discussion, note-taking using virtual whiteboards, and group work (Erickson et al., 2020; Hale, 2019; Hoffman, 2019). Henriksen et al. (2020) recommend using synchronous class time for active discussion about course content and utilizing group options, such as breakout rooms, to allow students to work collaboratively and create meaning together. Hoffman (2019) shared that video conferencing can be used to present traditional lectures while synchronously utilizing both audio and chat feedback tools to allow for real-time interaction and sharing of resources between students and instructors.

The authors utilized strategies reflected in recommendations from the recent literature, integrated with servant leadership principles, to ensure diverse learner and instructor needs were being met during the rapid transition to online learning. They recommended synchronous tools that required minimum Internet bandwidth and computing power to accommodate learner needs and support collaborative learning. The authors employed servant leadership behaviors by providing direction and empowering faculty to select appropriate synchronous technologies and strategies in their own courses by prioritizing access and inclusion. The authors accomplished this by recommending that faculty check in with their students about their access to technology to support synchronous participation, and to use asynchronous activities instead when learning outcomes could be achieved using either modality. The authors also recommended using synchronous class time for interactive activities instead of lecturing. Faculty were encouraged to use synchronous video-conferencing tools for small group work via breakout rooms during synchronous sessions and for office-hours meetings with their students.

Optimizing Efficacy with Professional Development

Professional development can help faculty and instructional designers gain knowledge and continually strengthen their ability to make proper decisions in choosing between asynchronous and synchronous tools to meet pedagogical needs. Goode et al. (2020) conducted a case study with computer science teachers on inclusive strategies in both synchronous and asynchronous sessions. Their findings suggest that purposeful facilitation can create a transformative culture of "shared experience" whereby facilitators and groups of teachers engage in collaborative lesson planning and debriefing discussions, in both synchronous and asynchronous sessions. Gelfer and Nguyen (2019) conducted a case study on the organization and development of an alternative format online bachelors' degree. This program included inclusivity accommodations within the online format to allow nontraditional students the opportunity to complete the program remotely.

The nature of the academic program and needs of the population can influence the choice of delivery mode and selection of tools. A real-world scenario of creating professional development in response to faculty needs in the authors' institution was a self-paced online teaching institute with a hybrid of asynchronous and synchronous modality. The institute was designed as several modules, as an online course, based on principles and evidence from research in instructional design, learning theories, distance education, and active learning strategies. The faculty participants who signed up for the institute took part in the core asynchronous activities from analyzing their existing teaching practice and course learning objectives, updating the syllabus according to the modality, proposing a course structure with interactivity plan, and modifying an assessment item for the class in an online or hybrid mode. These asynchronous activities were supported with synchronous consultations as needs emerged. The decision of this primary asynchronous modality in a learning management system (LMS), with just-in-time synchronous consultation, was grounded in providing an experiential learning opportunity and support as a community of practice (Smith et al. 2017; Steinert 2010). The experiential learning provided a flexible space and pace for faculty to access the professional development, with a minimal and inclusive requirement of technology capacity and Internet bandwidth. The synchronous consultation assisted the connection and presence between the instructional designers and support personnel and faculty. Ongoing asynchronous support including emails, LMS announcements, discussion responses, feedback, and scaffolding of peer interaction as a community of practice ensured ongoing and low-tech interactivity.

Features of Asynchronous and Synchronous Technologies for Access and Inclusion

Access and inclusivity topics discussed in the online learning literature include concerns that some students do not have equitable access to online instruction. This inequitable distribution of high-quality access to online learning raises an ethical issue that may be effectively explored through the "servant leadership" lens of stewardship, with its emphasis on care and concern for people. The people most vulnerable to issues of inaccessible and inequitable education may be students from low-income families (Reilly, 2020), students with mental health concerns (Araújo et al., 2020), students without computer or Internet access (Morgan, 2020; Petzold, 2020), students without broadband access (Skinner, 2019), students with dyslexia (Pang and Jen, 2018) or other learning disabilities (Snelling et al., 2020), students with sensory challenges (Gronseth, 2018), students who use assistive technology (Gronseth, 2018), students with individualized educational programs (Snelling et al., 2020), and students with minimal levels of proficiency in the language in which the online course is taught (Karkar-Esperat, 2018). Students in these scenarios can have difficulties participating in synchronous online classes for a number of reasons, including limited access to high-quality Internet connections, lack of computers, requirements to participate and react quickly, and more. For this reason, asynchronous approaches to online teaching may sometimes be more accessible and inclusive than synchronous approaches. A servant leadership approach of listening to the needs of the students may help with accessibility. For instance, the authors recommended that professors send a survey in advance of an online course to allow them to learn about students' access issues and tailor the a/synchronous requirements and other online learning approaches accordingly.

For all the advantages of synchronous technologies in replicating traditional classroom experiences, there are many issues to consider with respect to whether faculty, students, and the university have access to the equipment, Internet bandwidth, and technology skills to facilitate this format (Hale, 2019). Petzold (2020) addressed the challenges of moving online quickly and shared research-based strategies for using asynchronous modes to help overcome common barriers to technology access and skills. Possible methods to equitably increase access to online education have roots in applying universal design for learning (UDL) principles (Rogers-Shaw et al., 2018). The authors emphasized UDL principles when consulting with faculty during the course design process. In addition to instructional designer and teaching faculty collaborations in course design, the authors connected with support services across campus. For example, shared decision-making as an aspect of servant leadership can be extended beyond the classroom to invite broader collaborations with disability services, inclusion and access units, and other university offices that focus on student needs and accessibility.

A real-world scenario that took inclusion and access into account when making asynchronous vs. synchronous decisions was use of the asynchronous Sections and Groups functions in the LMS to optimize inclusion and access during course design. The global impact of the pandemic and reliance on network connections made the socioeconomic status (SES) divide even more visible (Warschauer et al., 2004). Using Sections made it possible to set different due times for assignments within the same course, which enhanced inclusion for students who needed accommodations because of a variety of reasons. Asynchronous group work with the LMS groups function made large-class communications more manageable because students could "see" other members' posts and learning activities clearly, with a smaller amount of traffic and closer reflection. Synchronous class meetings were structured based on these asynchronous groups, which increased the access to the instructor and their online presence. We also discovered synchronous video conferencing might create more challenges for equity, inclusion, and access because of technology capacity, background transparency/disclosure, skin tone with lighting conditions, and home privacy concerns (Roberts and McCluney, 2020). These discoveries could only have taken place in an environment, informed by a servant leadership approach, in which empowerment and collective wisdom were valued.

Summary

While distance education and the methods and processes it entails are not new, the same methods and processes have never been tested when mobilizing large groups of students and faculty to remote or online instruction in the face of a global pandemic. When making decisions in uncertain times, a servant approach to leadership can be a source of guidance and can inclusively coordinate needs, evaluate situations, and optimize capacity. The empowerment, stewardship, authenticity, and goal-driven directions of servant leadership can ideally engage all members in an online learning environment, including instructional designers, faculty, policymakers, support personnel, and students, so as to harness the affordances of asynchronous and synchronous modes of learning. With the listening and care constructs in servant leadership, it is also more likely to attend to the needs of addressing accessibility and inclusion (Van Dierendonck and Patterson, 2015). Evidently, the pandemic-related adoption of online learning has also driven the enhancement and development of newer features of asynchronous and synchronous technologies for teaching and learning, at an unusual speed (Bonk, 2020). These are accompanied by challenges to equity, inclusion, and accessibility in teaching and learning. To evaluate the newer technology affordances and integrate ever-evolving pedagogy in various disciplines, servant leadership will become increasingly important to connect all constituents to be better equipped to navigate the emerging ecosystem of higher education.

References

Araújo, F. J. O., Lima, L. S. A., Cidade, P. I. M., Nobre, C. B., & Neto, M. L. R. (2020). Letter to the editor: Impact of sars-cov-2 and its reverberation in global higher education and mental health. *Psychiatry Research, 288*. https://doi.org/10.1016/j.psychres.2020.112977

Bonk, C. J. (2020). Pandemic ponderings, 30 years to today: Synchronous signals, saviors, or survivors? *Distance Education, 41*(4), 589–599.

Correia, A. P., Liu, C., & Xu, F. (2020). Evaluating videoconferencing systems for the quality of the educational experience. *Distance Education, 41*(4), 429–452.

Dailey-Hebert, A. (2018). Maximizing interactivity in online learning: Moving beyond discussion boards. *Journal of Educators Online, 15*(3), 65–90. https://doi.org/10.9743/jeo.2018.15.3.8

Erickson, S., Neilson, C., O'Halloran, R., Bruce, C., & McLaughlin, E. (2020). 'I was quite surprised it worked so well': Student and facilitator perspectives of synchronous online Problem Based Learning. *Innovations in Education and Teaching International*, 1–12.

Gelfer, J. I., & Nguyen, N. (2019). An undergraduate inclusive teacher preparation programme in early childhood education: An online delivery approach. *Early Child Development and Care, 189*(4), 650–658.

Goode, J., Peterson, K., & Chapman, G. (2020). Online professional development for computer science teachers: Gender-inclusive instructional design strategies. *International Journal of Gender, Science and Technology, 11*(3), 394–404.

Gronseth, S. (2018). Inclusive design for online and blended courses: Connecting web content accessibility guidelines and universal design for learning. *Educational Renaissance, 7*, 14–22.

Hale, J. A. (2019). Technology in practice: Using web-conferencing software for synchronous class meetings. *Community College Enterprise, 25*(1), 80–85.

Hall, D. J., & Davis, R. A. (2007). Engaging multiple perspectives: A value-based decision-making model. *Decision Support Systems, 43*(4), 1588–1604. https://doi.org/10.1016/j.dss.2006.03.004

Henriksen, D., Creely, E., & Henderson, M. (2020). Folk pedagogies for teacher transitions: Approaches to synchronous online learning in the wake of COVID-19. *Journal of Technology and Teacher Education, 28*(2), 201–209.

Hoffman, E. B. (2019). The centrality of teaching presence: Using multiple modes to facilitate collaborative active engagement in a synchronous teacher online learning community. *Journal of Interactive Learning Research, 30*(2), 107–145.

Hummel, R., Lowry, G., Pinkney, T., & Zadoff, L. (2018). An inquiry into creating and supporting engagement in online courses. *IGI Global*. Retrieved from https://educate.bankstreet.edu/faculty-staff/31

Jacobi, L. (2017). The structure of discussions in an online communication course: What do students find most effective? *Journal of University Teaching and Learning Practice, 14*(1).

Jiang, M., Ballenger, J., & Holt, W. (2019). Educational leadership doctoral students' perceptions of the effectiveness of instructional strategies and course design in a fully online graduate statistics course. *Online Learning, 23*(4), 296–312. https://doi.org/10.24059/olj.v23i4.1568

Joiner, J. M., & Patterson, D. (2019). VoiceThread as a tool in online BSW education. *Journal of Teaching in Social Work, 39*(4–5), 440–454. https://doi.org/10.1080/08841233.2019.1649787

Judge, T. A., Bono, J. E., Ilies, R., & Gerhardt, M. W. (2002). Personality and leadership: A qualitative and quantitative review. *Journal of Applied Psychology, 87*(4), 765.

Kahai, S. S., Sosik, J. J., & Avolio, B. J. (2004). Effects of participative and directive leadership in electronic groups. *Group & Organization Management, 29*(1), 67–105. https://doi.org/10.1177/1059601103252100

Karkar-Esperat, T. M. (2018). International graduate students' challenges and learning experiences in online classes. *Journal of International Students, 8*(4), 1722–1735.

Kutsch, E., & Hall, M. (2005). Intervening conditions on the management of project risk: Dealing with uncertainty in information technology projects. *International Journal of Project Management, 23*(8), 591–599.

Li, C.-S., & Irby, B. (2008). An overview of online education: Attractiveness, benefits, challenges, concerns and recommendations. *College Student Journal, 42*(2), 449–458.

Lin, L.-C., Hung, I.-C., & Kinshuk, & Chen, N.-S. (2019). The impact of student engagement on learning outcomes in a cyber-flipped course. *Educational Technology Research & Development, 67*(6), 1573–1591. https://doi.org/10.1007/s11423-019-09698-9

Liu, J. C., & Alexander, R. (2017). Factors affecting faculty use of video conferencing in teaching: A mixed-method study. *Journal of Educational Technology Development and Exchange (JETDE), 10*(2), 37–54.

Liu, J. C., & Kaye, E. R. (2016). Preparing online learning readiness with learner-content interaction: Design for scaffolding self-regulated learning. In *Handbook of research on strategic management of interaction, presence, and participation in online courses* (pp. 216–243). IGI Global.

Liu, J. C., Spector, J. M., Lockee, B. B., & Childress, M. (2018). Design of innovative learning environment: An activity system perspective. In M. J. Spector, B. B. Lockee, & M. D. Childress (Eds.), *(2019). Learning, Design, and Technology: An International Compendium of Theory, Research, Practice, and Policy*. Springer International Publishing.

Martin, F., & Bolliger, D. U. (2018). Engagement matters: Student perceptions on the importance of engagement strategies in the online learning environment. *Online Learning, 22*(1), 205–222. https://doi.org/10.24059/olj.v22i1.1092

Morgan, H. (2020). Best practices for implementing remote learning during a pandemic. *The Clearing House: A Journal of Educational Strategies, Issues, and Ideas, 93*(3), 134–140. https://doi.org/10.1080/00098655.2020.1751480

Pang, L., & Jen, C. C. (2018). Inclusive dyslexia-friendly collaborative online learning environment: Malaysia case study. *Education and Information Technologies, 23*, 1023–1042.

Peterson, S. J., Walumbwa, F. O., Avolio, B. J., & Hannah, S. T. (2012). The relationship between authentic leadership and follower job performance: The mediating role of follower positivity in extreme contexts. *The Leadership Quarterly, 23*(3), 502–516. https://doi.org/10.1016/j.leaqua.2011.12.004

Petzold, A. M. (2020). Letter to the editor: Resources and recommendations for a quick transition to online instruction in physiology. *Advances in Physiology Education, 44*(2), 217–219. https://doi.org/10.1152/advan.00049.2020

Reilly, K. (2020). The online learning divide: School closures are leaving students without home computers or internet behind. *Time, 195*(12/13), 38–41.

Reynolds, K. (2011). Servant-leadership as gender-integrative leadership. *Journal of Leadership Education, 10*(2), 155–171. https://doi.org/10.12806/v10/i2/rf8

Roberts, L. M. & McCluney, C. L. (2020, June 17). Working from home while black, *Harvard Business Review.* https://hbr.org/2020/06/working-from-home-while-black

Robinson, F. (2011). Stop talking and listen: Discourse ethics and feminist care ethics in international political theory. *Millennium, 39*(3), 845–860. https://doi.org/10.1177/0305829811401176

Rogers-Shaw, C., Carr-Chellman, D. J., & Choi, J. (2018). Universal Design for Learning: Guidelines for Accessible Online Instruction. *Adult Learning, 29*(1), 20–31. https://doi.org/10.1177/1045159517735530

Sansosti, J. M., & Sansosti, F. J. (2012). Inclusion for students with high-functioning autism spectrum disorders: Definitions and decision making. *Psychology in the Schools, 49*(10), 917–931.

Simon, H. A. (1959). Theories of decision-making in economics and behavioral science. *The American Economic Review, 49*(3), 253–283.

Skinner, B. T. (2019). Making the connection: Broadband access and online course enrollment at public open admissions institutions. *Research in Higher Education, 60*, 960–999. https://doi.org/10.1007/s11162-018-9539-6

Smith, S. U., Hayes, S., & Shea, P. (2017). A critical review of the use of Wenger's Community of Practice (CoP) theoretical framework in online and blended learning research, 2000–2014. *Online Learning, 21*(1), 209–237.

Snelling, J., & Fingal, D. (2020). "10 strategies for online learning during a coronavirus outbreak," ISTE Blog, https://www.iste.org/explore/learning-during-covid-19/10-strategies-online-learning-during-coronavirus-outbreak (retrieved June 14, 2020).

Spears, L. C. (1995). *Reflections on leadership: How Robert K. Greenleaf's theory of servant-leadership influenced today's top management thinkers*. John Wiley.

Spears, L. C. (2010). Character and servant leadership: Ten characteristics of effective, caring leaders. *The Journal of Virtues & Leadership, 1*(1), 25–30.

Steinert, Y. (2010). Faculty development: from workshops to communities of practice. *Medical Teacher, 32*(5), 425–428.

Stone, A. G., Russell, R. F., & Patterson, K. (2004). Transformational versus servant leadership: A difference in leader focus. *Leadership and Organization Development Journal, 25*(4), 349–361. https://doi.org/10.1108/01437730410538671

Van Dierendonck, D., & Nuijten, I. (2010). The servant leadership survey: Development and validation of a multidimensional measure. *Journal of Business and Psychology, 26*(3), 249–267. https://doi.org/10.1007/s10869-010-9194-1

Van Dierendonck, D., & Patterson, K. (2015). Compassionate love as a cornerstone of servant leadership: An integration of previous theorizing and research. *Journal of Business Ethics, 128*(1), 119–131. https://doi.org/10.1007/s10551-014-2085-z

Wallace, R. M. (2003). Online learning in higher education: A review of research on interactions among teachers and students. *Education, Communication & Information, 3*(2), 241–280.

Warschauer, M., Knobel, M., & Stone, L. (2004). Technology and equity in schooling: Deconstructing the digital divide. *Educational Policy, 18*(4), 562–588.

Using Live Interactive Improv to Instill a Participatory, Transactional Learning Culture in the Classroom

Robert F. Kenny and Glenda A. Gunter

Introduction

Establishing an immersive, participatory classroom is more easily realized when it is based on the premise that students learn better when they take control and responsibility for their own learning (Bruner, 1961; Jonassen, 1992; Jonassen et al., 1993; Piaget, 1950; Twomey Fostnot, 1989; Vygotsky, 1978) and when students actually engage and interact with the learning provider, whether it is the instructor, the technology, or other mediated content. While this perspective might appear to be obvious, implementation and acceptance of the associated strategic principles have not been universal. Classroom teachers and instructional designers who wish to successfully implement engaged participatory learning can benefit by reviewing the tenets of transactional learning (Garrison & Archer, 2000). Transactional learning holds that full participation requires a cultural change that views the transactions occurring in the classroom (Gray, 1997; Kalyuga et al., 2003; Paas, 1992). In short, what makes the difference in assessing the means used to elicit responses from the learners that engage them in the learning process.

In this chapter, we will present a series of proven techniques developed by successful interactive improv performers that we believe will help teachers and instructional designers to implement an engaging, inquiry-based, and constructivist classroom. Our approach is a synthesized strategy that borrows from the pioneering efforts and longstanding traditions of interactive improv practitioners.

R. F. Kenny (✉)
Florida Gulf Coast University, Fort Myers, FL, USA
e-mail: rkenny@fgcu.edu

G. A. Gunter
University of Central Florida, Orlando, FL, USA

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*, Educational Communications and Technology: Issues and Innovations,
https://doi.org/10.1007/978-3-030-85078-4_3

Improvisational theatre, often called improvisation. Improv is the form of theatre, often comedy, in which most or all of what is performed is unplanned or unscripted: created spontaneously by the performers. Previous attempts to implement participatory practices may have failed mostly because educators have been unwilling or unable to find consensus as to what constitutes best practices for consistently effective, participatory classrooms. When looking for a model, several instances of successful human–human interaction strategies can be found in the successes of practitioners of clinical and developmental psychology, human performance professionals, and video game producers. Educators can learn a lot in reviewing what these other fields have done to integrate the improv strategies.

Educators since the turn of the century have noted with amazement how otherwise reluctant and nonengaged students are willing to spend hours being fully immersed and engaged in front of computer screens while playing interactive video games that are all structured around improvisational interactions (Nussbaum et al., 2003; Prensky, 2003; Standen et al., 2001). Game designers and producers, in particular, have learned how to successfully incorporate interactive transactions and transformative techniques that most instructors merely dream about in their own situations (Gunter et al., 2008; Klimmt & Hartmann, 2006; Reeves & Nast, 1996; Ryan & Desci, 2002).

A complete understanding of these interaction skills is what differentiates success from failure in interactive improv theater. Interactive improvisation dates back to the *commedia dell'arte*, which was formulated in Italy during the eighteenth century. Standard play formats would be customized according to current needs through the use of ad-libbed dialog (Mantzius, 1970). Interactive theater came along much later as a cumulative skill set based partially on improvisation. Interactive theater was originally manifested in the Theater of the Oppressed (TO) (Boal, 1993). In TO, interactive dialogs between the actor and spectators were utilized to empower the latter to take action against the social ills associated with those living in impoverished areas of Brazil (Boal, 2002). Boal's ideas were partly based on those of Paulo Freire (1970), who also utilized similar techniques in educational settings to bring about attitudinal changes on the part of lower-class students. Freire sought to overcome the then popular approaches that fostered a perceived dehumanizing relationship that evolved between teachers and students in which teachers looked upon their students as empty banks that should remain open to the "deposits" made by their teacher (Mann, 1996).

Interactive Performance and Learning

In interactive performance (IP), the audience plays an active role in co-creating the improvised situation or storyline. The process uses inter-actors who are trained in the skills of interacting with audience actors and who create and/or elaborate the environments or settings in which the stories are told. They then integrate audience members who volunteer at random ("spect-actors"), making them participant protagonists in their stories (Wirth et al., 2006). It is the role of the inter-actor to keep the story moving and encourage and further integrate the spect-actor(s) through the use of dialog, body language, and an interactive technique known as back leading. This process places the spect-actor, rather than the inter-actor, at the center of the experience. A well-trained inter-actor can make spect-actors become the driver of the stories without their even realizing it.

We suggest that interactive performance can be successfully utilized to help develop participatory, transactional learning environments. A successful, engaging participatory classroom is one in which the instructor plays a role similar to that of the interactor, and students play the role of the spect-actor. Like the spect-actor who collaborates with the inter-actor to create the entertainment experience, the instructor in this environment needs to be able to offer his or her students a similar opportunity in which they are invited to join collaborators in the creation of knowledge. The changing role of the teacher from being the sage on the stage to a guide on the side (McKenzie, 1998) is perhaps to admit that the best learning situations are actually derived from shared interactions. Like that with interactive performing, a properly implemented interactive teaching approach combines the richness of rehearsed (i.e., planned) material, the spontaneity of improvisation, and the empowerment of participation.

The following is a short list of the educational research found in the literature that serves as a premise to this review of using the principles of Improv Theater in the classroom.

ARCS Model

The ARCS model developed by John Keller and his followers (Keller, 1983, 1998; Keller & Kopp, 1987) has been well documented in the literature as the seminal and foundational motivational theory in educational and training environments. The model is hierarchical in nature in that each step or category is dependent on the previous ones to be present. Once the instructor gains students' attention, for example, he or she must then make the content relevant to the learner as well as previous content so that the former will "buy-in" (invest in belief creation). Once this happens, the instructor then can create more easily some type of appropriate challenge and provides an avenue for success.

Transactional Learning Theory

Transactional learning identifies what happens through interactions with individuals and experiences in which a teacher's (or other knowledge facilitator's) role is defined as encouraging learners to change the way they think about things or dive deeper into a topic. Transactional learning originated in Dewey's (1916) ideas on the transactional relationship between teachers and their students and the role education played in fostering a more democratic version of society. Freire (1970) and Mezirow (2000) furthered Dewey's ideas and settled on a perspective that the most effective learning takes place when learners go from beyond the simple memorization of facts to their becoming authentic learners who are ready to process and internalize that information. These learning "transactions" generally were triggered by some type of problem that is introduced and shared between learners and their teachers through the co-questioning of assumptions, beliefs and values, and consideration of differing points of view.

Self-Determination Theory

Self-determination theory is based on the observation that there exists a huge disconnect between a belief in the natural curiosity of individuals to learn new things and the all-too common experience of apathy, alienation, and irresponsible behaviors in the classroom (Ryan & Desci, 2002). Motivation is generated by at least two social and environmental factors: competency and autonomy. These are closely aligned with the concepts of Challenge and Success in the ARCS model, as well as the principles of engagement found in improvisation and Interactive Performance (Johnstone, 1999; Wirth, 1994). Self-determination theory has become a well-respected set of principles by which successful video game producers model the desired actions contained in their games.

Total Physical Response

Total physical response (TPR) was developed for learning foreign languages for which the learning experience seems more real (i.e., relevant) because students are making an active (i.e., physical) investment of their minds, bodies, and spirits (Asher, 2000b; Kunihira & Asher, 1965). Proficiency is advanced through conversations (i.e., transactions that take place between teacher and learner. Initially, Asher proposed TPR as a system in which some type of physical movement would be utilized to learn foreign languages. He later refined his thinking and evolved it into a concept of brain-switching, which relates a method for removing the fear of making mistakes and by applying right-brained tactics that rely on pattern recognition, visual and auditory inputs, and contextualized exemplars to make them more personalized (Asher, 2000a). These tactics can be directly compared to the offer-bending techniques that a skilled inter-actor learns in order to associate information to keep the story arc moving forward while on stage (Johnstone, 1999; Wirth, 1994).

Cognitive Coaching

Cognitive coaching is a reflective teaching model originally developed by Arthur Costa and Robert Garmston (1989) and is derived by blending psychological aspects of cognitive science with the interpersonal characteristics found in human interactions. Cognitive coaching is a method of instruction based on strategies that support students in becoming independent learners. By understanding the learner and their needs, the coach can help them become confident in problem solving by encouraging confidence and pride. As a supporter, the mentor devotes time to listening, providing reinforcement and responses. The reverse takes place with the participating student responding during "improvatory" learning experiences. Like with interactive improve, cognitive coaching is based on the assumption that learning requires that students understand the problem being presented and then the need to alter their thinking to solve it.

Theory Into Practice

As with a live, interactive performance, a successful coaching experience occurs through an interactive dialog in which the spect-actor (student) and inter-actor (instructor) take turns in leading the classroom conversation toward predictions, further questions, summarizing, and self-appraising (Wirth, 1994; Johnstone, 1979, 1999). We have pared the list of known interactive performance techniques down to a smaller subset that are closely aligned with the teaching practices and theories of Keller (1983, 1998; Keller & Kopp, 1987), Ryan and Desci (2002), Costa and Garmston (1989), and Asher (Asher, 2000b; Kunihira & Asher, 1965). The elements of our model have been validated in dozens of workshops that have been conducted by Wirth (1994) for more than a decade as he traveled throughout the country, and more recently in sessions conducted by both authors for masters' level, in-service and pre-service teachers. The process of developing a final instructional model is iterative. The authors intend to conduct future workshops in which the elements of the model will be modified and adjusted as needed.

Assumptions

Before beginning with specific strategies, it is important to make certain assumptions. The first is to understand that the atmosphere in the classroom is better served if it fosters the creation of a sense of play, an element common and central to successful interactive media, video games, and interactive theater. While one might think that the concept of play is rather nebulous, it has been studied to the point of being measured by specific metrics. Based on an interpretation of the findings presented in the P.E.N.S. model developed by researchers who studied the motivational pull of video games (Ryan et al., 2006), we suggest that, if properly implemented, play can become an efficacious and central part of a well-designed, interactive classroom. Developing a sense of play or performance in the classroom adds an emotional tag that emits a feeling of empowerment because the content feels more real (i.e., relevant) on a personal level. Like the emotional involvement derived in an interactive bit performed on an improv stage, this sense of play moves to an "investment in the belief" in the content being delivered (Wirth, 1994, p. 2). It is this investment that forms the basis of the learning transactions being sought.

It is important to realize that behavioral change is what is being managed and encouraged. Like in a good story, change is best accomplished when there is a disruption to the norm. Piaget (Wadsworth, 1978) describes this concept as a "disequilibration" in which the norm is interrupted to stimulate the cognitive powers of individuals due to their desire for consistency. The first step in the process is to achieve some type of overt physical change in behaviors or the physical appearance of the classroom (like changing the desks around in the room, teaching from a different location, or forming learning circles, etc.). It is better to manage major changes in small, incremental steps, working toward the larger ones. In Interactive Performance parlance, this is known as the "ramping." The inter-actor asks the spect-actor to engage in small increments using leading questions, paying attention to small changes in body language, facial expressions, and other clues. In educational terms, this is similar to Vygotsky's (1978) zone of proximal development, or the gap between what learners can do and what they might do with if they receive help.

Getting a large number of people to accept change is best accomplished by first getting a small group to go along as a form of "social proof." Once a few individuals begin to overtly buy into the proposed change, others will follow along until there is a majority. Any activity that starts out as a group exercise requires that the group members bring back to the whole class at least one new idea they have learned. This overt reflective activity can be accomplished by having one member from each group write on the board the most important thing they learned and then having the entire class determine if there are any common threads that arise by reading each group's contribution.

The trick is to have students participate (i.e., invest in the belief) with the instructor playing the role of the inter-actor or improvisational performer who takes whatever is offered by the spect-actor (i.e., student) to further along the storyline (i.e., academic content). By interacting with the teacher in this manner, the learner begins to physically participate (i.e., invest) in the process, in a manner similar to the Total Physical Response model described by Asher (2000b).

The first step in establishing a receptive learning environment is to help participants move past their fears so that they might begin to invest in the question. The instructor needs to recreate this same fail-safe environment in which the students begin to invest in the belief, allowing him or her to craft whatever response is offered toward the desired outcome. In other words, students should be rewarded for taking chances rather than being punished. Maximum participation will not occur if too many students are afraid to raise their hands. This approach is rooted in Freire's (1970) ideas that break away from established social rules associated with being right or wrong and establishes the same sense of inquiry and play found in a child's sandbox. In the classroom, all responses to questions become an investment toward the desired outcome(s).

A Sampling of Interactive Improv Methods That Elicit Participation

In an interactive improv performance, empowering the audience is key. If no one voluntarily makes an offer or interchange because they are afraid to appear foolish, it is up to the performer to provide a comfort zone by demonstrating that being wrong is harmless and not a source of discomfort. The performer may accomplish this by requesting questions for which he or she does not know the answer or perhaps intentionally making an incorrect response. The situation in the classroom is identical. The teacher models what being wrong means by being willing to take the risk of being incorrect or even by soliciting wrong answers. This furthers the empowerment and gives students permission to be wrong. A wrong answer becomes a right one because a wrong answer was solicited.

A third tactic is to allow students to guess or creatively suggest a response. Getting individuals to respond in this way provides an alternative means to grant permission to be wrong. The successful interactive improv performer quickly learns many of the ways to ramp things up and move things along. One method that many performers use is to provide the audience member with a "lifeline," in which he or she is offered an opportunity to call upon another individual to help them out. The process works identically in the classroom. A struggling student is offered an opportunity to call upon a peer to help them answer the question. Involving other students increases the number of those engaged in the activity. The process works best when the student who is struggling restates the correct answer using his or her own words so that he or she embodies (i.e., acts out) the experience.

Additional Methods to Engage

Most of what has been introduced so far falls in line with a class warm-up. The ramping process is involved both at the micro level (i.e. within a particular individual strategy) and at the macro level (throughout the entirety of all interactions):

Bending the Offer (Answer) Once students begin to invest in the dialog, the next step is to begin working with the answers that are provided and begin putting them to good use. Incorrect answers are "bent" toward desired ones. In improvisation, an offer is anything that is said or done. In the interactive classroom, students' answers to questions represent an offer. In an educational setting, bending an offered answer means to restate it or reinterpret it in a way that makes it a useful means to finding the desired one. In interactive performance, this is called a "peg": something is offered, and although seemingly incorrect, becomes the basis for further discovery.

Anthropomorphosis Once the momentum of participation has been established, the next step is to utilize a tactic to catalyze the experience. The instructor creates physical and emotional ties with the subject matter by anthropomorphizing it. This provides an opportunity for students to begin acting out the human-like characteristics of the object or concept. It requires at least minimal knowledge about the topic by some of the students in the class. The process begins by interviewing a student who has agreed to become that object or concept. For example, in a science class the topic might be electrons. The instructor begins by asking the student to play the role of an electron with questions like "How do you feel?" or "What do you do all day?"

Just like with an improvisational performance, it is important for the instructor to ask leading questions that cannot be answered with a simple "yes" or "no." Simple questions lead nowhere. In improv, the concept is that one party makes an offer that provides their partner with additional information so that he or she can decide on a direction for bending it or offering a peg. With a proper set-up and properly phrased questions, the interview technique can reap many dividends, but requires practice to learn how to create the correct form of questions lest they lead to new misconceptions.

Incorporating a Tag In interactive performance, a tag is a "brief handle that helps the audience reflect on the story they have just seen" (Wirth, 1994, p. 68). Summarization and reflection are valid and meaningful activities in situations whose goal is to have its participants recall information at a later time. The tag is what brings structure to what otherwise seems like an unplanned, ad-libbed enterprise. For students in a mathematics or science class, the tag could take the form of a written journal or a group discussion, or a short review at the end of the class period of the progress made, conclusions discovered, or most significant thing learned. In a literature class, one could ask students to utilize their journals to create a fictionalized account of a dialog that could have taken place between themselves and a famous person using the same interview techniques modeled and practiced in class. That review/dialog could then be utilized as the hook (advanced organizer) during the introduction to the next class session. The tag should always loop back to how the activity got started so that students begin to understand the process.

Group Interactions The activities described thus far are generally introduced to the class as a whole. It is important that they be iterated multiple times so that the concepts become recognized as the norm. Once a majority of the students begins to demonstrate their understanding of the flow and handling the interview process independently, the next step is to break the class into groups of three of four and have members ask each other questions. The role of the interview should be passed on with everyone taking turns asking and responding. On a rotating basis, one person is tasked with keeping a journal of the questions and responses so that a record is maintained to keep the groups on task. The instructor moves among the groups to witness the process and provide summative feedback.

Design Case Researchers at the Interactive Performance Lab (IPL) at the University of Central Florida utilized these Interactive Performance techniques to formulate an academic discipline in its School of Visual Arts and Design (Agogino et al., 2001; Burgoyne, 2004; Gressler, 2002). The use of these techniques presents a perfect design case for building interactive and engaging classrooms. Researches developed these as the basis for the strategies implemented in its TeachLive technology Initiative. TeachLive is a tool that is premised on the richly interactive, live role-playing strategies found in interactive improv and whose goal is to utilize the interactive improv performance strategies to assist with the university's teacher preparation and leadership programs.

While the steps outlined in these approaches are intended to encourage increased engagement, the rare situation may arise in which too many participate, resulting in frustration due to everyone wishing to participate at once. Group activities are the way to handle this situation.

Correlating These Strategies to Different Modalities

Research has been very clear that an immersive and engaging classroom environment is one of the most important physiognomies that can affect student learning. Simply put, students participate more fully in a program when they view the teaching and the learning environment as a supportive pathway that is interactive, collaborative, and positive. This is as important for the blended/online classroom environment climate as it is for the physical classroom. All three of these associations contribute to a positive climate and environment. The authors suggest that interactive improve is a valid means to that end.

With these changes in the online learning landscape, the researchers felt an ever-increasing need to ensure that socialization and the development of relationships would remain constantly in focus in their course design. As the various online collaborative tools evolved over time, the need to embrace the capabilities of technical advances also became more important. These included strategies such as real-time conferencing, virtual worlds, and more connected-based social media, community connections in their content designs. Considering the ongoing need for enhancing students learning experiences in higher education and training, the goal is to use improv strategies to enhance all learning environments, whether face-to-face or online and how to enhance the experiences of all students.

Summary and Conclusions

While this teaching approach appears to share many of the same characteristics and principles as other instructional delivery methods, the difference lies in its implementation. The instructional landscape is very similar to that of a video game in many ways. Interactive teaching involves authentic role-playing between teachers and students in which a content storyline is co-developed. As with an interactive performance, the story (i.e., knowledge goal) may be preset or created on the fly, but in either case, it becomes a tool or instrument for learning.

While some small case studies have been implemented to verify the assumptions made, the authors realize that the next step is to formalize the model and begin collecting empirical data to determine long-term instructional effectiveness and impediments to its full adoption in teacher preparation programs.

As far as the future is concerned, we continue to look at alternative solutions for improving teaching and learning while creating instructional strategies for the K-20 classroom for all modalities (i.e., blended/hybrid or fully online). Currently, we seek to utilize interactive performance tools that may be the most effective in recreating live classroom experiences for synchronous, online classes.

References

Agogino, A.M., Ng, E., & Trujillo, C. (2001). *Using interactive theater to enhance class- room climate*. Proceedings of the WEPAN/NAMEPA. Alexandria VA, April 21–24.

Asher, J. J. (2000a). *Learning another language through actions* (6th ed.). Sky Oaks Productions.

Asher, J. J. (2000b). *Brainswitching: Learning on the right side of the brain* (2nd ed.). Sky Oaks Productions.

Boal, A. (1993). *Theater of the oppressed* (pp. 132–133). Theatre Communications Group.

Boal, A. (2002). *Games for actors and non-actors*, (2nd ed). Translated by Adrian Jackson. Routledge.

Bruner, J. S. (1961). The act of discovery. *Harvard Educational Review, 31*(1), 21–32.

Burgoyne, S. (2004). Engaging the whole student: Interactive theatre in the classroom. *Essays on teaching excellence: Toward the best in the academy,* 15, (5), The Pod Network.

Costa, A., & Garmston, R. (1989). *The art of cognitive coaching: Supervision for intelligent teaching*. The Institute for Intelligent Behavior.

Dewey, J. (1916). *Democracy and education: An introduction to the philosophy of education*. Simon & Schuster.

Freire, P. (1970). *Pedagogy of the oppressed* (Ramos, MB, Trans.). Continuum.

Garrison, D. R., & Archer, W. (2000). *A transactional perspective on teaching and learning: Advances in learning and instruction (1st ed)*. Bingley (UK): Emerald Publishing.

Gray, A. (1997). *Contructivist teaching and learning*. SSTA Re- search Centre Report. Retrieved January 2, 2008, from http://saskschoolboards.ca/research/instruction/97-07.htm

Gressler, T. H. (2002). *Theatre as the essential liberal art in the American University*. Mellen Press.

Gunter, G. A., Kenny, R. F., & Vick, E. H. (2008). Taking educational games seriously: Using the RETAIN model to design endogenous fantasy into standalone educational games. *Educational Technology Research and Development, 56*(5-6), 511–537.

Johnstone, K. (1979). *Impro: Improvisation and the theatre*. Theatre Arts Books.

Johnstone, K. (1999). *Improv for storytellers*. Routledge/Theatre Arts Books.
Jonassen, D. H. (1992). Evaluating constructivistic learning. In T. M. Duffy & D. H. Jonassen (Eds.), *Constructivism and the technology of instruction : A conversation* (pp. 137–148). Lawrence Erlbaum.
Jonassen, D., Mayes, T., & McAleese, R. (1993). A manifesto for a constructivist approach to uses of technology in higher education. In T. M. Duffy, J. Lowyck, D. H. Jonassen, & T. M. Welsh (Eds.), *Designing environments for constructive learning*. Springer-Verlag.
Kalyuga, S., Ayres, P., Chandler, P., & Sweller, J. (2003). The expertise reversal effect. *Educational Psychologist, 38*(1), 23–31.
Keller, J. M. (1983). Motivational design of instruction. In C. M. Reigeluth (Ed.), *Instructional design theories and models: An overview of their current status* (pp. 383–434). Lawrence Erlbaum.
Keller, J. M. (1998). Using the ARCS process in CBI and distance education. In M. Theall (Ed.), *Motivation in teaching and learning: New directions for teaching and learning*. Jossey-Bass.
Keller, J. M., & Kopp, T. W. (1987). Application of the ARCS model to motivational design. In C. M. Reigeluth (Ed.), *Instructional theories in action: Lessons illustrating selected theories* (pp. 289–320). Lawrence Erlbaum.
Klimmt, C., & Hartmann, T. (2006). Effectance, self-efficacy and motivation to play video games. In P. Vorderer & J. Bryant (Eds.), *Playing video games: Motives, responses, and consequences*. Lawrence Erlbaum Associates.
Kunihira, S., & Asher, J. J. (1965). The strategy of the total physical response: An application to learning Japanese. *International Review of Applied Linguistics, 3*(4).
Mann, B. (1996). The pedagogical and political concepts of Mahatma Gandhi and Paulo Freire. In B. Claußen (Ed.), *International studies in political socialization and education*. Bd. 8. Hamburg. ISBN 3-926952-97-0.
Mantzius, Karl. (1970). *A history of theatrical art in ancient and modern times*. (von Cossel, L. (Trans.)). Peter Smith.
McKenzie, J. (1998). The wired classroom. *From Now On Educational Technology Journal*, 7(6), March. Retrieved February 3, 2009, from http://fno.org/mar98/flotilla2.html.
Mezirow, J. (2000). *Learning as transformation: Critical perspectives on a theory in progress*. Jossey Bass.
Nussbaum, M., Cumsllea, P., Marianov, V., Correaa, M., Floresa, P., Graua, V., Lagosa, F., Lópeza, X., Lópeza, V., Rodriguez, P., & Salinas, M. (2003). Beyond Nintendo: Design and assessment of educational video games for first and second grade students. *Computers & Education, 40*(1), 71–94.
Paas, F. (1992). Training strategies for attaining transfer of problem-solving skill in statistics: A cognitive-load approach. *Journal of Educational Psychology, 84*, 429–434.
Piaget, J. (1950). *The psychology of intelligence*. Routledge.
Prensky, M. (2003). ACM Computers in Entertainment, 1 (1), October 2003, Book 02.
Reeves, B., & Nast, C. (1996). *The media equation: How people treat computers, television, and new media like real people and places*. Cambridge University Press.
Ryan, R. M., & Desci, E. L. (2002). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*(1), 68–78.
Ryan, R. M., Rigby, S., & Przybylski, A. (2006). The motivational pull of video games: A self-determination theory approach. *Motivation and Emotion, 30*(4), 344–360.
Standen, P. J., Brown, D. J., & Cromby, J. J. (2001). The effective use of virtual environments in the education and rehabilitation of students with intellectual disabilities. *British Journal of Educational Technology, 32*(3), 289–299.
Twomey Fostnot, C. (1989). *Enquiring teachers, enquiring learners: A constructivist approach for teaching*. Teachers College Press.
Vygotsky, L. S. (1978). *Mind and society: The development of higher mental processes*. Harvard University Press.
Wadsworth, B. (1978). *Piaget for the classroom teacher*. Longman.

Wirth, J. (1994). *Interactive acting: Acting, improvisation, and interacting for audience participatory theatre*. Fall Creek Publishing.

Wirth, J., Ingraham, K., & Moshell, J. M. (2006). *Digital media and environmental inter- active performance*. Paper presented at the iDMAa+IMS Conference 2006 (International Digital Media and Arts Association), Oxford, OH, April 6-8, 2006. Retrieved January 2, 2009 from: www.units.muohio.edu/codeconference/schedule/Conference%20Schedule%20for%20Web.pdf.

Instructional Design as a Way of Acting in Relationship with Learners

Jason K. McDonald

Fifty years ago, in an article on the benefits of programmed instruction, Post (1972) argued that "learning is the responsibility of [learning] materials," and so the designer of those materials "can, to a great extent, control and engineer quality of learning and is, by extension, accountable for the results" (p. 14). This statement, although more explicit than most, reflects a long-standing tension in the field of instructional design: Who, ultimately, is responsible for the learning that people experience? But while contemporary instructional designers would likely reject Post's stark statement, recent research suggests that the underlying issue of who controls learning is still one they face. As Matthews and Yanchar (2018a, 2018b) concluded in their study of the topic, designers often want to enable people to take meaningful control over their own learning but can feel constrained in their ability to do so. The theories and strategies they rely on, the technologies they use, or situational factors (like lack of direct access to learners) leave them thinking that they have no choice but to place learners in a passive role and accept primary responsibility for learning themselves. And this has an influence on the form their instructional materials take. "The degree to which designers see themselves as solely or mostly responsible for a learner's success will play a role in how they design" (Matthews & Yanchar, 2018b, p. 112).

My audience in this chapter is designers who have experienced this kind of tension. While they want to see themselves as important contributors to the form that educational experiences take, they struggle to articulate a view of instructional design that does not place ultimate responsibility for learning in the instructional strategies or technological forces that are under their (the designers') control. It is difficult for them to conceptualize approaches to their work that do not at least

J. K. McDonald (✉)
Brigham Young University, Provo, UT, USA
e-mail: jason@byu.edu

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*, Educational Communications and Technology: Issues and Innovations,
https://doi.org/10.1007/978-3-030-85078-4_4

tacitly assume that the designer is the primary agent responsible for learning, even though they resist this conclusion and continue to search for alternatives. My purpose is to present a view of instructional design that can serve as such an alternative. First, I describe different ways that designers have historically assumed they were primarily responsible for students' learning. Second, I discuss how similar issues are still a concern even with recent evolutions in the field toward human-centered design practices. Third, I present a view of instructional design, based in the philosophy of Hannah Arendt, that considers it to be a type of relationship that designers enter into with learners, rather than principally being a process for making instructional products. In presenting this, I also suggest how a reframed view provides new ways of considering designer responsibility, helping designers better understand what they are influencing when they design. This can lead to designers being better partners with learners in pursuit of the unique disclosure of all parties involved, which is a type of achievement that could not be attained without viewing learners as equal contributors to the learning relationship.

Historical Assumptions About Designer Responsibility

Historically, instructional designers have approached the issue of responsibility for learning in different ways. On the one hand, the purpose of many instructional technologies is to provide learners some ability to shape at least certain aspects of an instructional experience (often called learner control over instruction). Sorgenfrei and Smolnik (2016), in their review of the literature on learner control, summarized the most common forms as being (a) the times that instruction takes place, (b) the environment where instruction happens, (c) the way instructional material is displayed or sequenced, (d) the type and amount of interaction with instructors or other learners, and (e) the selection of instructional material or learning activities (p. 158). However, these types of learner control are often viewed as secondary concerns as techniques that instructional designers employ after they have already determined the purposes, intended outcomes, and other strategies that define the shape of the learning experience (for instance, see the discussion in Ertmer & Newby, 2013, pp. 60–62). In placing learner control in a subordinate position, as a technique that will accomplish certain instructional purposes, it can sometimes appear as if those planning instruction view themselves as responsible for deciding the rules of the game while offering players (learners) a choice of whether their uniforms are green or blue.

In many ways, this view of learner control reflects Gur and Wiley's (2007) critique of contemporary instructional technology, where they characterized the controlling tendencies designers can exhibit as being a type of "objectification" of learners. Learners are treated as an "object, raw material, or resource" to be transformed through their exposure to the materials the designer creates. And while it may seem this would only be a problem with passive, instructivist forms of education, Gur and Wiley saw it as a possibility that could occur in other paradigms as well, particularly when designers are required to create instruction that is specified and packaged in advance, so that it can be relied upon to consistently produce "predetermined [instructional] ends." Presumably, this can occur even when the learning activities in which students engage have active or constructivist characteristics. The downward pressure designers can feel to specify and fix in advance as many details about an experience as possible can pull them away from the learner-centered ideals with which they began. Designers may be required to prove a course achieves promised ends, demonstrate it complies with quality specifications, standardize it so that it can be sold commercially or transferred between instructors or institutions, or design it as a stand-alone experience that can be completed without an instructor's assistance (cf. McDonald et al., 2005). The resulting instruction may ostensibly resemble the experience toward which they were originally aiming (such as an active learning environment), but in practice, designers can find that it does not achieve the results they had hoped to achieve (McDonald & Gibbons, 2009).

A more invisible, but possibly more pervasive, manifestation of designers' assumed responsibility can be seen in the deterministic tendencies of many learning and instructional theories. Evidence of these tendencies can even be found in theories that are typically viewed as sympathetic toward the concepts of learner control or learner agency. While affirming the value of learner choice as an instructional method, theories can still be at least somewhat deterministic in attributing control over learning to instructional strategies, environmental forces, or internal cognitive processes. For instance, in Matthews's (2016) review of the literature on the theories of self-regulated learning, situated learning, and constructivism, he found that researchers can be inconsistent in their approach to learner agency. While affirming the value of learners' taking an active role in their learning, and even to some extent asserting that learners' participation is an integral component of learning, some of the most well-known researchers in these paradigms still have a difficult time escaping the position that cultural or cognitive processes outside of learners' control are the ultimate determiners of whether learning actually occurs.

Consequently, the practices derived from these theories can be inconsistent, where designers see themselves as granting students the ability to choose options within instruction, but at the same time believing the strategies themselves are what really determine whether learning takes place. As Matthews and Yanchar (2018b) concluded, this can create "a kind of irony," where learners can seem to be "active … in clicking on and using interactive elements of instruction," but designers might assume they are actually "quite passive, in the sense of being unable to resist mental engagement with the interactive element they've been asked to click" (p. 119). So if human agency can be attributed to anyone in the setting it would again appear to be designers since they are responsible for choosing the instructional strategies in the first place.

Contemporary Issues Concerning Designer Responsibility

While granting that this may have been true historically, one might wonder if it is still the case that instructional designers are either explicitly or tacitly assuming they are primarily responsible for learning, especially given recent interest they have shown in becoming a more human-centered, design-oriented field (Boling & Gray, 2014; Buchanan et al., 2013). While there are a number of shapes their interest in design has taken, one that has become relatively common is the use of formalized design thinking processes (Baker III & Moukhliss, 2020; A. H. Brown & Green, 2018), popularized by Stanford University and the product design firm IDEO (T. Brown & Katz, 2011; Chen et al., 2018; Glen et al., 2015; Woudhuysen, 2011). Design thinking is commonly described as being human-centered (Baker III & Moukhliss, 2020; Micheli et al., 2019), meaning it includes steps for addressing human concerns with understanding and empathy, even to the extent of sometimes including the ultimate users of a product in the design process (Sanders & Stappers, 2008). So designers may assume that if they follow design thinking processes they will be supporting people as being the primary agents of their own learning.

Questions have been raised, however, about whether the most popular design thinking processes actually are as human centered as they claim to be. Kimbell (2011), for instance, in her review of design thinking's history, concluded that "many accounts of design thinking identify the designer as the main agent in design" (p. 299), and that "even when design thinking involves designers having empathy for users, the designer … is presented as [the] agent of change within an organization or project" (p. 300). Kimbell argued that design thinking, despite its human-centered language, still presents design and designers as being the driving forces responsible for change. It simplistically presumes that if designers use the correct processes that innovative outcomes will somehow result, regardless of the agency of other players involved, a critique echoed by Johansson-Sköldberg et al. (2013), Lourens (2015), and Stolterman (2016).

So while design thinking may represent an advancement in some respects, it does not escape the fundamental issue of designer responsibility. If the design process itself contains a deterministic power, then primary responsibility is placed upon the designer to select the right process and execute it the right way (McDonald & Gibbons, 2009). An unfortunate implication of this is that it can encourage a hegemonic approach to design, where the users of a design become secondary players in the designer's own story, largely existing to consume the products that she (the designer) determined to be important. Even when a product is presumably based on what users so-called need, design thinking presents the achievement as the result of some designer's creativity, as a person who was crafty enough to frame the problem in an innovative way and discover a previously hidden opportunity (Bowen et al., 2016; Dorst, 2015; Verganti, 2008). The users themselves are viewed as being at the designer's mercy, unable to solve their own problems, and requiring that the designer turn her attention toward them and apply the seemingly magic design process (Woudhuysen, 2011).

An Alternative View: Instructional Design as a Relationship

This does not mean that what instructional designers do is futile or that they have no ability to influence a situation. But whatever influence they are having when they design, their design processes, learning theories, or instructional strategies are not the primary factors that define or control whatever learning occurs. To clarify how designers can support but not be responsible for learning, I present an alternative view of instructional design that considers it as primarily being a type of relationship that designers enter into with learners. This does not ignore the important role that design processes or designed products play, but it places them in the subordinate position as being means for designers to enact their relationships rather than being the end of their work in itself. (I also note that this relational view is not specific to instructional design. It also describes design more generally, but I do not have space to explore that argument here.) This view of instructional design resembles relational views of education such as Noddings's care ethics (e.g., Noddings, 2012), and design approaches that give a prominent place to those being designed for such as participatory design (de Vries & Reinmann, 2018; Pedersen, 2020), or the design justice movement (Costanza-Chock, 2018). But to frame my argument I will primarily draw on Hannah Arendt's explication of the differences between making things and acting in relationship with others (Arendt, 1998), as well as educational theorists who have built upon Arendt's work (e.g., Biesta, 2013; Dunne, 1997).

Although Arendt is often considered to be a political philosopher, her work has been used in other fields—including education (Biesta, 2013) and design (Tassinari et al., 2017)—to articulate views of practice that give primacy to human judgment and self-disclosing expression rather than bureaucratic systems of control (for a broad overview of her work, see D'Entreves, 2019). One of Arendt's most well-known books, titled *The Human Condition* (Arendt, 1998), explored a framework of three, distinct modes of existence in which people can find themselves—(a) labor, or their everyday efforts to survive; (b) work (also called making or fabrication), which is their ability to produce artifacts they find useful or pleasing; and (c) action, or their ability to enter into relationships with others, forming communities that are useful in themselves and not because they are means for achieving other ends. Framing instructional design as a type of relationship relies on differences between the latter two categories. To minimize my use of unfamiliar jargon, I will primarily refer to them as making and action (or acting in a relationship).

Making

In Arendt's (1998) view, making refers to the activities in which people engage to create objects that provide durable value. Making is characterized not only by the nature of the things created but also by people's purposes for creating them. Most of the time the value that is derived from the made object is instrumental; it enables or facilitates the accomplishment of certain ends that provide people a sense of satisfaction or importance. Additionally, when people are making they are typically guided by some type of plan, model, or underlying desire. Even if the maker cannot anticipate in advance every activity that will lead to the end result, and even if her goals change over time, her work is always aimed toward some end that she is attempting to articulate and clarify through the act of making itself. When she is making, she cannot justify her activity for its own sake, but only as it contributes toward some productive goal that will ultimately stand apart from herself as an actor. But at the same time, the made object is not only an extension of the desires of those creating it. Although the maker may have had certain ends in mind, once the object exists it can be put to other uses or even lead to unanticipated consequences in its primary use.

Given all these demands, makers value stability and predictability (Dunne, 1997). They seek to routinize and rationalize their making processes to efficiently achieve their goals, minimize the risks of any unexpected effects, and measure the productivity of their work. Eventually, nearly everything they encounter is framed as being (a) inputs into their processes of making, (b) material being transformed by the steps of the process, or (c) the resulting output of the process. All of these elements are able to be codified and evaluated for how well they contributed toward the maker's purpose or aim.

Instructional Design as a Type of Arendtian Making

In Arendt's (1998) framework, most views of instructional design are examples of this type of making. This is especially the case for traditional views that define the field as a "process of systematically applying instructional theory and empirical findings to the planning of instruction" (Dick, 1987, p. 183). Perhaps the most obvious point of alignment is that the result of designers' efforts is usually some type of product, service, system, or curriculum that is aimed toward identifiable ends (instructional goals, learning outcomes, etc.). Instructional strategies or methods are necessary components of these products that at least partially dictate whether its intended ends are achieved. Another point of similarity is that "mainstream approaches to instructional design tend to have a low tolerance for risk …. Their intent is to generate dependable, predictable results …. [using] processes [that] value consistency and order" (McDonald, 2016). Even recognizing that most design models encourage designers to use them iteratively, revisiting earlier phases as more is learned about the design problem, their ultimate goal is to drive out uncertainty through activities such as defining goals, planning how to achieve them, and measuring the results (Gibbons et al., 2014). But even instructional design practices based on design thinking tend to align with Arendt's views of making. Although design thinking does not rely on the same systematic rationality as do traditional processes, the result is similar—design thinking structures one's movement toward an end goal through a series of steps meant to manage, or at least reduce, the effects of uncertainty (Henriksen et al., 2017).

According to Arendt (1998), if instructional designers approach their practice from a making perspective—defining their purpose as producing objects or services that are intended to have an identifiable effect—then it is not surprising that they can also be found attempting to take ultimate responsibility for student learning (even if they might reject such a proposition if it were presented to them explicitly). Assuming such responsibility is not a defect that results from using an out-of-date process or instructional strategy (such as ones modeled on behaviorism), with the solution being to adopt processes/strategies more aligned with learner control. Rather, it is the result of a demand placed upon them to demonstrate their value and produce some type of defined result, often imposed on them as an expectation from external stakeholders. The downward pressure in such a model is for instructional designers to view learners in a similar manner as other makers view the material with which they work. Learners become matter to be mastered and shaped, and instructional strategies and techniques are the tools designers have to produce the forms of learning that will adequately demonstrate that they are fulfilling their responsibility. This is the case even when designers view the outcomes as being in the learners' best interests, and perhaps even aligned with natural learning processes.

Acting in Relationships

Making is not the only form of human achievement Arendt described, however. The relationships people enter into, forming communities that are good in themselves and not merely means to other ends, are also important. In fact, in Arendt's thinking these communities best provide the conditions for human flourishing. Arendt's account of acting in these relationships (Arendt, 1998, pp. 175–247) contains many insights for instructional designers. But limits of space permit only a brief contrast between action and making that can be used to frame an alternative view of instructional design: Whereas making encourages the use of processes or strategies that provide some form of predictable outcome, acting in a relationship is allowed to be inherently unpredictable because the goal is not to produce a predetermined outcome but for the actors to respond to each other freely. This view of action not only discourages one party from taking responsibility for the activities of another (e.g., designers taking responsibility for student learning), it cannot exist if any party in the relationship attempts to do so. Each actor in a relationship is equally able to "set something into motion" (p. 177) that cannot be anticipated with certainty by what they or others did before. Arendt called this the human capacity for "beginning" (p. 177). When others respond to an actor's beginning, there is the possibility that they will redirect its motion, setting it off in another, unpredictable direction. But this only happens when people have the freedom to reveal what makes them distinct from others—a possibility that is at least partially suppressed when actors take upon themselves the responsibility to produce predictable outcomes.

Of course, people often do desire that their communities work together toward some type of identifiable accomplishment. But in Arendt's idea of action, the specifics of those accomplishments are not what is of ultimate value; they may be tangible manifestations of the group's interests, but the intangible disclosures of self that "bind them together" (Arendt, 1998, p. 182) are more fundamental. The accomplishments become subordinate to the community members' self-revelations. For instance, Biesta (2006) noted a difference between a group of individuals who "*work* together [to] produce things [e.g., certain types of learning outcomes]" (p. 82; emphasis in original), and a learning community that finds value in "becoming [new people] through the way in which [they] engage with what [they] learn" (p. 94). In the first, the freedom of individuals is subservient to the outcomes the group is pursuing. If one or more actors are responsible to ensure the outcomes are achieved, they will be incentivized to control the situation, trying to prevent others from disclosing any distinctness if it interferes with the group's ability to reach its goals. But in the second, the community prioritizes the distinctness of the people involved above the other accomplishments they are pursuing.

Arendt (1998) recognized this means that "action almost never achieves its [original] purposes" (p. 184). But this is acceptable because if everyone is free to disclose their uniqueness then whatever is actually achieved also has the possibility of being truly unprecedented. The uncontrollable interactions between people's beginnings and responses to other's beginnings lead to the creation of "something new … which cannot be expected from whatever may have happened before" (pp. 177–178). By this Arendt was not referring to new objects or artifacts in the world (although she recognized that this could also result); she was referring to the development of people's identities. Identity is not something one forms in advance and then discloses to others, but is formed in the situations where one discloses it. Biesta (2013) noted that this should be of particular importance to educators since in many ways what is considered truly valuable learning happens when learners create something new (if not actually unprecedented at least new to them), and not only when they mimic what others have done before.

What a person begins is fragile, however. Others may pick it up or not, and even if they accept it they may divert it into directions the original actor did not anticipate or may not agree with. So both the promise of accomplishing something beyond any individual's capability and the peril of people's efforts leading to failure spring from the same source. And these risks cannot be driven out through the adoption of the right kind of process or technique (Biesta, 2013). If one hopes for a specific goal to be accepted by a community, its achievement depends on "the degree to which [it] strikes a responsive chord in others who will co-operate with it and carry it along toward some completion" (Dunne, 1997, p. 93). Arendt's (1998) described this as people's capacity to promise, as in promising that while one views the beginning she initiates as desirable, she will continue in the relationship regardless of whatever end is actually produced. Acting in a relationship, therefore, requires trust from all parties involved. Yet this is different than how makers trust their process or other techniques. In Arendt's view, parties to the promise in a relationship know there is no guarantee. They hope that others will follow-through, but know that doing so depends on those individual's capabilities and goodwill. But makers attempt to externalize trust, infusing it into their processes, strategies, theories, or methods. They attempt to ensure that they have tools that can adequately achieve the outcomes they view themselves as having the responsibility to achieve, and that can compensate for any weaknesses in other people or uncertainty found in the situation itself (cf. Dunne, 1997; Nelson & Stolterman, 2012).

Instructional Design as Arendtian Action

Considering instructional design to be a relationship of action in this Arendtian sense addresses many of the deficiencies found in a making model. This does not mean designers abandon their efforts to create products, services, or systems, nor that they do so without the assistance of process, strategy, or method. But it does put all of those tangible manifestations of their work into a subordinate position to the relationship designers have with learners, as well as others involved (such as stakeholders or team members). Of course, these relationships will be different than what goes on between teachers and students. They will also be different in various design contexts, such as where designers are preparing materials for teachers to use versus when they are designing a course for learners to use without a teacher's assistance. So I do not prescribe a model for what an Arendtian design relationship must be. My purpose is to summarize some of what designers will do, and what they will properly influence, when they consider themselves as acting in relationships with other parties in a learning situation, as opposed to what they might do when they see themselves as craftspeople who make learning artifacts (products, environments, experiences, etc.) out of materials under their control.

First, instructional designers will not view their activities as primarily being meant to develop something that exists apart from them, nor will they view the products or services they create as the end of their efforts. Rather, all of these are types of beginnings they can offer into a learning relationship. Designers are disclosing something about themselves when they act, attempting to set something into motion they think is worthwhile for the collective well-being of the groups to which they belong. Activities such as learner analysis, prototyping, evaluating, and so on are therefore not tools they use like they might use a saw. They are expressions of something unique about the designer, a disclosure of what she thinks learning can or should be. So how a designer carries out design activities is a revelation about what she thinks is important, valuable, good, and worthwhile. The same is true of the products designers create, or the strategies and techniques they employ in particular learning activities—these are not tools to ensure the production of certain learning outcomes, but proposals designers offer, attempting to set into motion (begin) what they envision good learning to be. Therefore, the first area of influence that designers have in Arendtian design relationships (and one of the things they are actually responsible for) is offering compelling beginnings that others may be persuaded to pick up, as opposed to being responsible for whether any outcomes are actually achieved.

Second, instructional designers will recognize that what they set into motion is only valuable to the extent that it is picked up by others with whom they are in a relationship. This includes the potential that others will use it to begin something on their own that is different than what the designer anticipated. The agency of all parties (learners, stakeholders, team members) matters. In many ways, this is similar to what is offered by participatory design approaches. Although common views of participatory design often limit it to being when a designer "[seeks] the involvement of any stakeholders [or end users] at any point in the process" (Bannon et al., 2019, p. 28), it was originally meant to be more democratic, where design was not "designer-driven" (p. 31), and where design processes were themselves redesigned in partnership with those being designed for to ensure they were not controlling or manipulative. So what I am suggesting may differ only in emphasis, where I encourage designers to respect what others set into motion not only for how it advances a design project but for how it also allows those others to freely disclose something about themselves. This is the second form of influence and responsibility designers have: how they respond to the beginnings of others. Do they attempt to rechannel those beginnings, so the intended outcomes of the project or the design can continue to be pursued as specified? Or do they accept what others set into motion, so that even if the anticipated purposes are not achieved they might jointly create something unexpected, something "boundless" that escapes "the limited, graspable framework" the designer could see on her own (Arendt, 1998, p. 190)?

Finally, instructional designers will promise others that they will hold up their end of the relationship. They should contribute to a sense of trust among all parties involved that they are invested, and working to allow the full revelation of everyone's identities. This implies that designers should allow for flexibility in what they design, so their designs can be redirected by learners toward other ends that those learners find to be more freeing. It also implies that designers may join with learners in attempting to persuade stakeholders that the stakeholders' outcomes are not as important as what the learners are attempting to set into motion. But it also implies that designers might join with stakeholders in attempting to persuade learners that there is something important about the outcomes the stakeholders proposed. Or designers may do all of these at the same time. Yet, however they go about it, designers will recognize that there is no guarantee, nor will it be possible to pre-specify a process or method that will be useful. This "is the price human beings pay for freedom," as Arendt concluded (Arendt, 1998, p. 244). But if they cannot guarantee results, they can influence the relationship by being the types of designers (and the types of people) that other parties can trust, so that when they recommend a certain course of action other people have a basis on which to accept their judgment.

Implications and Concluding Thoughts

There are a number of implications to this view of instructional design as a type of Arendtian relationship. I conclude with a brief discussion of only a few, each of which is recommended as a topic for further exploration and additional research.

As alluded to earlier, there is not a one-size-fits-all model for what it looks like when instructional designers are in a relationship with their learners. The literature of co-design and participatory design may provide some insights (Simonsen & Roberson, 2013), but instructional designers should not stop with these. There may be other ways for designers to cultivate the relationships of action that Arendt described that go beyond participatory design models. For instance, what might it look like when instructional designers promise their learners that they will support them in their self-disclosures? Especially when in many cases designers have little-to-no contact with learners after the design is complete (e.g., self-study courses; stand-alone learning resources)? While current literature provides some suggestions, such as Matthews and Yanchar's (2018a) recommendation that if nothing else designers can ask themselves, "what would I want if I was taking this class?" (p. 155), further consideration of this and similar issues is needed. And there is especially a need to carry out this kind of research in a manner that places those impacted by design at the center, rather than only being carried out from the designer's perspective (Costanza-Chock, 2018).

Accepting instructional design as a relationship in Arendt's sense will require designers to be more flexible in the designs they create, allowing for adaptations in the outcomes learners actually achieve, when they achieve them, or to what extent learning material is mastered. Admittedly, these issues are often outside of designers' control, with stakeholders mandating that designers take responsibility for certain outcomes. This pressure may be greater on entry-level designers who are often tasked with direct course development. So designers will either need support from those with more authority to promote views such as those described here or will need to develop the institutional power to engage in more direct negotiation with stakeholders themselves. This may be difficult, especially since how well an instructional design achieves the stakeholders' preferred outcomes is one of the typical ways designers demonstrate their value to an organization (Barnett & Mattox, 2010). The difficulty may be compounded when the outcomes are somewhat outside of stakeholders' control as well (e.g., the public demands that airline pilots receive adequate training). But perhaps these extreme situations are less common than designers might think. And even in situations where prespecified outcomes are unavoidable, it seems likely that designers can find other ways to accept what learners set into motion, or otherwise recognize their self-disclosure. As already noted, this will depend more on designers' ability to persuade than control. If nothing else, they can at least accept that their primary purpose is to respond to others freely while allowing them the same freedom, and not being to create a product or service of some type. If they approach their work from this perspective, it seems possible that they will find whatever creative approaches they can to cultivating their relationships with learners despite situational constraints they encounter.

Additionally, if learning relationships are a joint accomplishment between instructional designers, learners, and other concerned parties, then instructional designers and design researchers will need to expand the types of sources they draw upon when planning or studying instructional situations. This is in contrast to some views that frame the field as being primarily applied psychology or applied learning sciences (for a review of some of these trends, see McDonald & Yanchar, 2020). While certainly such fields provide insight, in a relational view of design they will not always be the priority. Dunne's (1997) expansion of Arendt's views even suggested that existing knowledge may only be of limited applicability in situations where actors are able to jointly create "something new … which [could not] be expected from whatever may have happened before" (Arendt, 1998, pp. 177–178). So there may be cases where designers will benefit more from reworking scholarship from other fields that study relationships into views of instructional design as a type of relationship. For instance, robust views of instructional design relationships might benefit from scholarship on relationship roles and responsibilities, patterns in relationships, or how dysfunctional relationships can be repaired (e.g., Barnett & Mattox, 2010; Lankshear et al., 2013). The same could be said about instructional design researchers drawing inspiration from fields such as theater or music, which are also concerned with how activities between people (performers and an audience) can become a joint accomplishment (e.g., Machon, 2013), rather than being viewed primarily as a tangible product.

Finally, I encourage instructional designers to accept the lack of certainty that is implied when one acts in an Arendtian relationship. It may be uncomfortable at times. But, in truth, designers never have the certainty they want, and even if they try to assume responsibility for learning outcomes, rely on strategies or techniques as reliable methods for activating natural learning processes, or otherwise assume they are the driving force of change, such feelings are little more than an illusion (cf. Yanchar & Spackman, 2012). Designers will be wise to accept this uncertainty, and even to embrace it (cf. McDonald, 2016). As Dunne (1997) argued, "We benefit more by what comes into play in our experience without our having the ability to summon it than by what results from our deliberate calculation and choice" (p. 14). The discussion of Arendtian action presented here meant to contribute toward a view of the field that can free instructional designers to better work with whatever comes into their play, rather than trying to calculate, control, or take responsibility for outcomes that are best left as the byproduct of such free and uncontrollable disclosure.

References

Arendt, H. (1998). *The human condition*. The University of Chicago Press.

Baker, F. W., III, & Moukhliss, S. (2020). Concretising design thinking: A content analysis of systematic and extended literature reviews on design thinking and human-centred design. *Review of Education, 8*(1), 305–333. https://doi.org/10.1002/rev3.3186
Bannon, L., Bardzell, J., & Bødker, S. (2019). Reimagining participatory design. *Interactions, 26*(1), 27–32.
Barnett, K., & Mattox, J. R. (2010). Measuring success and ROI in corporate training. *Journal of Asynchronous Learning Network, 14*(2), 28–44. https://doi.org/10.24059/olj.v14i2.157
Biesta, G. J. J. (2006). *Beyond learning: Democratic education for a human future*. Paradigm Publishers.
Biesta, G. J. J. (2013). *The beautiful risk of education*. Taylor & Francis.
Boling, E., & Gray, C. M. (2014). Design: The topic that should not be closed. *TechTrends, 58*(6), 17–19. https://doi.org/10.1007/s11528-014-0798-6
Bowen, S., Durrant, A., Nissen, B., Bowers, J., & Wright, P. (2016). The value of designers' creative practice within complex collaborations. *Design Studies, 46*, 174–198.
Brown, A. H., & Green, T. D. (2018). Beyond teaching instructional design models: Exploring the design process to advance professional development and expertise. *Journal of Computing in Higher Education, 30*(1), 176–186. https://doi.org/10.1007/s12528-017-9164-y
Brown, T., & Katz, B. (2011). Change by design. *Journal of Product Innovation Management, 28*(3), 381–383. https://doi.org/10.1111/j.1540-5885.2011.00806.x
Buchanan, R., Cross, N., Durling, D., Nelson, H. G., Owen, C., Valtonen, A., Boling, E., Gibbons, A. S., & Visscher-Voerman, I. (2013). Design. *Educational Technology, 53*(5), 25–42.
Chen, S., Benedicktus, R., Kim, Y., & Shih, E. (2018). Teaching design thinking in marketing: Linking product design and marketing strategy in a product development class. *Journal of Marketing Education, 40*(3), 176–187. https://doi.org/10.1177/0273475317753678
Costanza-Chock, S. (2018). Design justice: Towards an intersectional feminist framework for design theory and practice. *DRS2018: Catalyst*. https://doi.org/10.21606/drs.2018.679
D'Entreves, M. P. (2019). Hannah Arendt. In E. Zalta (Ed.), *The Stanford encyclopedia of philosophy*. https://plato.stanford.edu/archives/fall2019/entries/arendt/
de Vries, B., & Reinmann, G. (2018). Resonating with reflexive design: On participatory design, narrative research and crystallization. *Educational Design Research, 2*(1), 1–13. https://doi.org/10.15460/eder.2.1.1184
Dick, W. (1987). A history of instructional design and its impact on educational psychology. In J. A. Glover & R. R. Ronning (Eds.), *Historical foundations of educational psychology* (pp. 183–202). Plenum Press.
Dorst, K. (2015). *Frame innovation: Creating new thinking by design*. The MIT Press.
Dunne, J. (1997). *Back to the rough ground: Practical judgment and the lure of technique*. University of Notre Dame Press.
Ertmer, P. A., & Newby, T. J. (2013). Behaviorism, cognitivism, constructivism: Comparing critical features from an instructional design perspective. *Performance Improvement Quarterly, 26*(2), 43–71. https://doi.org/10.1002/piq.21143
Gibbons, A. S., Boling, E., & Smith, K. M. (2014). Instructional design models. In J. M. Spector, M. D. Merrill, J. J. G. Van Merriënboer, & M. P. Driscoll (Eds.), *Handbook of research on educational communications and technology* (4th ed., pp. 607–615). Springer Science+Business Media. https://doi.org/10.1007/978-1-4614-3185-5_48
Glen, R., Suciu, C., Baughn, C. C., & Anson, R. (2015). Teaching design thinking in business schools. *International Journal of Management Education, 13*(2), 182–192. https://doi.org/10.1016/j.ijme.2015.05.001
Gur, B. S., & Wiley, D. A. (2007). Instructional technology and objectification. *Canadian Journal of Learning and Technology, 33*(3).
Henriksen, D., Richardson, C., & Mehta, R. (2017). Design thinking: A creative approach to educational problems of practice. *Thinking Skills and Creativity, 26*, 140–153. https://doi.org/10.1016/j.tsc.2017.10.001

Johansson-Sköldberg, U., Woodilla, J., & Çetinkaya, M. (2013). Design thinking: Past, present and possible futures. *Creativity and Innovation Management, 22*(2), 121–146. https://doi.org/10.1111/caim.12023

Kimbell, L. (2011). Rethinking design thinking: Part I. *Design and Culture, 3*(3), 285–306. https://doi.org/10.2752/175470811X13071166525216

Lankshear, S., Kerr, M. S., Laschinger, H. K., & Wong, C. A. (2013). Professional practice leadership roles: The role of organizational power and personal influence in creating a professional practice environment for nurses. *Health Care Management Review, 38*(4), 349–360. https://doi.org/10.1097/HMR.0b013e31826fd517

Lourens, N. (2015). *A critique of design thinking : An interrogation into the value and values of design thinking*. University of Pretoria.

Machon, J. (2013). *Immersive theaters: Intimacy and immediacy in contemporary performance*. Palgrave Macmillan.

Matthews, M. T. (2016). *Learner agency and responsibility in educational technology*. (Unpublished doctoral dissertation). Brigham Young University.

Matthews, M. T., & Yanchar, S. C. (2018a). Instructional design as manipulation of, or cooperation with, learners? *TechTrends, 62*(2), 152–157. https://doi.org/10.1007/s11528-017-0245-6

Matthews, M. T., & Yanchar, S. C. (2018b). Instructional designers' perspectives on learners' responsibility for learning. *Journal of Computing in Higher Education, 30*(1), 111–124. https://doi.org/10.1007/s12528-018-9175-3

McDonald, J. K. (2016). Embracing the danger: Accepting the implications of innovation. *Educational Technology, 56*(6), 14–17.

McDonald, J. K., & Gibbons, A. S. (2009). Technology I, II, and III: Criteria for understanding and improving the practice of instructional technology. *Educational Technology Research and Development, 57*(3), 377–392. https://doi.org/10.1007/s11423-007-9051-8

McDonald, J. K., & Yanchar, S. C. (2020). Towards a view of originary theory in instructional design. *Educational Technology Research and Development, 68*(2), 633–651. https://doi.org/10.1007/s11423-019-09734-8

McDonald, J. K., Yanchar, S. C., & Osguthorpe, R. T. (2005). Learning from programmed instruction: Examining implications for modern instructional technology. *Educational Technology Research and Development, 53*(2), 84–98. https://doi.org/10.1007/BF02504867

Micheli, P., Wilner, S. J. S., Bhatti, S. H., Mura, M., & Beverland, M. B. (2019). Doing design thinking: Conceptual review, synthesis, and research agenda. *Journal of Product Innovation Management, 36*(2), 124–148. https://doi.org/10.1111/jpim.12466

Nelson, H. G., & Stolterman, E. (2012). *The design way: Intentional change in an unpredictable world* (2nd ed.). The MIT Press.

Noddings, N. (2012). The caring relation in teaching. *Oxford Review of Education, 38*(6), 771–781.

Pedersen, S. (2020). Staging negotiation spaces: A co-design framework. *Design Studies, 68*, 58–81. https://doi.org/10.1016/j.destud.2020.02.002

Post, D. (1972). Up the programmer: How to stop PI from boring learners and strangling results. *Educational Technology, 12*(8), 14–17.

Sanders, E. B.-N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. *Co-Design, 4*(1), 5–18. https://doi.org/10.1080/15710880701875068

Simonsen, J., & Roberson, T. (Eds.). (2013). *Routledge international handbook of participatory design*. Routledge.

Sorgenfrei, C., & Smolnik, S. (2016). The effectiveness of e-learning systems: A review of the empirical literature on learner control. *Decision Sciences Journal of Innovative Education, 14*(2), 154–184. https://doi.org/10.1111/dsji.12095

Stolterman, E. (2016). *Some thoughts about the problematic term "design thinking."* Retrieved from http://transground.blogspot.com/2016/12/composing-some-blogposts-in-small-ebook.html

Tassinari, V., Piredda, F., & Bertolotti, E. (2017). Storytelling in design for social innovation and politics: A reading through the lenses of Hannah Arendt. *The Design Journal, 20*(sup1), S3486–S3495. https://doi.org/10.1080/14606925.2017.1352852

Verganti, R. (2008). Design, meanings, and radical innovation: A metamodel and a research agenda. *Journal of Product Innovation Management, 25*(5), 436–456. https://doi.org/10.1111/j.1540-5885.2008.00313.x

Woudhuysen, J. (2011). The craze for design thinking: Roots, a critique, and toward an alternative. *Design Principles and Practices, 5*(6), 235–248. https://doi.org/10.18848/1833-1874/CGP/v05i06/38216

Yanchar, S. C., & Spackman, J. S. (2012). Agency and learning: Some implications for educational technology theory and research. *Educational Technology, 52*(5), 3–13.

The Case for Rethinking Multimedia

Hal Hinderliter

Mayer's (2002) Cognitive Theory of Multimedia Learning (CTML) has been a mainstay of instructional design for nearly two decades, but recent developments in theoretical frameworks relevant to multimedia learning point to a reversal of many previously held assumptions (Mayer, 2005; Mayer & Fiorella, 2014; van den Broek et al., 2014). Activities that update or redefine CTML's many principles indicate the need for closer examination of the theories and principles used to support our multimedia design practices. This chapter will examine multiple issues regarding CTML that question its influential status within the instructional design community.

Instructional design for online course delivery has long taken a positive view toward the use of multimedia (Reiser & Gagné, 1983, p. 3). The term has been in use since at least 1959, with the term "media" (the plural of "medium") referencing the technological channels of distribution through which representations are made available to audiences; e.g., text, photography, audio recordings, television, streaming video. Multimedia presentations enable the simultaneous delivery of content via multiple channels, allowing learners to access a particular message in more than one way; e.g., a classroom lecture delivered as a narrated PowerPoint video, or an e-book that incorporates animated diagrams.

In Mayer's omnibus theory, multimedia is both the overarching concept as well as the key initial principle. According to Mayer's (2002) definition of a multimedia effect as stated in his cognitive theory of multimedia learning, delivering instruction as both visual and auditory content will increase learners' opportunity to absorb and retain its contents. While this idea may seem indisputable in today's media-rich environment, it represents the modern rejection of previously accepted notions that "combined audiovisual presentation is no better than auditory alone" (Penney, 1975,

H. Hinderliter (✉)
Northern Illinois University, DeKalb, IL, USA
e-mail: hal@halhinderliter.com

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*, Educational Communications and Technology: Issues and Innovations, https://doi.org/10.1007/978-3-030-85078-4_5

p. 69). This chapter reviews several theories that laid the groundwork for Mayer's treatise, then discusses recent developments and concerns over the applicability of its many principles in terms of the range of modes affected and the types of learners who may benefit. Accordingly, this chapter does not challenge Mayer's "presentation modes approach" (Mayer, 2002, p. 96) to multimedia; instead, its scope is limited to enumerating a short list of concerns regarding CTML's frequently invoked prescriptions: the design of the experiments that form the basis of the theory, the relevance of the situations in which these experiments were conducted, the difficulty of replicating these results, the cognitivist assumptions on which its principles are based, and the impact of these assumptions on the accessibility of CTML-guided content.

Review

The study of multimedia's efficacy for instructional tasks predates the Internet, online learning, and the use of personal computers in classrooms. Throughout Mayer's most influential research (see Mayer et al., 1996; Mayer, 2002, 2005; Mayer & Johnson, 2008), multiple aspects of multimedia learning are seen within a cognitivist framework. This focus on cognition when examining learning processes, that is, how our brains process then store information, can be traced to Miller (1956), among others. His seminal paper on the limits of short-term working memory put forth the idea that humans face "severe limitations on the amount of information that we are able to receive, process, and remember" before postulating that these limitations could be reduced by "organizing the stimulus input simultaneously into several dimensions and successively into a sequence of chunks" (Miller, 1956, p. 96). By foregrounding the importance of human cognitive processes, Miller advanced the idea that human capacity to learn was limited by inadequate working memory.

The Roots of CTML

Miller's ideas were expanded upon through Atkinson and Shiffrin's (1968) information processing theory, Anderson's (1977) schema theory, and others (e.g., Fleming & Levie, 1978; Johnson-Laird, 1983). Among the most influential of these ideas was Paivio's (1986) dual-coding theory, which proposed separate processing centers for language and nonverbal stimuli. Paivio theorized that presentation modalities, which he defined as verbal or nonverbal, have an important impact on students. Dual-coding theory differed from prior behaviorist notions of knowledge acquisition, which held that modality was unimportant; prior to the advent of cognitivism, the content being communicated was considered key, while the choice of delivery method was thought to be inconsequential.

Sweller (1988) described a production model for human problem solving that views the human mind's cognitive processes as a series of switch gates on a circuit board; this theory of cognitive load proposed a discrete, limited capacity for human visual and auditory input. Three forms of cognitive processing are summed to define learners' total cognitive load: intrinsic load, that is, the effort required to understand the primary learning task; extraneous load, that is, the undesirable additional stress incurred by poorly formed instructions; and germane load, for example, the effort involved in fixing new information within long-term memory. Cognitive load theory cautions against overloading the brain's processing capacity so that problem-solving schemas may be acquired for transfer into long-term memory. The resilience of cognitive load theory can be seen today when instructional designers configure learning environments so as to avoid overwhelming learners' restricted audiovisual processing capacity, a situation known as *cognitive overload*. The popularity of cognitive load theory led to the proposal of several related ideas, each focused on avoiding or controlling the effects of cognitive load.

Chandler and Sweller (1991) proposed the redundancy principle, that is, that redundant material decreases the intelligibility of instruction by overloading learners' processing capacity. As technology made it easier to combine text and graphics during instruction, Chandler and Sweller (1992) also identified a split attention effect as the cognitive load created by switching between focal points. By the mid-1990s, cognitive load-related theories pertaining to how learners acquire information from presentations were multiple. These closely related ideas were often used interchangeably to justify a common belief: that displaying too much text within a narrated presentation would overload visual working memory, leading to inferior learning outcomes.

Defining the Principles of Multimedia Learning

With so many related ideas competing for attention, it is unsurprising that Mayer decided to coordinate them all beneath a single umbrella, which he called the Cognitive Theory of Multimedia Learning (CTML). Mayer developed CTML over a series of publications. The first of these (Mayer et al., 1996) promoted the combining of visual and verbal stimuli in an annotated illustration called a multimedia summary. This technique was said to promote the retention and transfer of scientific information by reducing students' cognitive load through three principles: *conciseness*, meaning that only a few sentences and illustrations are used; *coherence*, meaning that related content is presented in cause-and-effect sequence; and *coordination*, meaning that graphics and sentences are presented contiguously.

In a literature review, Mayer (2002) elaborated his first list of nine key principles for multimedia learning; these principles were retained when Mayer (2014) later expanded the list to 12 principles:

- The *multimedia effect* is the belief in better transfer when a message contains words and pictures rather than words alone.
- The *spatial contiguity effect* is the belief that words and related graphics should be presented in close physical proximity to each other.
- The *temporal contiguity effect* states that visual content and related audio content should be presented at the same time.
- The *coherence effect* is that irrelevant words, graphics, and sounds should be excluded.
- The *modality effect* is the belief that animated graphics and videos should be accompanied only by narration, not by text.
- The *redundancy effect* states that animated graphics and videos should be accompanied only by narration, not the combination of text and narration.
- The *pretraining effect* says that introducing topics before instruction is better than explaining them after instruction.
- The *signaling effect* promotes signaling the importance or relationship of concepts, either graphically, for example, through the use of bullet points, or verbally, for example, using words such as "because" or "as a result."
- The *personalization principle* calls for the use of conversational language as opposed to formal language.

Expanding the Definition of CTML

In one chapter of a book he edited for Cambridge University Press, Mayer (2005) published a more detailed explanation of multimedia learning that included three primary assumptions: *dual channels*, that is, that visual and auditory stimuli are processed separately; *limited capacity*, that is, that the amount of information these channels can process is circumscribed; and *active processing*, that is, that attending to, organizing, and integrating information leads to meaningful learning.

More crucially to the purpose of this chapter, Mayer (2005) also included research that showed measurable benefits from specific forms of redundancy under certain conditions, for example, when text-only slides are accompanied by redundant narration. Mayer's acknowledgment of redundant narration's value in text-only situations advanced his prior research with Moreno (Moreno & Mayer, 2002), which reported a threefold increase in correct answers when learners were shown presentations where the narration was an exact reflection of the on-screen text, i.e., verbally redundant. This finding ran counter to Kalyuga et al.'s (1999) delineation of a redundancy effect as well as Mayer's (2002) initial definition of CTML's redundancy principle.

Soon after, Mayer and Johnson (2008) offered a more articulated sense of multimedia learning principles in an attempt to explain such contradictory test results. Mayer called these exceptions to the rule *boundary conditions*. As one occurrence of such a condition, Mayer and Johnson (2008) said that redundancy, previously defined as a deleterious effect, becomes helpful in narrated presentations when short text labels are adjacent to the graphics they describe. They described such boundary conditions as a "reverse redundancy effect" that can occur under several conditions: when the narration is complex or contains unfamiliar words, when the narration is not in the learner's native language, when the pace of presentation is slow or learner-controlled, or when the audience is composed of low-knowledge learners. Later, Mayer and Fiorella (2014) reiterated redundancy's boundary condition for text-only slides accompanied by matching narration, noting: "The redundancy effect can disappear when no graphics are presented. In this case, adding on-screen text does not create split attention because there is no other material to process in the visual channel" (p. 299).

Other researchers have proposed additional boundary conditions, including for the personalization effect. For example, results for higher-knowledge learners did not improve when formal language was replaced by conversational language (McLaren et al., 2011; Wang et al., 2008). As CTML expanded from 9 (Mayer, 2002) to 12 principles (Mayer, 2017), each with the possibility of boundary conditions that might cause a reversal of the stated effect, its complexity has become a matter of concern. de Jong (2010) challenged the legitimacy of multimedia learning theory due to the growing number of proposed boundary conditions. While each new extension to CTML demands attention, this added complexity also increases the need for assurance of its utility. To that end, numerous questions can and should be posed to help us rethink Mayer's broadly accepted guidelines for the use of multimedia.

Discussion

Having listed some of the formative research and publications that define CTML, this chapter will now address several concerns regarding this influential theory.

Experiment Design

Unlike some theories that explore a solitary phenomenon through a single experiment, Mayer's CTML is a coalition of multiple theories that pre-date its introduction. In that 2002 publication, Mayer supported his list of principles by referring to sixty previous tests conducted within 20 studies, a corpus that he had collected and analyzed over the course of 12 years. Mayer is the principal or second investigator in nearly all of these studies, the great majority of which were conducted between 1989 and 2001. Sixty is certainly an impressive number of tests, but many of these experiments are based on the same instrument even when the stated purpose of the experiment differs from the principle it is used to support.

As just one example, multiple aspects of CTML – the multimedia effect, temporal contiguity, and pretraining – are explored through various repetitions of the "pumps" experiment (Mayer & Gallini, 1990; Mayer & Anderson, 1991, 1992; Mayer & Mathias, 2001). In Mayer and Anderson's (1991) experiment, only 15 subjects participated in each of two treatments; in both forms of the experiment, subjects viewed a computer-based animated cut-away line drawing of the inner workings of a bicycle pump, with one group hearing an audio explanation of the process before viewing the animation, and another hearing the audio while the animation was playing. No visual text was provided. After the treatment, participants were assessed via four open-ended questions posing hypothetical situations intended to test transfer of the knowledge gained by watching the animation. Each participant was given only 2.5 min to answer each question; these responses were scored on a scale of 1–4 for the first three questions but only a maximum of two points was allocated for the fourth question. Given the brief window of time allowed for participants to compose their written responses and the subjectivity of scoring them, the truncated scale on which the responses were scored, a pretreatment screening process that did not inquire as to participants' knowledge of fluid mechanics, the unknown variations in English proficiency and compositional ability among participants, and the limited number of participants undergoing each treatment ($n = 15$), questions may be raised as to whether these results are truly representative of the phenomenon under study.

Perhaps more significantly, Mayer and Anderson (1991) state that this experiment is designed to evaluate Paivio's dual-coding hypothesis against two alternate suppositions: the single-code hypothesis, and the separate dual-code hypothesis; these alternatives to Paivio's theory are not credited to any prior source, implying that they may have been crafted to function as straw men in this scenario. These issues would already pose significant concern when considering this intended application of the experiment, but Mayer (2002) relies on the Mayer and Anderson (1991) results to support his formulation of only marginally related principles, for example, temporal contiguity. When today's instructional designers defer to CTML's temporal contiguity principle as defined by Mayer, that is, that best results come when "corresponding words and pictures are presented at the same time" (Mayer, 2002, p. 111), most are likely unaware that this position is based on treatments using audio narration with an animation, not the use of visual text with narration as commonly found in narrated text-only presentations.

Another aspect of Mayer and Anderson's (1991) experiment that fails to receive sufficient scrutiny is its reliance on system-driven timing. The efficacy of instruction via online and assistive technologies is affected by the degree of user control allowed over the speed and timing of the presentation; this is especially pertinent for non-native language speakers as well as learners with physical or neurological limitations. Other early computer-mediated experiments referenced by Mayer (2002) would have generated higher cognitive loads through the use of system-paced presentations, for example, when Mayer and Anderson's (1991) participants were given only 30–45 s to absorb the meaning of each animation. Unfortunately, Mayer (2002) does not discuss the impact of (the now ubiquitous) user-controlled timing on the validity or applicability of CTML's principles.

Situational Relevance

To say that much has changed about the delivery of multimedia instructional content since the last decade of the twentieth century is a substantial understatement. The 60 experiments offered in support of CTML include paper-based treatments (Mayer, 1989; Mayer & Gallini, 1990; Mayer et al., 1996) as well as computer-based treatments involving HyperCard stacks on a monochrome Macintosh Ilci computer (Mayer & Anderson, 1991). Additionally, these experiments took place in classrooms and computer labs rather than in the solitary isolation experienced by today's online learners, who typically access their instruction from home via the Internet. Perhaps most relevantly, students watching computer-based animations in the early 1990s would have been fascinated by such a novel high-tech approach; in today's media-rich environment, however, students are highly acclimated to the use of animation, video, and narration. Any assumption that the differences between today's educational environment and the situations in which these experiments were conducted more than two decades ago should have no influence on the validity of CTML's principles seems unlikely to be true.

To this end, Tabbers et al. (2004) asked if broadly accepted findings regarding the modality effect might not be generalizable due to the unique conditions and content of the previous research. Tabbers et al. surveyed the previous research in this area, then questioned if these experiments were adequately reflective of real educational environments (p. 74). The authors expressed concern that many of the landmark studies in this area were conducted under laboratory conditions and involved only brief instruction focused solely on technical domains (e.g., Jeung et al., 1997; Kalyuga et al., 1999; Mayer & Moreno, 1998; Moreno & Mayer, 1999; Mousavi et al., 1995; Tindall-Ford et al., 1997). This potential inapplicability of previous research to today's online educational settings exacerbates the lack of targeted research into multimedia learning's potential. Since the publication of Tabbers et al.'s provocative research, the use of computer-based experiments has grown but few previous studies have been thoroughly replicated using adequate sample sizes within modern online instructional environments.

Replication Concerns

The landmark results of early research into cognitive learning principles have proven difficult to replicate, inspiring questions as to whether we should strictly adhere to CTML's principles when multiple empirical studies can offer only a mixed record of support. As early as 1975, Penny reviewed published studies showing that learners could best remember lists in short-term memory when the information was presented auditorily rather than visually, that is, the modality effect – but contemporaneously, dissenting studies found superior results from visual presentation (Kroll et al., 1972; Marcer, 1967; Scarborough, 1972). Since that time, numerous experiments designed to investigate individual multimedia effects have produced contrary or inconclusive results (Jeung et al., 1997; Kalyuga et al., 1999; Leahy & Sweller, 2011; Savoji et al., 2011; Tabbers et al., 2004) that cast doubt on the immutability of CTML's oft-cited principles. Research conducted by Tabbers et al. (2004) found that use of visual learning material was superior to audio in terms of student transfer and retention; in Tabber's words, "Replacing visual text with spoken text even had a negative effect on learning, contrary to what both cognitive load theory and Mayer's theory of multimedia learning would predict" (p. 80). Such challenges with replicability should be of great concern, especially given that Mayer has associated CTML compliance with large effect sizes (e.g., Mayer, 2002; Moreno & Mayer, 1999.)

Cognitivist Assumptions

Constructivist scholars have long been uneasy with the presumption that cognitive research should be seen as a deterministic force in education (Greeno, 1989; Derry, 1992). Constructivist pedagogy recommends the customization of lesson plans in order to suit the unique individuality of each learner, while cognitivism seeks to determine a singular "true" manner in which students learn new information en route to the development of global prescriptions that will benefit all. Constructivists may consider the conceptualization of students' minds as analogous to computers to be a gross oversimplification, but CTML is among many theories advanced by cognitivist thinkers that remain embedded within modern instructional design practices. This has occurred because such principles are truly useful tools in guiding the development of instructional content; however, cognitivist assumptions may be better thought of as rough outlines marking the complex contours of human understanding. This is especially true when researchers are tempted to forego experimental research by relying solely on insights gleaned from models of cognitive processes, as the complexity of real-world situations and the immense variability of human functionality cannot be accounted for through one-size-fits-all suppositions.

Impact on Accessibility

Due to the factors previously discussed, the broad applicability of CTML's principles is often in conflict with issues of accessibility. Mayer and Johnson (2008) proposed that boundary conditions are relevant to low-knowledge learners, but what of learners with other challenges, for example, vision impairment, hearing impairment, cognitive impairments, or low language proficiency? While such groups have traditionally been overlooked in research on multimedia learning, together they comprise a substantial, growing portion of the student body. The narrow focus of most cognitivist-derived educational research on neurotypical native English speakers raises concerns regarding the generalizability of such findings. In an experiment with non-native English speakers, Toh et al. (2010) found that learners exposed to temporally contiguous and verbally redundant instruction performed significantly better than those who experienced only audio narration. Surprisingly, some researchers have decried attempts to elevate the needs of second-language students or learners with disabilities. For example, the influential scholar Sweller (2005) has strongly advocated against the use of fully redundant text and narration as a waste of precious cognitive resources; despite admitting that "information that is redundant for one person may be essential for another" (Sweller, 2005, p. 165), he remains adamant that "information should be presented in a single form only, i.e., with all other versions and all unnecessary explanation eliminated" (p. 167).

This issue foregrounds the need for accessibility in online instruction. Relevant teaching theories such as Universal Design for Learning (Rose et al., 2006) urge us to adopt the most broadly accessible approach in every situation, as opposed to the most familiar, the most convenient, or the most exclusive. Many aspects of CTML are compatible with accessible learning frameworks such as Universal Design for Learning. The multimedia effect, contiguity, coherence, pretraining, signaling, and personalization are all helpful to learners with disabilities; only CTML's modality and redundancy effects preclude the use of narration with redundant on-screen text. Regardless of its impact on neurotypical students' test scores, the use of verbally redundant multimedia presentations frees hearing-impaired learners, students with low-language proficiency, and those studying in noisy environments from the need for captions. (In such cases, however, closed captions should still be made available for use with assistive technologies such as Braille terminals.)

Conclusion

Ongoing research that explores delivery styles for multimedia presentations should be considered fundamental to our practices. Advances in computer processing power, learning management systems, interactive programming technologies, and students' familiarity with multimedia render experiments from more than a decade ago unsuitable as proxies for the modern distance learning experience. Mayer's Cognitive Theory of Multimedia Learning has provided a useful framework for the development of online instruction. However, it remains a theory in flux, with multiple studies providing contrasting insights into the utility and efficacy of its many principles. Rather than adopt an unquestioning allegiance to CTML, today's instructional designers should evaluate each principle's effectiveness on a broad variety of learners within the context of modern online learning environments. Content creators must decide whether to design for an idealized audience with the caveat that boundary conditions may apply to others, or to consider just how few learners match this idealized conception – then design presentations that offer accessibility for the many.

To quantify the validity and applicability of Mayer's multimedia learning principles to both general and nontraditional audiences, continued research is needed. Specifically, more quantitative research must be conducted on a variety of learners within actual online courses so that our accepted approaches to multimedia design can be contrasted with recent scholarship expanding or challenging those practices. Further discussion regarding the implication of multimedia theory on current practices should provide meaningful insights into our fundamental assumptions regarding instructional design and their impact, if any, on learners' underlying cognitive processes.

References

Anderson, R. C. (1977). The notion of schemata and the educational enterprise. In R. C. Anderson, R. J. Spiro, & W. E. Montauge (Eds.), *Schooling and the acquisition of knowledge*. Erlbaum.

Atkinson, R. C., & Shiffrin, R. M. (1968). Human memory: A proposed system and its control processes. In K. W. Spence & J. T. Spence (Eds.), *The psychology of learning and motivation* (Vol. 2, pp. 89–195). Academic Press.

Chandler, P., & Sweller, J. (1991). Cognitive load theory and the format of instruction. *Cognition and Instruction, 8*(4), 293–332.

Chandler, P., & Sweller, J. (1992). The split-attention effect as a factor in the design of instruction. *British Journal of Educational Psychology, 62*, 233–246.

de Jong, T. (2010). Cognitive load theory, educational research, and instructional design: Some food for thought. *Instructional Science, 38*(2), 105–134.

Derry, S. J. (1992). Beyond symbolic processing: Expanding horizons for educational psychology. *Journal of Educational Psychology, 84*(4), 413–418.

Fleming, M., & Levie, W. H. (1978). *Instructional message design: Principles from the behavioral sciences*. Educational Technology Publications.

Greeno, J. G. (1989). Situations, mental models, and generative knowledge. In D. Klahr & K. Kotovsky (Eds.), *Complex information processing: The impact of Herbert A. Simon* (pp. 285–318). Erlbaum.

Jeung, H., Chandler, P., & Sweller, J. (1997). The role of visual indicators in dual sensory mode instruction. *Educational Psychology, 17*, 329–343.

Johnson-Laird, P. N. (1983). *Mental models: Towards a cognitive science of language, inference, and consciousness*. Harvard University Press.

Kalyuga, S., Chandler, P., & Sweller, J. (1999). Managing split-attention and redundancy in multimedia instruction. *Applied Cognitive Psychology, 13*, 351–371.

Kroll, N. E. A., Parkinson, S. R., & Parks, T. E. (1972). Sensory and active storage of compound visual and auditory stimuli. *Journal of Experimental Psychology, 95*, 32–38.

Leahy, W., & Sweller, J. (2011). Cognitive load theory, modality of presentation, and the transient information effect. *Applied Cognitive Psychology, 25*, 943–951.

Marcer, D. (1967). The effect of presentation method on short-term recall of CCC trigrams. *Psychonomic Science, 8*, 335–336.

Mayer, R. E. (1989). Systematic thinking fostered by illustrations in scientific text. *Journal of Educational Psychology, 81*, 240–246.

Mayer, R. E. (2002). Multimedia learning. *Psychology of Learning and Motivation, 41*, 85–139.

Mayer, R. E. (2005). Cognitive theory of multimedia learning. In R. E. Mayer (Ed.), *The Cambridge handbook of multimedia learning* (pp. 201–212). Cambridge University Press.

Mayer, R. E. (2014). Multimedia instruction. In J. Michael Spector, M. David Merrill, E. Jan, & M. J. Bishop (Eds.), *Handbook of research on educational communications and technology* (pp. 385–399). Springer.
Mayer, R. E. (2017). Using multimedia for e-learning. *Journal of Computer Assisted Learning, 33*, 403–423.
Mayer, R. E., & Anderson, R. B. (1991). Animations need narrations: An experimental test of a dual-coding hypothesis. *Journal of Educational Psychology, 83*, 484–490.
Mayer, R. E., & Anderson, R. B. (1992). The instructive animation: Helping students build connections between words and pictures in multimedia learning. *Journal of Educational Psychology, 84*, 444–452.
Mayer, R. E., Bove, W., Bryman, A., Mars, R., & Tapangco, L. (1996). When less is more: Meaningful learning from visual and verbal summaries of science textbook lessons. *Journal of Educational Psychology, 88*(1), 64–73.
Mayer, R. E., & Fiorella, L. (2014). Principles for reducing extraneous processing in multimedia learning: Coherence, signaling, redundancy, spatial contiguity, and temporal contiguity principles. In R. E. Mayer (Ed.), *The Cambridge handbook of multimedia learning* (pp. 279–315). Cambridge University Press.
Mayer, R. E., & Gallini, J. (1990). When is an illustration worth ten thousand words? *Journal of Educational Psychology, 82*, 715–726.
Mayer, R. E., & Johnson, C. I. (2008). Revising the redundancy principle in multimedia learning. *Journal of Educational Psychology, 100*(2), 380–386.
Mayer, R. E., & Mathias, A. (2001, April). *Static and interactive pretraining that reduces cognitive load during multimedia learning.* Paper presented at the annual convention of the American Educational Research Association, Seattle, WA.
Mayer, R. E., & Moreno, R. (1998). A split-attention effect in multimedia learning: Evidence for dual processing systems in working memory. *Journal of Educational Psychology, 90*(2), 312–320.
McLaren, B. M., DeLeeuw, K. E., & Mayer, R. E. (2011). A politeness effect in learning with web-based intelligent tutors. *International Journal of Human-Computer Studies, 69*(1–2), 70–79.
Miller, G. A. (1956). The magical number seven, plus or minus two: Some limits on our capacity to process information. *Psychological Review, 63*(2), 81–97.
Moreno, R., & Mayer, R. E. (1999). Cognitive principles of multimedia learning: The role of modality and contiguity. *Journal of Educational Psychology, 91*(2), 358–368.
Moreno, R., & Mayer, R. E. (2002). Verbal redundancy in multimedia learning: When reading helps listening. *Journal of Educational Psychology, 94*(1), 156–163.
Mousavi, S. Y., Low, R., & Sweller, J. (1995). Reducing cognitive load by mixing auditory and visual presentation modes. *Journal of Educational Psychology, 87*, 319–334.
Paivio, A. (1986). *Mental representations: A dual-coding approach*. Oxford University Press.
Penney, C. G. (1975). Modality effects in short-term verbal memory. *Psychological Bulletin, 82*(1), 68–84.
Reiser, R. A., & Gagné, R. M. (1983). *Selecting media for instruction*. Educational Technology.
Rose, D., Harbour, W., Johnston, C. S., & Abarbanell, L. (2006). Universal design for learning in postsecondary education: Reflections on principles and their application. *Journal of Postsecondary Education and Disability, 19*(2), 135–151.
Savoji, A. P., Hassanabadi, H., & Fasihipour, Z. (2011). The modality effect in learner-paced multimedia learning. *Procedia – Social and Behavioral Sciences, 30*, 1488–1493.
Scarborough, D. L. (1972). Stimulus modality effects on forgetting in short-term memory. *Journal of Experimental Psychology, 95*, 285–289.
Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science, 12*, 257–285.
Sweller, J. (2005). The redundancy principle in multimedia learning. In R. E. Mayer (Ed.), *The Cambridge handbook of multimedia learning* (pp. 159–168). Cambridge University Press.

Tabbers, H. K., Martens, R. L., & van Merriënboer, J. J. G. (2004). Multimedia instructions and cognitive load theory: Effects of modality and cueing. *British Journal of Educational Psychology, 74*, 71–81.

Tindall-Ford, S., Chandler, P., & Sweller, J. (1997). When two sensory modes are better than one. *Journal of Experimental Psychology: Applied, 3*(4), 257–287.

Toh, S. C., Munassar, W. A. S., & Yahaya, W. A. J. W. (2010). Redundancy effect in multimedia learning: A closer look. In *Proceedings of ASCILITE – Australian Society for Computers in Learning in Tertiary Education Annual Conference 2010*, pp. 988–998.

van den Broek, G. S. E., Segers, E., & Verhoeven, L. (2014). Effects of text modality in multimedia presentations on written and oral performance. *Journal of Computer Assisted Learning, 30*(5), 438–449.

Wang, N., Johnson, W. L., Mayer, R. E., Rizzo, P., Shaw, E., & Collins, H. (2008). The politeness effect: Pedagogical agents and learning outcomes. *International Journal of Human-Computer Studies, 66*, 98–112.

Designing Master Courses That Promote Significant, Engaged Learning

Amy M. Grincewicz and Bethany Simunich

Background and Context

In the early 1990s, innovative methods for delivering and expanding online education offerings dominated the literature, but a new research emphasis emerged with a focus on the relationship between course development and course quality (Chao et al., 2010). In the last decade, significant emphasis has been placed on the concept of online course design and development, with instructional designers and technologists collaborating with faculty to create engaging and meaningful online course content. What has also become apparent is that designing high-quality online courses and programs frequently requires a greater time and financial investment, leading institutions to explore viable options for creating quality online learning at scale. Germane to the future of higher education are solutions for developing, managing, and sustaining quality in online courses. Institutions across the country are exploring and analyzing methods to address measuring online course quality by designing online courses with the highest quality standards and delivering these quality courses with engaged online instructors.

A commonly held belief about quality design and development of the asynchronous online environment stipulates that the core teaching material, resources, and instructional strategies need to be in place prior to the start of the class (Ragan, 2017). Unlike a face-to-face classroom environment, where an instructor may alter the design or planned activities as the class unfolds, the online learning environment generally requires more preparation and development time before delivery. The

A. M. Grincewicz (✉)
Kent State University, Kent, OH, USA
e-mail: agrincew@kent.edu

B. Simunich
Quality Matters Inc., Annapolis, MD, USA

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*, Educational Communications and Technology: Issues and Innovations,
https://doi.org/10.1007/978-3-030-85078-4_6

increased preparation effort typically includes two distinct processes: design and development. Throughout this chapter, we will use the term “design” to denote the purposeful instructional design of a course for the online environment that becomes the pedagogical framework, and the term “develop” to mean the development of the accessible, digital materials, and their thoughtful organization within the learning management system (LMS). The MCM model spans both design and development, as well as the active teaching that occurs during delivery, which is given greater focus in the latter portion of this chapter.

Ragan (2017) further contended that the goal of designing an online learning environment is to empower online learners to take responsibility for managing their own learning experience and free instructors to concentrate their time and energy on facilitating a truly engaged learning experience. As Kearsley (2012) observed, “The most important role of the instructor in online classes is to ensure a high degree of interactivity and participation” (p. 78). This implies designing content that drives learners to actively interact with both the subject matter and their peers, as well as assessments and activities that are application-based and cognitively engaging.

One way to meet the challenge of designing quality online courses, given the time and financial investment, is to create what is frequently termed a “master course.” The Master Course Model (MCM) discussed in this chapter is a scalable solution to maximize faculty expertise, even with limited design, technology, and media resources. However, embedded within the MCM is the idea that instructors will likely teach courses that they did not design—a distinctly different approach to traditional faculty-owned and -led learning. This chapter will explore the master course design model as a foundation for creating engaged learning experiences for both the learner and the instructor, and will additionally discuss faculty objections or concerns for the impact of the MCM on teaching and faculty autonomy. Throughout, the term “teaching instructor” will be used to denote anyone who teaches a higher education course, whether full-time or part-time, while “faculty designers” refer to part-time or full-time faculty who design a course, and “SME designers” refers to Subject Matter Experts who design or help design a course as contracted work, but are not employed by the institution as faculty. Peters’ (1983) theory of industrialization of teaching and learning along with instructional design models (i.e., Backward Design and Integrated Course Design) are the foundation for creating a quality master course that allows ample opportunities for the instructor to make the master course come to life while they are teaching.

The Master Course Model: Advantages and Opportunities

For our purposes, a master course is defined as a course that is designed and developed by one or more faculty designers or Subject Matter Expert (SME) designers, but will be taught by teaching instructors who may not have designed and developed the course. Most often, master course design teams also include an instructional designer and/or instructional or educational technologist as part of the collaborative team, as well as digital accessibility experts and other institutional personnel, including SMEs from the institution's library (Grincewicz, 2012, 2014; Puzziferro & Shelton, 2008). This is one advantage of a well-executed MCM, and the focus of the model presented in this chapter: designing and developing master courses using a multiexpert and multidisciplinary team can provide both time efficiency and a higher-quality course because of distributed expertise in all the facets of online quality, including teaching, design, technology, accessibility, etc.

Time efficiency is one major advantage of the MCM. Many institutions spend a full semester developing high-quality courses, and 29% of faculty report spending 100 hours or more developing a good online course (Freeman, 2015). There is also a learning curve for online pedagogy, technology, and accessibility that creates large obstacles to faculty facing the daunting task of developing their first online course. Most often, it is simply not possible for faculty to design an online course that exhibits the best practices of online instructional design, incorporates technology well, meets accessibility requirements, and is well-organized in the LMS to promote learning achievement, given their limited time and competing priorities. A collaborative MCM, such as the one presented in this chapter, allows faculty to use their time and expertise for the greatest benefit, while relying on the expertise of instructional designers and technology experts to augment faculty expertise to create a quality online offering.

Another clear advantage of the MCM is the financial benefit; Schmidt et al. (2013) indicated that a significant cost advantage exists for institutions that develop quality online master courses that can be copied and reused by other teaching instructors to help create a consistent experience for students. Lastly, an additional advantage of the MCM is providing educational equity for learners across modality as the MCM provides learners with the same learning outcomes from course to course and within each course section (Hill, 2012; Borgemenke et al., 2013; Franetovic & Bush, 2013).

An institution's decision to create master courses may also be influenced by institutional goals for providing consistent content and outcomes in all sections of a given course (Crowley, 2017; Franetovic & Bush, 2013; Smaldino & Yamagata-Lynch, 2015). "The goal of designing and producing electronic course templates is to facilitate building electronic course sites by academic staff—quickly and easily, as well as to make the student learning experience more structured and consistent" (Fresen et al., 2014, p. 3). The use of a master course allows faculty to focus on delivering and facilitating course material and topics rather than on course design (Crowley, 2017). Additionally, Borgemenke et al. (2013) found that a universal course template benefits both students and instructors with consistent course content and a user-friendly interface for navigating course assignments in a module format. Past research has shown that ease of navigation, including the usability component of "findability", has a significant impact on online student motivation and self-efficacy, producing frustration and impacting instructor credibility when absent (Simunich et al., 2015).

It is important to acknowledge, however, that an older, but perhaps persistent, definition of a master course was a course designed by a single, often tenured, professor, for distribution into several sections, to then be taught by adjunct faculty or teaching assistants (Hill, 2012). Traditionally, this model and definition took on the moniker of "canned course." This chapter's presentation of master courses, however, differs in that the course itself can be collaboratively designed by multiple, full-time program faculty, an approach that then creates a course reflective of the program's goals, competencies, and varied faculty perspectives. In short, we acknowledge the common, frequently negative, experience that faculty have had with master courses, and are proposing a model that is more collaborative and inclusive, respecting both the breadth and depth of faculty expertise, as well as the knowledge and skills of an instructional designer and other institutional staff, when available. The focus of today's master course is to create engaging, high-quality courses at scale, utilizing both faculty time and institutional resources wisely, and maintaining a focus on educational equity across course sections.

However, the MCM should still be viewed through a critical lens as the model itself challenges the traditional faculty autonomy involved in design and teaching. Faculty designers who are designing a master course may feel as though their learning vision, via the design, cannot be facilitated by another instructor. Similarly, an instructor teaching a course they did not design may struggle in small or deeply significant ways to facilitate learning based on a design they did not create. Rather than ignoring the professional, and even emotional, impact of the MCM, however, this chapter acknowledges the inherent challenges and objections to master courses, though ultimately presents a model based on collaboration, collegiality, and maximizing educational resources to create quality online learning experiences.

In Support of a Collaborative Approach

In specific reference to master courses, creating a design model that maximizes resources to create a high-quality online course is a sensible management approach. Realistically, quality online courses involve not only faculty subject matter expertise, but also additional expertise from often limited institutional staff such as instructional designers, educational technologists, multimedia specialists, subject matter librarians, copyright specialists, instructional technologists, web designers, and accessibility experts. In many cases, institutions might hire a temporary employee to serve in a specialized capacity, especially with regard to creating quality, engaging multimedia content. High-quality online courses are resource-intensive and often incur design costs not seen in face-to-face courses. Limited human and financial resources are one reason that institutions might develop an MCM.

Additionally, designing a single high-quality course is often the best choice for maintaining learning equity between course sections. In most situations, sections of a given course share common learning objectives, even if they differ in content, activities, and assessments. In some instances, however, these differences can result in dramatically different learning experiences between sections. When this situation occurs in face-to-face sections, students might compare section syllabi or discuss class expectations to discover differences, but having learning inequity across sections online can be much more easily and directly observed. Ensuring that students in a given course are provided with a consistent, quality learning experience with appropriate rigor of each section is also vital in courses that serve as prerequisites, as requirements within a major or minor field of study, or for courses that might include activities such as professional licensure exams.

However, institutional efficiencies and learning parity come at some cost to faculty autonomy. Traditionally, full-time faculty design and teach their own courses, with their individual pedagogical approach being a vital part of academic freedom. Institutional discussions regarding MCMs often include faculty concerns regarding loss of autonomy and voice, anxieties about teaching a course they did not design, legal concerns regarding intellectual property, and faculty compensation and hiring. These are valid concerns that are discussed throughout this chapter and that must be discussed at the local/institutional level as well as a way to begin a dialogue about best approaches to designing master courses. Focusing on a collaborative and collegial MCM, however, can provide the stage for including many voices, thereby capitalizing on an increased knowledge base and varied perspectives within the department. Multiple faculty designers can contribute in various ways and to varying degrees in creating course learning objectives, activities, assessments, and/or content. Faculty designers may provide additional feedback on the course design before the course is finalized and provided to the teaching instructors.

Ideally, master courses should be created as a collaborative and purposeful communication exchange to elevate many faculty voices within a department or program. Discussions of level and type of contribution, attribution and/or compensation, and institutional guidelines and requirements should be discussed prior to the start of design. This collegial approach includes multiple program faculty as faculty designers and may also include contracted SMEs as designers. As a way to create a collaborative feedback loop between designers and instructors, a successful MCM might also include the creation of a teaching instructor guide that shares with future instructors the thinking and assumptions behind the design, as well as a plan for instructor and student feedback on the design and its components as the prime guidance for future course revisions. Teaching instructors should have an open communication channel with each other and/or someone in a "course coordinator" type of position, so that active, just-in-time teaching ideas can be shared across sections, and technical issues can be quickly and unilaterally addressed. Many teaching instructors of master courses keep an active log of teaching and design notes, just as they would for courses they themselves designed, and share that log with the master course faculty designers to further aid in the revision process. As a best practice, master course teaching instructors are provided with clear guidance on what changes can be made to the course sections, what types of issues should be reported to the course coordinator as an immediate fix, and what things should be noted for future revisions. This guidance, as well as the creation of a feedback loop and teaching instructor guide, is most often created and managed by the faculty member who coordinates the sections of the master course and/or an institutional instructional designer.

Theoretical and Design Frameworks Relevant to the MCM

Online courses require the use of relevant technologies; however, it is the pedagogy rather than the technology that is crucial for the success of online courses (Palloff & Pratt, 2011). This pedagogy can be a combination of instructivist and constructivist approaches to learning. While researchers continuously debate which approach enables learning most efficiently and effectively, Kuhn (2007) explained that the chosen method depends on the content and the learner.

Instructional designers have a variety of instructional design frameworks to use as a foundation for designing instruction. These frameworks can act as a compass to guide the course design around the course objectives to create a high-quality course. Many of these instructional frameworks have overlapping concepts that can be utilized in the MCM collaborative process. This section describes a few frameworks and synthesizes how they can be used to create a high-quality master course.

Industrialization of Teaching

Peters' (1983) industrialization of teaching model provides the theoretical framework behind the development of online master courses through the principles of industrialization. Peters (1998) emphasized that distance education, from its beginnings, differed from traditional education through one major structural component: its ability to make a profit, while traditional education was established for educating and training citizens. Peters (1998) pointed out that teaching used to be a single act of labor, whereas distance education provides teaching through a division of labor where planning, developing, and presenting subject matter are done by different persons at different times and at different locations. He posited that the development of courses occurs before the start of teaching, an action that has become more important than the active teaching that occurs as a course is being delivered. Peters (1998) compared the preparation for distance education courses with "production planning in the industrialized production process, which was also carried out by specially qualified experts" (p. 110).

Peters' (1998) work provides a theoretical framework for comparing assumptions about management in a post-industrialized genre of distance education management. Shelton and Saltsman (2005) reiterated that Peters' theory provides educational leaders with an industrial-style management approach to maximize efficiency and minimize cost. Simonson (1999) indicated that standardization, concentration, and centralization were key components in Peters' (1983) theory. For example, standardization meant the entire instructional process was "made standard according to pre-established criteria so that learners receive the same curriculum in uniform ways" (Simonson, 1999, p. 6). Peters' (1998) industrialization of teaching model has profound implications for the current and future state of distance education management in higher education.

In support of Peters' industrial model as well as the MCM presented here, Chao et al. (2010) found that adoption of a collaborative course development model requires diverse sources of expertise not usually possessed by one person. The pedagogy involved in online course design is a complex process "and it is not reasonable to believe that a high caliber online course of instruction can be created by just one or two people" (Caplan, 2004, p. 186). With the abundance of technology and online tools available, a collaborative approach to online course design may result in a higher quality course than one created autonomously (Brown et al., 2013) as faculty designers not only contribute varied perspectives, but also have potentially differing knowledge of online design approaches and frameworks. Therefore, designing an online course as a collaborative effort produces a course richer in perspectives and more deeply grounded in instructional design and distance education theories and frameworks, especially if an experienced instructional designer is part of the design team.

A sound design and development team brings extensive online teaching experience, online course design experience, educational technology experience, discipline experience, institutional knowledge, and leadership experience to the collaborative team. MCM design teams commonly consist of one or more program faculty and/or SMEs, as well as an instructional designer and/or educational technologist, and other previously mentioned staff, depending on the resources of the institution. It is the robust nature of this team, as well as the resources that institutions can often offer toward the design of master courses, that promote significant learning experiences within the course design. Researchers have analyzed online design and pedagogical practice and found that a collaborative instructional design partnership between faculty and team members provided positive outcomes for course development (Brown et al., 2013; Grincewicz, 2012, 2014; Puzziferro & Shelton, 2008).

A systematic approach to designing significant learning experiences, often referred to as "Backward Design," has been originated by Wiggins and McTighe (1998) and is included as a central feature of Fink's model for Integrated Course Design (Fink, 2013). The process is referred to as "backward" because it starts with a vision of the desired results or the learning achievement of students. In this way, Backward Design is considered a "results-focused" design approach rather than a content-focused approach. The design process then works backward to develop the assessments, which will provide evidence of learning achievement, and finally the course materials and instructional methods, both of which support students doing well on the assessments. Backward Design is an instructional model first utilized for face-to-face courses, but when adapted to online course design, the process must be extended to include choosing technology to support the pedagogical, aligned design, and the purposeful inclusion of course components designed to elevate interaction and presence, which do not happen organically online as they often do in face-to-face courses.

However, institutions do not always have the benefit of instructional design expertise, whether through experienced faculty or trained instructional designers, and may instead default to a content-focused design approach. This approach begins by choosing content for the online course and sets the teaching instructor up to facilitate students to achieve the course objectives, even if the course materials do not directly support the objectives. Further, not all faculty designers may be well-versed in designing online courses, rather than classroom-based, face-to face courses. Content-focused online course design is problematic, however, as an abundance of literature indicates that effective online course design consider learner-centered pedagogical approaches using active learning strategies and meaning-making using modern technologies (Christensen & Osguthorpe, 2004; Crews et al., 2015; Lee et al., 2015; Nash, 2015; Scoppio, 2017).

Therefore, a viable institutional MCM should include either faculty designers or instructional designers who are trained in online design and development best practices for creating effective learning environments that promote significant learning. Many institutions have no or few instructional designers, however, and the MCM often serves as one good option to maximize the expertise of a limited instructional design staff (Garrett et al., 2020). Institutions that create master courses using an MCM team with an embedded instructional designer often have a greater ability to deliberately design engaging online courses. MCM design teams, depending on staffing, can often capitalize on other limited institutional expertise as well, such as subject matter librarians, multimedia specialists, and accessibility experts.

Integrated Course Design

Fink's (2013) Integrated Course Design (ICD) Model and Taxonomy of Significant Learning allows master course design to greatly improve student learning by providing opportunities for significant learning experiences that apply to both instructivist and constructivist frameworks. Fink's (2013) ICD model contains five key components: (1) situational factors, (2) learning goals, (3) learning activities, (4) feedback and assessment, and (5) integration. These components should be addressed in the course design and focus on the following significant learning goals:

1. *Foundational knowledge*: Students' mastery of basic facts and concepts deemed relevant to the course.
2. *Application*: Students' ability to apply foundational knowledge.
3. *Integration*: Students' capacity to appreciate the application of foundational knowledge in other coursework.
4. *Human dimension*: Students' ability to perceive the value of integrating foundational knowledge for oneself.
5. *Caring*: Students' reassessment of personal perceptions about a subject based upon a deeper understanding and application of the foundational knowledge.
6. *Learning how to learn*: Students having the ability to continue learning about a subject and using foundational knowledge learned in a course even after the course has ended.

Fink (2013) contends that significant learning may occur when course design focuses on all six types of learning goals. ICD arranges the stages of Backward Design into a simultaneous planning strategy, informed by environmental and contextual factors specific to higher education. ICD guides faculty designers through aligning learning objectives, learning activities, rubrics, and assessments that focus on significant learning goals.

Using the MCM to Promote Online Quality Assurance

Institutions have focused their online quality assurance efforts on ensuring that online courses are designed to help students achieve learning outcomes while simultaneously feeling connected and engaged. A viable MCM includes a method for quality assurance as a vital component, especially given the greater effort and larger financial investment that are devoted to many master courses. Proactive educational administrators concentrate efforts on considering "what is needed to ensure high quality instruction while maximizing the utility of distance education" (Travis & Leist, 2014, p. 37). Additionally, after the emergency pivot to remote instruction that nearly all higher education institutions experienced in spring 2020, students may be looking for greater assurance from their institution that future online courses offered will be of high quality.

The literature is plentiful regarding divergent processes and theory for designing practical online education, yet no one theory has emerged as the dominant model for design quality online learning at scale. The Backward Design and ICD models, however, can be applied to building a master course that additionally follows a quality online design rubric that brings to focus other facets of quality online learning, such as supporting students with institutional resources and ensuring accessibility of digital materials. Metrics and standards for quality online design, such as the Quality Matters Rubric for Higher Education™ (https://www.qualitymatters.org/), are a common way to ensure quality as they focus on sound instructional design principles such as alignment.

QM's Higher Education Rubric contains a set of 8 General Standards and 43 Specific Review Standards and 23 Essential Standards used to evaluate the design of online and blended courses. Courses under review meet QM standards and earn a QM Certification by earning a score of 85% or higher via a robust, collaborative, peer-review process (QM, 2018). The QM Higher Education Rubric is unique in that it is regularly updated by a select committee of faculty, instructional designers, and other online learning experts to reflect the latest in online learning research and practice.

> The Rubric continues to be a living document that is reviewed and improved every two or three years following the same rigorous approach which has become the guiding principle of QM: collegial, collaborative, continuous, and centered in an academic foundation around student learning. (Shattuck, 2010, p. 51)

Building an online master course with the QM Rubric provides institutions with eight rigorous, quality general standards that aid in educational policy review processes and program accreditation (Cicchino, 2017):

1. Course Overview and Introduction;
2. Learning Objectives (Competencies);
3. Assessment and Measurement;
4. Instructional Materials;
5. Course Activities and Learner Interaction;
6. Course Technology;
7. Learner Support;
8. Accessibility and Usability. (Quality Matters, 2018, p. 1)

Design frameworks provide models for achieving learning objectives in weekly/content-based modules, developing activities, and engaging students, while also allowing faculty designers to have a holistic view of the in-depth design work needed for a quality online course. Quality design rubrics also commonly reflect Silber's Principle-Based Model of Instructional Design to promote quality learning experiences and reduce cognitive load through a holistic framework based on instructional design principles.

Silber (2010) outlined a series of principles of instructional design relative to higher education instructional design including

- Creating a clear path for learning where objectives, learning activities, and assessments align.
- Research and theory guide design decisions that focus on the alignment of objectives, activities, and assessments.
- Designs may need to accommodate varying learner skills levels; therefore, designers should analyze the students enrolled in the course in order to adapt instruction to meet the needs of all the students.
- Designing lessons on the principles of attention, relevance, confidence, and satisfaction (ARCS).
- Creating authentic learning experiences focused on activating prior knowledge. These experiences should transfer directly to the student's work or professional life.
- Including practice-learning activities that use the principles of worked examples for novice students and feedback for proficient students.
- Assessing students' problem-solving skills and application of the material.

These principles are not exhaustive, but they form a basis for course design that promotes learning. Integrating these principles into the course design process establishes a framework for developing high-quality master courses.

Moving from Instructor-Centered to Learner-Centered Design

Direct instruction functions differently online, where the environment does not lend itself well to instructor-centered teaching strategies such as lecture. Online, direct instruction usually resides in elements such as short instructor-created videos, expert interviews, topical multimedia presentations, websites, textbook and journal readings, simulations, and screencasts. This presents a distinct challenge for the teaching instructor who focused primarily or wholly on direct instruction as a way to interact with students. However, active online teaching is more focused on guiding and directing students in their learning by providing feedback, adding clarity, and helping them connect course concepts in pursuit of course learning objectives.

In an MCM, direct instruction can also include the introductions, descriptions, sequencing, and materials that are presented to the student. This information is supportive to assist students with constructing schemata and aligns with the learning task and outcomes (van Merriënboer et al., 2002). Supportive information provides the bridge between learners' prior knowledge and the learning tasks by the inclusion of mentioning previous knowledge, organization, and providing examples (Silber, 2010).

Learner-centered instruction covers a variety of instructional types and focuses on practice items to provide learners a path to help build automaticity for recall of information (van Merriënboer et al., 2002) that should be designed into master courses. Strategies for learner-centered design within the master course should include indirect instruction, interactive instruction, and independent instruction. Indirect instruction assists learners with coming to a conclusion through reflective and problem-solving activities. Interactive instruction requires learners to interact with one another with discussions and provide peer feedback to acquire new understanding of a concept. Independent instruction helps learners build decision-making abilities through summative assessments. A variety of learner-centered practice activities should be included within each content area that aligns to multiple outcomes (Silber, 2010). In addition, all activities should be authentic and applicable to real-world situations (Silber, 2010; van Merriënboer et al., 2002).

Cognitive Load Theory

The multidisciplinary team that drives the MCM is also well-equipped to attend to cognitive load issues for online students. Cognitive Load Theory (CLT) focuses on how instructional materials interact with working and long-term memory, and directs designers to develop instructional materials to reduce the cognitive load (van Merriënboer & Ayres, 2005). The principles behind the theory are that working memory is extremely limited, long-term memory is essentially unlimited, the process of learning requires active encoding from working to long-term memory, and if working memory becomes overloaded, then learning is ineffective (Sweller, 1988).

Additionally, CLT recommends aligning new knowledge with previous knowledge to avoid providing confusing information to learners and to stimulate a deeper thought process (de Jong, 2010).

CLT has many implications in the design of learning materials, which must, if they are to be effective, keep the cognitive load of learners at a minimum during the learning process. One way to reduce cognitive load is the modality effect where information is presented with auditory and visual components to reinforce the concepts (van Merriënboer & Ayres, 2005). A second way to reduce cognitive load is for designers to organize learning tasks from simple to complex and, in addition, build in scaffolding supports at the beginning, then allowing the supports to fade to help reduce load (van Merriënboer & Sluijsmans, 2009). FinallyF, designers can lessen germane load by having a variety of instructional activities within the content-based modules (van Merriënboer & Sluijsmans, 2009).

Specific recommendations relative to the design of instructional material to reduce cognitive load can also be found in the Silber's previously mentioned Principle-Based Model of Instructional Design (2010), such as

- Change problem-solving methods to avoid means-ends approaches that impose a heavy working memory load by using worked examples.
- Eliminate the working memory load associated with having to integrate several sources of information by physically integrating those sources of information within the learning environment components.
- Eliminate the working memory load associated with unnecessarily processing repetitive information by reducing redundancy.
- Increase working memory capacity by using auditory as well as visual information under conditions where both sources of information are essential (i.e., non-redundant) to understanding.

In designing master courses around cognitive learning theories, Silber recommends having learners complete five tasks: (1) select information, (2) link new information with prior knowledge, (3) organize the information, (4) link new and existing information, and (5) strengthen memory (1998, p. 68). These fives tasks are designed around chunking information and developing mnemonics to help with recall. Chunking information improves cognitive processing by reducing cognitive load; technologists should include motivational learning objects to assist with information chunking (Keller, 2008). Mnemonics allow for more effective and efficient memorization by taking large memories and chunking into smaller sections (Silber, 1998, 2010).

In addition, Silber's model mentions using multiple forms of media within instructional components (Silber, 2010). These multimedia elements need to consider the principles behind dual coding theory, which assesses how learners mentally process information presented verbally and nonverbally (Martinez, 2010). Dual-coding theory utilizes two processing systems, one on verbal tasks and the other on imagery, and supports the use of a variety of multimedia to help learners process the information without being overwhelmed (Koehler et al., 2005; Yadav et al., 2011). In reducing cognitive load, technologists should also consider the principles of Universal Design of Instruction (UDI) in using appropriate text, graphics, media, layout, and formatting guidelines to design accessible multimedia pieces (Burgstahler & Cory, 2008).

Teaching Master Courses

Lastly, we turn to focus on the active online teaching embedded in the MCM, which positions teaching instructors as vital collaborators with the designers, and as the individuals primarily responsible for guiding and directing students during delivery. As previously mentioned, faculty have historically held teaching according to their pedagogical philosophy as one of the tenets of academic freedom. As defined by the American Federation of Teachers, academic freedom is

> … the right of faculty members, acting both as individuals and as a collective, to determine without outside interference: (1) the college curriculum; (2) course content; (3) teaching; (4) student evaluation; and (5) the conduct of scholarly inquiry.

Instructors asked to teach courses they did not design themselves may harbor feelings that doing so impinges on their academic freedom. For example, they did not select the content included in the course. However, one consideration is whether those attitudes and beliefs might be mitigated or changed by faculty development for online teaching. In short, to teach a master course, instructors must first understand the active online teaching strategies they might employ during delivery, as well as additions they could make to the designed course that would not affect alignment, assignments, etc.

Identifying these elements, however, typically requires some advanced knowledge of online pedagogy. If teaching instructors are less aware of how to incorporate active teaching in courses created by faculty designers, identifying active teaching opportunities often becomes a shared responsibility or collaboration among instructional designers, faculty designers, teaching instructors, and anyone engaged in online teaching best practices, including faculty development experts in institutional centers for teaching and learning. Additionally, institutions that employ a practice of allowing teaching instructors to provide feedback to the faculty designers on the course design may serve to create a collegially created plan for revision, based on the expertise of multiple departmental faculty.

A key component to approaching the delivery of a master course is understanding and extending teaching presence within the master course concept. Teaching presence is the design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes (Anderson et al., 2001). It is one of three components, along with cognitive presence and social presence, that comprise the Community of Inquiry framework. While the other facets of the Community of Inquiry framework are not discussed here, what is important to know is that teaching presence is the catalyst for online presence, and it begins with the design of the course.

The first function of teaching presence is designing the educational experience, which includes selecting and organizing content, and designing and developing activities and assessments (Garrison et al., 1999). Garrison, Anderson, and Archer go on to state:

> A teacher or instructor typically performs this [first] function. The second function, facilitation, is a responsibility that may be shared among the teacher and some or all of the other participants or students. This sharing of the facilitation function is appropriate in higher education and common in computer conferencing. (p. 90)

Teaching a master course, however, extends this idea to both functions of teaching presence; in other words, the modern MCM assumes that both design and facilitation may be shared among various educational staff, such as full-time faculty, part-time faculty, instructional designers, and graduate teaching assistants. The goal is not to have a "master instructor," but rather to leverage the collective expertise from departmental faculty, instructional designers, and others to create a high-quality, scalable, online learning environment.

The three categories of teaching presence indicators—instructional management, building understanding, and direct instruction—can be attended to by any of the participants in a community of inquiry, including students. The category of instructional management has various indicators that can be understood through the lens of the MCM. For example, the instructor who actively teaches the course can still engage with aspects such as planning issues and utilization of the medium. While not involved in setting the curriculum designing methods and assessment, the teaching instructor is still engaging in the following actions that fall under the instructional management category: posting announcements to guide and inform students, using various methods to introduce and summarize learning units, and collecting/reading/responding to student feedback as the course progresses.

The second category, building understanding, is also a shared duty between the faculty designer(s) and teaching instructor. Garrison et al. (1999) define this category within an educational context as being "…concerned with productive and valid knowledge acquisition" (p. 101). For example, the developer's design creates the foundational learning opportunities for knowledge acquisition. However, it is the teaching instructor who carries out the rest of the activities related to the process of active intervention and community-building. In active intervention, "… the teacher draws in less active participants, acknowledges individual contributions, reinforces appropriate contributions, focuses discussion, and generally facilitates an educational transaction" (p. 101). This is an apt description of the effective, active teaching that takes place in quality online courses, regardless of who designed them. Online instructors provide robust feedback for improvement, may use strategies such as Socratic-type probing in discussions to focus and deepen learning, and engage in actions designed to build and sustain an online learning community, such as acknowledging varying student voices, perspectives, and contributions while facilitating the type of collaborative learning opportunities that support social and cognitive presence as well.

The final category of teaching presence indicators is direct instruction, which Garrison et al. (1999) characterize as "the ultimate 'teaching' responsibility":

> The teacher's responsibility is to facilitate reflection and discourse by presenting content, questions, and proactively guiding and summarizing the discussion as well as confirming understanding through assessment and feedback. The process must provide constructive explanatory feedback.... It requires considerable content expertise, not to mention pedagogical expertise, to make the links among contributed ideas, to diagnose misconceptions, and to inject knowledge from diverse sources such as textbooks, published articles, and internet-based resources. (p. 102)

This underscores both the immense importance and the common misunderstanding of the role of the master course instructor. Far from being relegated to the role of "grader," the teaching instructor extends the direct instruction begun by the faculty designer's choice (or creation) of instructional material. For example, direct instruction provided through a recorded lecture by the design team is then put into the learning context by the active teaching instructor, who can introduce the material, relate topics and ideas among instructional material, connect materials to activities and assessments, extend thinking by introducing additional/optional "deeper-dive" material, create just-in-time instructional pieces to clarify misunderstandings, and provide the robust, timely feedback that is the hallmark characterization of effective online teaching.

Conclusion

The modern MCM underscores both of the distinct components of design and teaching in the online classroom, as well as the ways that they reinforce and overlap one another. Swan (2012) found that using quality course design standards alone to improve a course was not enough to raise student perceptions of teaching presence, which further supports the idea that it is the combination of design and active teaching that provide a quality, effective online learning experience for students. Swan et al. (2014) created a collaborative approach to improving an online program that used a two-step process of focusing on the Quality Matters and Community of Inquiry frameworks to first address course design, and then address course implementation/teaching. Results showed improved learning outcomes in most of the course in the program using this approach. In short, both research and faculty experience support the individual and combined importance of design and teaching, making the Master Course Model a design and pedagogical approach that, at its best, can fully utilize faculty, instructional designer, and other staff expertise to collaboratively create a quality, scalable online learning experience for students.

References

Anderson, T., Rourke, L., Garrison, R., & Archer, W. (2001). Assessing teaching presence in a computer conferencing context. *Journal of Asynchronous Learning Networks, 5*(2) Retrieved from: https://auspace.athabascau.ca/bitstream/handle/2149/725/assessing_teaching_presence.pdf?sequence=1&isAllowed=y

Borgemenke, A. J., Holt, W. C., & Fish, W. W. (2013). Universal course shell template design and implementation to enhance student outcomes in online coursework. *The Quarterly Review of Distance Education, 14*(1), 17–23.

Brown, B., Eaton, S. E., Jacobsen, D. M., Roy, S., & Friesen, S. (2013). Instructional design collaboration: A professional learning and growth experience. *MERLOT Journal of Online Learning and Delivering, 9*(3), 439–452. Retrieved from https://jolt.merlot.org/vol9no3/brown_0913.htm

Burgstahler, S., & Cory, R. (2008). *Universal design in higher education: From principles to practice.* Cambridge, Mass: Harvard Education Press.

Caplan, D. (2004). The development of online courses. In T. Anderson & F. Elloumi (Eds.), *Theory and practice of online learning*. Athabasca University.

Chao, I. T., Saj, T., & Hamilton, D. (2010). Using collaborative course development to achieve online course quality standards. *International Review of Research in Open and Distance Learning, 11*(3), 106–126. https://doi.org/10.19173/irrodl.v11i3.912

Christensen, T. K., & Osguthorpe, R. T. (2004). How do instructional-design practitioners make instructional-strategy decisions? *Performance Improvement Quarterly, 17*(3), 45–65. https://doi.org/10.1111/j.1937-8327.2004.tb00313.x

Cicchino, R. M. (2017). *Providing faculty with a consistent foundation, based on the Quality Matters Rubric, to develop online courses*. Retrieved from https://secure.onlinelearningconsortium.org/effective_practices/providing-faculty-consistent-foundation-based-quality-matters%E2%84%A2-rubric-develop-on

Crews, T. B., Wilkinson, K., & Neill, J. K. (2015). Principles for good practice in undergraduate education: Effective online course design to assist students' success. *MERLOT Journal of Online Learning and Teaching, 11*(1), 87–103. Retrieved from https://jolt.merlot.org/vol11no1/Crews_0315.pdf

Crowley, K. (2017, June 5). *Facilitating master courses* [Blog post]. Retrieved from https://www.learninghouse.com/center-for-teaching-and-learning/facilitating-master-courses/

de Jong, T. (2010). Cognitive load theory, educational research, and instructional design: Some food for thought. *Instructional Science, 38*(2), 105–134. https://doi.org/10.1007/s11251-009-9110-0

Fink, L. D. (2013). *Creating significant learning experiences: An integrated approach to designing college courses*. Jossey-Bass.

Franetovic, M., & Bush, R. (2013). *Master course shell practice: Redesign of institutional online course look and feel, alignment of core course content and delivery, and quality improvement*. Retrieved from https://secure.onlinelearningconsortium.org/node/411286

Freeman, L. A. (2015). Instructor time requirements to develop and teach online courses. *Online Journal of Distance Learning Administration, 18*(1), 1–13. Retrieved from https://www.westga.edu/~distance/ojdla/spring181/freeman181.html

Fresen, J. W., Hill, R. K., & Geng, F. (2014). A collection of suggested electronic course templates for use in higher education. *Research in Learning Technology, 22*, 1–15. https://doi.org/10.3402/rlt.v22.21669

Garrett, R., Legon, R., Fredericksen, E. E., & Simunich, B. (2020). *CHLOE 5: The pivot to remote teaching in Spring 2020 and its impact, the changing landscape of online education, 2020.* https://www.qualitymatters.org/qa-resources/resource-center/articles-resources/CHLOE-5-report-2020

Garrison, D. R., Anderson, T., & Archer, W. (1999). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education, 2*(2–3), 87–105. https://doi.org/10.1016/s1096-7516(00)00016-6

Grincewicz, A. M. (2012). A model for developing quality graduate programs using blended courses in nursing education. In *Proceedings of E-Learn 2012*. AACE.

Grincewicz, A. M. (2014). Designing quality blended courses. In L. Kyei-Blankson & E. Ntuli (Eds.), *Practical applications and experiences in K-20 blended learning environments* (pp. 43–55). Information Science Reference. https://doi.org/10.4018/978-1-4666-4912-5.ch004

Hill, P. (2012, March 26). The master course: A key difference in educational delivery methods. Retrieved September 29, 2020, from https://eliterate.us/the-master-course-a-key-difference-in-educational-delivery-methods/

Kearsley, G. (2012). *Online education: Learning and teaching in cyberspace*. Wadsworth/Thomson.

Keller, J. (2008). First principles of motivation to learn and e3-learning. *Distance Education, 29*(2), 175–185. https://doi.org/10.1080/01587910802154970

Koehler, M., Yadav, A., Phillips, M., & Cavazos-Kottke, S. (2005). What is video good for? Examining how media and story genre interact. *Journal of Educational Multimedia and Hypermedia, 14*(3), 249–272. Retrieved from http://www.aace.org/pubs/jemh/

Kuhn, D. (2007). Is direct instruction an answer to the right question? *Educational Psychologist, 42*(2), 109–113. https://doi.org/10.1080/00461520701263376

Lee, E., Pate, J. A., & Cozart, D. (2015). Autonomy support for online students. *Tech Trends: Linking Research & Practice to Improve Learning, 59*(4), 54–61. https://doi.org/10.1007/s11528-015-0871-9

Martinez, M. E. (2010). *Learning and cognition: The design of the mind*. Allyn & Bacon.

Nash, J. A. (2015). Future of online education in crisis: A call to action. *The Turkish Online Journal of Educational Technology, 14*(2), 80–87.

Palloff, R. M., & Pratt, K. (2011). *The excellent online instructor*. Jossey-Bass.

Peters, O. (1983). Distance teaching and industrial production: A comparative interpretation in outline. In D. Sewart, D. Keegan, & B. Holmberg (Eds.), *Distance education: International perspectives* (pp. 95–113). Croom Helm.

Peters, O. (1998). *Learning and teaching in distance education* (2nd ed.). Routledge.

Puzziferro, M., & Shelton, K. (2008). A model for developing high-quality online course: Integrating a systems approach with learning theory. *Journal of Asynchronous Learning Networks, 12*(3–4), 119–136. Retrieved from http://sloanconsortium.org/publications/jaln_main

Quality Matters. (2018). *Quality Matters higher education rubric workbook* (6th ed.). MarylandOnline.

Ragan, L. C. (2017). *10 principles of effective online teaching: Best practices in distance education*. Faculty Focus Special Report. Retrieved from https://www.facultyfocus.com/wp-content/uploads/2015/02/10-Principles-of-Effective-Online-Teaching.pdf

Schmidt, S. W., Hodge, E. M., & Tschida, C. M. (2013). How university faculty members developed their online teaching skills. *The Quarterly Review of Distance Education, 14*(3), 131–140.

Scoppio, G. (2017). Mind the gap: Enabling online faculty and instructional designers in mapping new models for quality online courses. *Education and Information Technologies, 22*(3), 725–746. https://doi.org/10.1007/s10639-015-9452-y

Shattuck, K. (2010). *Quality Matters: A faculty-centered program to assure quality in online course design. Collected essays on learning and teaching* (CELT) (vol III), pp. 49–53. Windsor, Canada: University of Windsor.

Shelton, K., & Saltsman, G. (2005). *An administrator's guide to online education*. IAP Information Age Publishing.

Silber, K. H. (1998). The cognitive approach to training development: A practitioner's assessment. *Educational Technology Research and Development, 46*(4), 58–72. https://doi.org/10.1007/BF02299674

Silber, K. H. (2010). A principle-based model of instructional design. In K. Silber & W. Forshay (Eds.), *Handbook of improving performance in the workplace* (Vol. 1, pp. 53–92). Pfeiffer.

Simonson, M. (1999). Equivalency theory and distance education. *TechTrends, 43*(5), 5–8. https://doi.org/10.1007/BF02818157

Simunich, B., Robins, D. B., & Kelly, V. (2015). The impact of findability on student motivation, self-efficacy, and perceptions of online course quality. *American Journal of Distance Education, 29*(3), 174–185. https://doi.org/10.1080/08923647.2015.1058604

Smaldino, S. E., & Yamagata-Lynch, L. (2015). The course-in-a-box: Design issues. *TechTrends, 59*(4), 71–77. https://doi.org/10.1007/s11528-015-0873-7

Swan, K., Day, S. L., Bogle, L. R., & Matthews, D. B. (2014). A collaborative, design-based approach to improving an online program. *The Internet and Higher Education, 21*, 74–81. https://doi.org/10.1016/j.iheduc.2013.10.006

Swan, K., Matthews, D., Bogle, L., Boles, E., & Day, S. (2012). Linking online course design and implementation to learning outcomes: A design experiment. *The Internet and Higher Education, 15*(2), 81–88. https://doi.org/10.1016/j.iheduc.2011.07.002

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science, 12*, 257–285. https://doi.org/10.1207/s15516709cog1202_4

Travis, J. E., & Leist, J. (2014). Online instruction in rural community colleges: Meeting needs with maintaining quality. *Journal of Applied Research in the Community College, 21*(2), 33–41.

van Merriënboer, J. G., Clark, R. E., & De Croock, M. M. (2002). Blueprints for complex learning: The 4C/ID-model. *Educational Technology, Research and Development, 50*(2), 39–64. https://doi.org/10.1007/BF02504993

van Merriënboer, J. G., & Sluijsmans, D. A. (2009). Toward a synthesis of cognitive load theory, four-component instructional design, and self-directed learning. *Educational Psychology Review, 21*(1), 55–66. https://doi.org/10.1007/s10648-008-9092-5

van Merriënboer, J. J. G., & Ayres, P. (2005). Research on cognitive load theory and its design implications for E-learning. *Educational Technology, Research and Development, 53*(3), 5–13. https://doi.org/10.1007/BF02504793

Wiggins, G., & McTighe, J. (1998). *Understanding by Design*. Association for Supervision and Curriculum Development.

Yadav, A., Phillips, M. M., Lundeberg, M. A., Koehler, M. J., Hilden, K., & Dirkin, K. H. (2011). If a picture is worth a thousand words is video worth a million? Differences in affective and cognitive processing of video and text cases. *Journal of Computing in Higher Education, 23*(1), 15–37. https://doi.org/10.1007/s12528-011-9042-y

Analogies, Metaphors, Proverbs, and Similes for Learning

Dennis Cheek

> … metaphors influence every aspect of our lives, including our professional and academic pursuits. Metaphors are plentiful in the field of design, but we seldom give much thought to how they affect our perceptions of the profession and the people in it. (Russell T. Osguthorpe, 2007, p. 48)

Introduction

In everyday speech, it is clear that many people equate learning with education and education with schooling. A visitor from another planet, based on human discourse, could well conclude that these terms seem to be somewhat synonymous. When people talk about learning, it is almost always in reference to schooling; an educated person is someone who has graduated from a particular type of educational institution (institute, school, college, university). The self-taught person appears to be a rare and nearly extinct species among these human beings. School-leaving diplomas and certificates seem to be the main educational currency, making a person fit for employment, entrance into a higher level of education, or suitable for acceptance into other social settings (e.g., entrance into clubs, associations, and personal relationships).

The "business" of education evident to this alien consists of many moving parts, including personnel, facilities, age-determined levels, formal disciplines of study, curricular documents, instructional processes, transportation systems,

D. Cheek (✉)
Values Education Pte. Ltd., Singapore, Singapore

IÉSEG School of Management, Lille, France
e-mail: d.cheek@ieseg.fr

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*, Educational Communications and Technology: Issues and Innovations,
https://doi.org/10.1007/978-3-030-85078-4_7

administrative oversight, endless examinations, and training programs. Education is often characterized by writers on education as ponderous, complex, and frequently impenetrable to outsiders. The alien might also notice that educational technologists, learning designers, educational psychologists, and educators more generally have often strongly favored *technicist* means-ends reasoning (Waks, 2008) as reflected in things like "backwards design," "universal design," curricula in schools, and writings of learning theorists (including those in instructional design).

Critics of formal systems of education such as Ivan Illich (2000), John Holt (1990, 1995), Maria Montessori (1995), Kieran Egan (2005, 2007), Paolo Freire (2017), and John Dewey (1997, 2018) have complained about its stultifying nature, politicized agendas, mass routinization, fetishization of prior knowledge and bygone traditions, and limited utility for life, work, and living. Pundits have questioned whether much that is generally labeled as "education" is synonymous with "learning." This is especially true for exam-dominated learning environments where student achievement is measured by results on required examinations of various types (Curren, 2006, 2007; Illeris, 2018). Dismissive criticisms of education systems have spawned innumerable innovations yet resulted in only moderate enduring and widespread changes from place to place, country to country, and generation to generation (Rury & Tamura, 2019; Spring, 2018). While learning does occur in schools (i.e., time on task), it also occurs in many other human environments, such as businesses, civic organizations, social gatherings, self-selected social groups, families, and communities. Substantial learning remains largely self-determined, self-guided, and self-acquired. We can also note that much time spent within schools has no obvious connections to learning (i.e., time off-task). It is evident that learning is much more widespread than the presence of formal educational systems and in many ways learning vastly exceeds it, particularly when viewed from a lifespan perspective (Rury & Tamura, 2019).

Whether learning *itself* as a construct should be or even can be defined with an unalterable, eminently useful, and fruitful precision has been contested almost since its inception. Think about learning. We can, and we must. But perhaps we can make better progress by *how* we go about thinking about it. This chapter posits it is futile to formulate a definition of learning to which everyone can subscribe. The volume within which this essay appears has a number of papers that define learning or aspects of learning in various ways *fruitful* for the topics being explored in the respective chapters. Learning is highly contextual in nature and defies easy definition that travels widely and well.

Deep reflection about learning suggests that the clearer we seek to define it, the more elusive it becomes. But we can all utilize language skills we possess to move a conversation about learning forward – productively and responsively. Language *about* learning can serve as a vehicle for communication aiding our collective understanding of its varied dimensions and encapsulating our best attempts to apprehend its depth, breadth, diversity, and impact on human thought, behaviors, purposes, and actions.

Analogies, Metaphors, Proverbs, and Similes (AMPS)

Great writers understand that reality is too complex to confront in its awesome entirety. Instead, they use stories and literary devices such as analogies, metaphors, proverbs, and similes (AMPS) to approach that which is unapproachable and to name that which is unnamable. The enduring attraction of *The Chronicles of Narnia* series by C. S. Lewis, the *Harry Potter* books by J. K. Rowling, and great works of literature such as *The Aeneid*, *The Bhagavad-Gita*, *The Bible*, *Crime and Punishment*, *The Iliad*, *King Lear*, *Journey to the West*, and *The Kokinshu* is that they approach many complex truths about human beings and transcendent matters through symbols, imagined worlds, poetry, and the power of words to work their magic upon our thoughts, emotions, and imaginations.

Each of the characters in such literature "expand via metaphor," as the writer and noted literary critic Sir Victor Sawdon Pritchett observed (Donahue, 2014, p. 6). Metaphors bring into juxtaposition two things that are initially not seen as alike (Guttenplan, 2005). This unleashes the reader's own imagination such that a character seems to *grow* before us with our imagination filling out the person using the various connotations and shades of meaning associated with a particular word or phrase to add depth, breadth, and substance (Ervas, Gola & Rossi, 2017; Gola & Ervas, 2016). This is part of the central power of literature; it is an engagement of the writer's imagination combining with the reader's own (cf. Lewis, 1967). It affects not only our understanding of characters in stories but also themes, institutions, ideas, events, etc., encountered in literature.

It is helpful to remind ourselves, courtesy of *The American Heritage Dictionary* (Pickett, 2001), of the general meaning and etymology of four key words:

> *Analogy* – n., pl. -gies 1a Similarity in some respects between things otherwise dissimilar. b. A comparison based on such similarity. 2. *Biol*. Correspondence in function between organs of dissimilar evolution. 3. An inference that if two things are alike in some respects, they must be alike in others. [Gk. *analogos*, proportionate]
>
> *Metaphor* – n. A figure of speech in which a word or phrase that ordinarily designates one thing is used to designate another, thus making an implicit comparison, as in *the evening of life*. [Gk. *metaphora*: *META* - + **pherein**, carry]
>
> *Proverb* – n. A short pithy saying in widespread use that expresses a basic truth or practical precept. [Lat., *prōverbium*]
>
> *Simile* – n. A figure of speech in which two essentially unlike things are compared, often using *like* or *as,* as in *"eyes like stars*." [Lat., like]

AMPS readily demonstrate a strong connection with human thought. One thorough exploration of this interrelationship can be found in the work of Lakoff and Johnson (1980, 1999), who argue that human minds are embodied, human thought is mostly unconscious, and almost all abstract concepts that we create and use are largely metaphorical in nature (cf. Hampe, 2017; Littlemore, 2019). AMPS prove useful to human beings because they enable us to approach themes or topics that defy easy description, defeat facile definition, and limit fruitful demarcation from related themes or topics (Gibbs Jr., 2019; Fogelin, 2011). By their widespread use across the world's many living and dead languages, cultures, ethnic groups, and social groups, we reach clearer individual and mutual understandings about what we intend to convey (Glucksberg, 2001; Kittay, 1990). The wide variations in their specific adoption and adaptation within various contexts are apparent when one studies, for example, the widespread use of adages and proverbs around the globe; often the same basic idea is conveyed by an entirely different metaphor that is situationally determined (e.g., Blaisdell, 2013; Cordry, 1997; Houghton, 1992; Mieder, 1986; Whiting, 1989). The effective use of AMPS allows others to begin engaging with our ideas and frequently moves humans forward to some means of consensus clear enough to prompt further collaboration and concerted joint actions. They are exceedingly useful throughout everyday life. Human beings are preeminently story tellers, a human activity fundamental to our development as thinkers and meaning makers across our lifespans (Schank, 1995). Our own stories almost effortlessly incorporate AMPS as we seek to express our ideas and thoughts to others (Kovecses, 2010, 2015).

Even more importantly than the already mentioned uses for these literary and oral devices is the fact that the use of AMPS is integral to the very thing English-speaking humans call "learning." A learner seeking new information and deeper understandings of things is rapidly overwhelmed by the complexity of the world we know as *reality*. AMPS provide ways to identify and link selected aspects of the "new" things we seek to know with selected things with which we are already familiar. Metaphors in particular are so widely used in everyday discourse that we scarcely are conscious of them and the way they are functioning to aid communication, clarify understandings, promote learning, and help us solve practical as well as conceptual problems (Wade, 2017).

It is not an accident that as humans sought to understand the mysteries of the human body and health and disease that AMPS in ancient Greek and Latin as well as modern languages began to fill medical glossaries as bona fide medical terms. These words, which now stand for discrete things in medicine and are daily spoken by millions of physicians and healthcare workers around the globe, originally were AMPS-employed to make sense out of what people of each generation were seeing and seeking to better understand. Organs and human anatomical structures were frequently given names based on something else they resembled with which people were already familiar. Functions performed by organs, tissue, or other anatomical or physiological structures or processes frequently were named for human-created processes or structures already in use within society. Medical textbooks and medical instruction to this day utilize AMPS extensively to initiate future clinicians to the massive knowledge and insights accumulated over millennia and to explain to novices how the body does its "work" all the way down to invisible molecules, atoms, and chemical reactions that exceed anything humans have built on larger scales (Pena & Andrade-Filho, 2010). In similar manner, metaphors have a long history of use across the sciences. Theodore Brown, a distinguished chemist at the University of Illinois, highlights through a series of studies of the atom, models in chemistry and biology, and specific topics including protein folding, chaperone proteins, and global warming, the presence and power of metaphorical thinking in both scientific reasoning and in scientific communication to other scientists as well as students and wider publics (Brown, 2003).

Numerous studies demonstrate that metaphors (and presumably AMPS more generally?) serve the following purposes for learners (Wegner et al., 2020):

- Knowledge acquisition
- Problem solving
- Personal development
- Motivation and other regulation-related uses

It appears from recent studies that learners who strongly self-identify with using metaphors to enhance their personal development are also the most likely to have stronger intrinsic motivation to learn, engage more frequently in deep processing strategies, and are most aware of the tentative nature of human knowledge. Learners who most frequently utilize metaphors for motivation or other *regulation-related* uses exhibit less structured approaches to learning, lower intrinsic motivation, hold the least sophisticated epistemological beliefs across the four groups, and tend to focus more on superficial approaches to learning (Wegner et al., 2020). In other words, learners need to see what they are learning as an aid to their own personal growth rather than merely for meeting course requirements or achieving some extrinsic goal. For learning designers, this means we need to help learners see how thinking about all the things that pertain to rich learning experiences benefits them personally as well as becoming a benefit to others. The underlying purposes for learning appear to matter greatly. AMPS are one means by which learners might more readily identify and acquire new knowledge and skills as they aid this important *personalization* process.

How AMPS Work to Enhance Learning

Donaghue (2014), in *Metaphor*, makes the point that the original Greek root word for metaphor carries with it the connotation of transferring a word from one place to another. One word is literally carried over from its normal usage to a new usage, replacing the word that would normally be expected. The purpose of a "good metaphor is to give something a different life, a new life" (Donaghue, 2014, p. 2). Its use in this new context helps the learner to connect the word they already know and understand (in terms of its function and usage) to come to terms with a new idea that they are now seeking to understand (Ritchie, 2013; Seligman & Weller, 2018). Ancient writers understood this particular way in which AMPS function as can be seen by the well-known *Institutio Oratoria* by Quintilian, who describes in Book 8 the various functions of such tropes, replete with examples drawn from the literature of his time (Donaghue, 2014). The general orientation is one that two millennia later has been designated as *constructivist* in character; human beings create personal meaning and personal knowledge via internal thought as well as social engagements, where AMPS themselves play a key facilitative role.

Metaphors often “fill a gap” (Wade, 2017) when referring to detailed processes involved in human activities. Donald Schön (1983) realized that a reflective practitioner was a skilled user of metaphors, especially of the generative type, that is, a metaphor that establishes a similarity and then exploits it further to generate additional insights that enable novices to grasp many aspects of the new knowledge or skill to which the metaphor was applied. Advanced proficiency at this type of mental and verbal maneuver is one of the hallmarks of a highly skilled, *reflective* practitioner.

Osgulthorpe (2007), in a short yet powerful essay, acknowledged that in his introductory design courses at Brigham Young University he would routinely employ the metaphor of *architect* as the designer and a *carpenter* as the developer; reasoning with his students that an architect creates the blueprint for the building just as a designer creates the content and task analysis for a learning environment. Developers, in this metaphor, then execute the work of the designer who is distanced professionally and operationally from the role (work) of the developer. He goes on to question his own practice in light of Thomas Friedman’s widely known metaphor of a *flat world* to represent contemporary globalization. He persuasively argues that no longer can instructional designers occupy such a rigidly separate role and instead puts forward the new metaphor of “designers and developers . . . [as] more like farmers who [together] plant and nurture and harvest – who know the quality of the soil, the needs for water, and other nutrients, and the possibilities for successful results” (p. 48). He reminds readers that the metaphors we choose to use to represent our work and roles are powerful shapers of professionals and those who follow in their footsteps.

The use of metaphorical and figurative language addresses a number of important cognitive, emotional, and affective needs of learners. For example, Ligorio et al. (2016) report the following ways AMPS usage helps online learners:

- Affect conceptual reorganization and knowledge enhancement.
- Support expression of affective domain and building of a common identity.
- Give concreteness and familiarity to the immateriality of virtual space.
- Support social presence and collaborative knowledge building in online learning experiences.

There are many unresolved academic debates regarding AMPS, including the similarities and differences between metaphors and similes (Barnden, 2016), the relationship between the metaphorical and the literal (Indurkhya, 2016), and the degree to which learners have and can access preexisting large symbolic worlds from which to elicit AMPS. Educational research literature contains relatively few studies of AMPS, particularly if we ignore foreign language acquisition, literary and rhetoric studies, and communication studies. Work in foreign language learning settings, for example, demonstrates that employing AMPS in the context of regular learning of a new language enables learners to expand their vocabulary more rapidly, enhances recall of vocabulary and promotes correct usage, and helps them to understand subtleties in the acquisition language (Neimeier, 2017).

When considering educational research itself, Low (2017) reports a series of interesting studies that considered elicited metaphors (EM) in education research. Multiple studies found that using EM helps students describe things that were difficult to detail or describe, helps them link to visual images that aids retention of learning and complex concepts, and enables them to express emotions or affect.

Deploying AMPS to Advance Learning and Learning Design

AMPS provides a fertile and inexhaustible means to consider anew the many ways in which human beings learn and the countless metaphors we can employ to talk about learning itself. AMPS can help us metacognitively engage with what we are learning and provide fertile means to make sense of it. This orientation to learning through effective use of AMPS can inform our creation of a much wider set of learning designs and release within us greater ingenuity when thinking about learning environments.

The history of education is replete with the use of AMPS to talk about the core business of teaching and learning, for example, learning by doing, discovery learning, drawing upon children's funds of knowledge, and learning investigations. Wade (2017) highlights a number of such terms that have been floated over the years by curriculum documents, policies, and well-known educationalists. Below, I have renamed and reconfigured these terms to juxtapose two ends of a series of continuums that we can imagine regarding the goals of learning (or education). None of them are intrinsically wrong, and all of them embody their own tradeoffs. The list is illustrative only and can and should be multiplied many times over. AMPS can also be carried down to the micro-level in addition to these macro-level examples.

- A catalyst or an inhibitor
- The filling of an empty vessel or the lighting of a fire
- The intellectual development of an individual or the development of a well-rounded person
- A highly skilled individual or an adept generalist
- A degree or a set of carefully documented competencies
- An underdetermined wandering (or walkabout) or a delineated pathway/course
- Lifelong learning or experiences over a fixed time period

The noted psychologist Jerome Bruner (1990) argued three decades ago that scientists and other learners across disciplines utilize analogical reasoning as a strategy to solve problems as they wrestle with issues of similarity, structure, and purpose. Using AMPS in the context of everyday living and working brings clarity to human thought related to a particular issue, decision, or course of action. It enables a designer to go through an internally driven yet socially enriched thought process through metaphorical prompts like (1) as exhilarating as …, (2) as challenging as …, (3) as structured as …, (4) as open-ended as …, (5) as inviting as…, (6) looking like ..., (7) feeling like..., and (8) interconnected like ... Deploying AMPS consistently and opportunely in one's work and in one's learning serves as a "bridging strategy." It provides an elixir to formulate, play with, improve, and apply fresh thinking and new approaches to conceptually difficult tasks or to grasp challenging intellectual ideas (Gentner & Asmuth, 2019).

AMPS have been widely understood to be present and powerful in fields such as medicine, law, linguistics, architecture, engineering, and the sciences (Ball & Christensen, 2009; Casakin, 2011; Christensen & Schunn, 2007; Clement, 2013; Coyne et al., 1994; Gertner & Asmuth, 2019; Pena & Andrade-Filho, 2010). A natural setting study of students and expert reviewers at work in an architectural design course documents the frequency, use, extent, and context for the use of AMPS by students as well as the reviewers of student work (Dogan et al., 2019). They found that metaphors were employed most frequently and widely applied throughout the review process. Embodiment was often invoked through the figures of speech employed. Part of their conclusion is worth quoting in full (p. 83):

> Given the pervasiveness and ease of the use of analogies, metaphors, and primarily distant analogies, instructors might take more advantage of the full potential of analogical reasoning and metaphors in design education. Beginning design education students come equipped with an ability to think through analogies and metaphors. The studio needs to build upon this primary ability in facilitating the creative design process and effective communication among the various actors. Design instructors should benefit from metaphors in expressing their ideas not just for purposes of enriching the design language but primarily to foster the design thinking. Analogies should be used to make similarities explicit and adaptable to new situations. Students, in turn, need to be encouraged to use metaphors and analogies to help them be creative while learning how to design and better communicate themselves.

While AMPS are present and useful worldwide, teachers and learners also have to be thoughtful in how they employ AMPS in their respective locales and learning situations. Cultural sensitivity is required, and some time must be spent in locating, understanding, and using "dynamic equivalence" AMPS from different cultures, ethnic groups, and languages when working and learning within diverse settings (Milheim, 2018). Fortunately as adages and proverbs literature exhibits, there is a considerable wealth of materials from which to derive appropriate analogues for the situation at hand in addition to inquiring directly of students or colleagues for choice examples of the same idea from different cultures, languages, or ethnic/social groups (e.g., Wilson, 1970; St. Clair, 2013, 2018, 2019; Speake, 2003; Cordry, 1997). Allowing students to both share and explain appropriate examples from their own backgrounds aids their own learning of the content in focus as well as contributing positively to the learning of others.

Taking seriously the thoughtful and explicit use of AMPS within our design considerations throws new light on old problems. For example, there is the ideal of a "universal design" (UD) approach to the design of learning experiences. Yet many applications of so-called UD appear to downplay or largely ignore the *humane* aspect of human beings, including their cultural orientation and the specific language(s) they call their *native* tongues. Deliberately preidentifying our own use of AMPS within our instructional practices and forcing ourselves to identify appropriate parallel expressions from diverse cultures can promote much more culturally sensitive appropriation and contextualization for diverse learners. We need to always think about cognition as inevitably socially and culturally situated for the learner. We communicate our understanding of this principle when we start to regularly and consistently utilize language expressions that "travel well" or adeptly "flex" across languages, cultures, and social groups. Language appropriation should not and cannot consist of the search for an elusive word or words that will universally apply; rather, we should be seeking to find and employ words and expressions from multiple cultures that promote universal understanding among learners. Consciously "watching our words" sends many powerful positive messages to those who are different from us: (1) I see you, (2) I hear you, (3) I recognize the equal power and efficacy of your own language, and (4) I seek above all to communicate well to all those whom I seek to teach.

Conclusion

It is the premise of this chapter that the use of analogies, metaphors, proverbs, and similes (AMPS) is already widespread and deployed daily by humans everywhere they may be found. More intentional and widespread use of AMPS by learning designers in the course of their everyday design work and their work with learners is needed. Novices, teachers, and practitioners can and should make more frequent and effective use of AMPS. The deliberate inclusion of AMPS within learning materials for all ages is overdue. Given the large diversity found within human societies in the contemporary world, it behooves all learning designers to regularly seek out, catalogue, and effectively utilize culturally and linguistically appropriate analogous AMPS from diverse human cultures. These deliberate moves should increase over time human learning across and within societies. As the English-language metaphor says, "You can take that to the bank." It will pay rich dividends over time!

References

Ball, L. J., & Christensen, B. T. (2009). Analogical reasoning and mental simulation in design: Two strategies linked to uncertainty resolution. *Design Studies, 30*(2), 169–186.

Barnden, J. (2016). Metaphor and simile: Categorizing and comparing categorization and comparison. In E. Gola & F. Ervas (Eds.), *Metaphor and communication* (pp. 25–46). John Benjamins Publishing Company.

Blaisdell, R. (2013). *There's a saying for that: Proverbs from around the world*. Dover Publications, Inc.

Brown, T. L. (2003). *Making truth: Metaphors in science*. University of Illinois Press.

Bruner, J. S. (1990). *Acts of meaning*. Harvard University Press.

Casakin, H. (2011). Metaphorical reasoning and design expertise: A perspective for design education. *Journal of Learning Design, 4*(2), 29–38.

Christensen, B. T., & Schunn, C. D. (2007). The relationship of analogical distance to analogical function and preinventive structure: The case of engineering design. *Memory & Cognition, 35*(1), 29–38.
Clement, J. J. (2013). Roles for explanatory models and analogies in conceptual change. In S. Vosniadou (Ed.), *International handbook of research on conceptual change* (pp. 412–446). Routledge.
Cordry, H. V. (Ed.). (1997). *The multicultural dictionary of proverbs: Over 20,000 adages from more than 120 languages, nationalities, and ethnic groups*. McFarland Publishing.
Coyne, R., Snodgrass, A., & Martin, D. (1994). Metaphors in the design studio. *Journal of Architectural Education, 48*(2), 113–125.
Curren, R. (Ed.). (2006). *A companion to the philosophy of education*. Blackwell Publishing.
Curren, R. (Ed.). (2007). *Philosophy of education: An anthology*. Blackwell Publishing.
Dewey, J. (1997). *Experience and education*. Free Press.
Dewey, J. (2018). *Democracy and education: An introduction to the philosophy of education*. Myers Education Press.
Dogan, F., Taneri, B., & Erbil, L. (2019). Use of analogies, metaphors, and similes by students and reviewers at an undergraduate architectural design review. *Artificial Intelligence for Engineering Design, Analysis, and Manufacturing, 33*, 69–84.
Donaghue, D. (2014). *Metaphor*. Harvard University Press.
Egan, K. (2005). *An imaginative approach to teaching*. Jossey-Bass.
Egan, K. (2007). *The educated mind: How cognitive tools shape our understanding*. University of Chicago Press.
Ervas, F., Gola, E., & Rossi, M. G. (Eds.). (2017). *Metaphor in communication, science, and education*. De Gruyter Mouton.
Fogelin, R. J. (2011). *Figuratively speaking*. Oxford University Press, rev. ed.
Freire, P. (2017). *Pedagogy of the oppressed*. Penguin Books.
Gentner, D., & Asmuth, J. (2019). Metaphoric extension, relational categories, and abstraction. *Language, Cognition and Neuroscience, 34*(10), 1298–1307.
Gibbs, R. W., Jr. (2019). *Metaphor wars: Conceptual metaphors in human life*. Cambridge University Press.
Glucksberg, S. (2001). *Understanding figurative language: From metaphor to idioms*. Oxford University Press.
Gola, E., & Ervas, F. (Eds.). (2016). *Metaphor and communication*. John Benjamins Publishing Company.
Guttenplan, S. (2005). *Objects of metaphor*. Oxford University Press.
Hampe, B. (Ed.). (2017). *Metaphor: Embodied cognition and discourse*. Cambridge University Press.
Holt, J. (1990). *Learning all the time*. DeCapo Lifelong Books, rev. ed.
Holt, J. (1995). *How children fail*. DeCapo Lifelong Books, rev. ed.
Houghton, P. (Ed.). (1992). *The Cassell book of proverbs*. Cassell Publications.
Illeris, K. (2018). *Contemporary theories of learning: Learning theorists … in their own words*. Routledge. 2e.
Illich, I. (2000). *Deschooling society*. Marion Boyars Publishing Ltd.
Indurkhya, B. (2016). Towards a model of metaphorical understanding. In E. Gola & F. Ervas (Eds.), *Metaphor and communication* (pp. 123–146). John Benjamins Publishing Company.
Kittay, E. F. (1990). *Metaphor: Its cognitive force and linguistic structure*. Oxford University Press.
Kovecses, Z. (2010). *Metaphor: A practical introduction*. Oxford University Press, 2e.
Kovecses, Z. (2015). *Where metaphors come from: Reconsidering context in metaphor*. Oxford University Press.
Lakoff, M., & Johnson, G. (1980). *Metaphors we live by*. University of Chicago Press.
Lakoff, M., & Johnson, G. (1999). *Philosophy in the flesh: The embodied mind and its challenge to western thought*. Basic Books.
Lewis, C. S. (1967). *Studies in words*. Cambridge University Press.

Ligorio, M. B., Iodice, M., & Manca, S. (2016). Metaphors and online learning. In E. Gola & F. Ervas (Eds.), *Metaphor and communication* (pp. 235–248). John Benjamins Publishing Company.

Littlemore, J. (2019). *Metaphors in the mind: Sources of variation in embodied metaphor*. Cambridge University Press.

Low, G. (2017). Eliciting metaphor in educational research: Is it really worth the effort? In F. Ervas, E. Gola, & M. G. Rossi (Eds.), *Metaphor in communication, science and education* (pp. 249–266). De Gruyter Mouton.

Mieder, W. (Ed.). (1986). *The Prentice-Hall encyclopedia of world proverbs*. MJF Books.

Milheim, K. L. (Ed.). (2018). *Cultivating diverse online classrooms through effective instructional design*. IGI Global.

Montessori, M. (1995). *The absorbent mind: A classic in education and child development for educators and parents*. Holt Paperbacks.

Niemeir, S. (2017). Teaching (in) metaphors. In F. Ervas, E. Gola, & M. G. Rossi (Eds.), *Metaphor in communication, science and education* (pp. 267–282). De Gruyter Mouton.

Osguthorpe, R. T. (2007). Instructional design in a flat world. *Educational Technology, 47*(2), 48–50.

Pena, G. P., & Andrade-Filho, J. D. S. (2010). Analogies in medicine: Valuable for learning, reasoning, remembering, and naming. *Advances in Health Sciences Education, 15*, 609–619.

Pickett, J. P. (2001). *The American heritage dictionary*. Dell Publishing, 4e.

Ritchie, L. D. (2013). *Metaphor*. Cambridge University Press.

Rury, J. L., & Tamura, E. H. (Eds.). (2019). *The Oxford handbook of the history of education*. Oxford University Press.

Schank, R. (1995). *Tell me a story: Narrative and intelligence*. Northwestern University Press.

Schön, D. A. (1983). *The reflective practitioner*. Jossey-Bass.

Seligman, A. B., & Weller, R. P. (2018). *How things count the same: Memory, mimesis, and metaphor*. Oxford University Press.

Speake, J. (2003). *The Oxford dictionary of proverbs*. Oxford University Press, 4e.

Spring, J. (2018). *The American school: From the Puritans to the Trump era*. Routledge, 10e.

St. Clair, S. J. (Ed.). (2013, 2018, 2019). *Most comprehensive origin of cliches, proverbs, and figurative expressions* Vol. 1 (2013), Vol. 2 (revised and expanded, 2019), Vol. 3 (2018). St. Clair Publications.

Wade, J. C. (2017). Metaphor and the shaping of educational thinking. In F. Ervas, E. Gola, & M. G. Rossi (Eds.), *Metaphor in communication, science and education* (pp. 305–321). De Gruyter Mouton.

Waks, L. J. (2008). The making of a schooling and technology skeptic. In L. J. Waks (Ed.), *Leaders in philosophy of education: Intellectual self-portraits* (pp. 251–258). Sense Publishers.

Wegner, E., Burkhardt, C., Weinhuber, & Nückles, M. (2020). What metaphors of learning can (and cannot) tell us about student learning. *Learning and Individual Differences, 80*(May), 101884. https://doi.org/10.1016/j.lindif.2020.101884

Whiting, B. J. (1989). *Modern proverbs and proverbial sayings*. Harvard University Press.

Wilson, F. P. (Ed.). (1970). *The Oxford dictionary of English proverbs*. Compiled by William George Smith. Oxford University Press, 3e.

Learning Experience in an Instructional Design Doctoral Program: A Redesign Case

Elizabeth Boling

Introduction

The faculty of a long-established doctoral program in educational technology, of which the author is a member, began in 2003 a routine review of their qualifying exams. A discussion of our traditional proctored, closed-book exam concluded that it was an unreliable indicator of the knowledge and competencies required to complete a successful dissertation, so we began to speculate on more authentic experiences we might use to replace those exams. We agreed that "authentic" experiences would be, for this program, those sharing characteristics with key activities carried out by higher education faculty—broadly speaking, those associated with academic research, teaching, and service. Each new configuration for the qualifying exams that was proposed served to highlight additional unsatisfying features of the doctoral program and our discussions rapidly escalated to encompass the entire design of the program. A long process of negotiation and thought experiments ensued, leading eventually to a fully redesigned program that was implemented starting in 2005. That program is described in this design case, together with some of its false starts and revisions. We now see the program as an integrated learning experience rather than a series of courses followed by a major exam and a dissertation; some of the key decisions required for this are also discussed.

E. Boling (✉)
Indiana University, Bloomington, IN, USA
e-mail: eboling@iu.edu

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*, Educational Communications and Technology: Issues and Innovations,
https://doi.org/10.1007/978-3-030-85078-4_8

Description of the Program

Rather than list course requirements and their sequence, let us view the program as an experience and from the perspective of one fictional doctoral student. She is Alana, 25 years old, studying outside her home country after earning a master's degree, and working there for 2 years in media communications. Alana is a composite of many students, and therefore not fully individualized. No one but her fictional self can know what she is really thinking, of course, or specifically how she is experiencing the program. However, she is the product of many observations and conversations accumulated throughout almost 30 years of the author's experience teaching and mentoring in this program.

When Alana arrives for orientation, she encounters a number of unfamiliar terms—*research groups*, *doctoral seminar*, *first-authored study*, *dossier*, and *Dossier2*—and when she meets current students, they mention all these terms frequently. She gets the idea early on that these are key features of the program and particularly that she needs to gear up for her *dossier* right away. It is surprising and challenging for her to realize, as she does quickly, how much of this program is going to be happening outside of the courses listed in the program requirements. This experience was going to be a challenge, she knew, but now she is extra nervous because the requirement to conduct a first-authored study sounds daunting and fellow students emphasize that she should start thinking about it soon.

Alana will take regular courses as in any program, including an early core of doctoral readings, general research methods, methods in the context of the field, elective credits, minor courses, and dissertation hours. However, her experience extends beyond courses when she joins two research groups in her second term and begins a seminar series. Individual faculty and groups of faculty convene research groups regularly outside of classes. Alana attends one group led by her advisor in her area of scholarly interest, and another that is exploratory. She participates in the second group because a peer suggested that she would gain valuable experience in the data analysis technique they are conducting.

Over the next four semesters, Alana contributes to these ongoing studies in both of her research groups; in one, she does participate in data analysis, and in the other, completes readings that the group uses to prepare for a study. Over the next couple of years, she participates in several studies and conference presentations with these groups. In parallel, she completes a literature review in her area of interest, develops a research proposal, and carries out her first-authored study. At each stage, she presents her work in the seminar, a repeated experience over four consecutive terms, mainly focused on getting feedback from peers at all stages in the program. Her advisor leads the research group she has selected as primary and advises her on this study, so they have regular consultations. Alana will have several conference presentations and a published paper on her vita as a result of this work.

Alana owns a good deal of her progress and decision-making in this environment; she makes choices that go beyond selecting courses to take, choices that have significant impact on her progress and learning. She knows she will be required to show evidence of service when her dossier is reviewed, so she volunteers one year to help organize the annual student-run conference onsite, and the next year to run it herself. She worries about the teaching requirement for dossier because she has not taught before, so in her third year she volunteers to help set up and manage an online course with her advisor. In her fourth, she lands an adjunct assignment with the local junior college teaching an undergraduate media design course. She worries that she may not be amassing enough evidence of her growing competency but tries not to compare herself to her peers any more than is healthy, although she asks several who are ahead of her in the program to show her their dossiers as exemplars. She is relieved to see that she is not far out of line with them.

As diligent as she has been, and prepared as she knows she is, *Dossier2*, the event at which she defends her dossier and presents in-depth on her first-authored study, is nerve-wracking. It is the major portion of her qualifying exam, and the entire department will be present. Two faculty members who are not on her advisory committee have reviewed her dossier in advance and after she presents will ask her questions about it. Afterward, the whole faculty discuss her dossier and will vote on whether she passes or fails, whether there are conditions for passing, and what those conditions will be. A week later when Alana hears she has passed with the condition that she revise her candidate's statement for clarity, she quickly moves on to do so. She completes her coursework, including a dissertation proposal class, files for candidacy, and then follows a traditional process toward completing her dissertation. She is simultaneously apprehensive yet confident heading into this phase of her program. It is a new challenge to face her dissertation study knowing that she must drive the process now, but her advisor knows her and her work well at this point, and she has experience independently carrying out research. She is ready to go.

Designing the Program

As tedious as the process of redesigning this program sometimes came to be for the faculty back in 2003, once we had convinced ourselves that nothing short of wholesale change would satisfy us, the project was absorbing. The meetings in which we hashed out the final plan continued through the entire summer of 2004, and almost every member of faculty attended every meeting. Faculty readers will recognize this as a strong signal of engagement indeed. Not that it was all fun. The process included disagreements, digging in over favored ideas, looping back through decisions already made, and the kind of speech-making to which faculty are prone—something in which all of us participated.

Having begun with the question of quals, we soon perceived that the experience of studying for the doctorate was one in which the reassuringly structured nature of coursework had been lulling students into complacency until they reached the edge of a disorienting and dangerous drop-off where they were suddenly expected to conduct independent research largely on their own. They had, of course, a research committee to guide them but were often unsure how to press forward with a project, and we saw many of them lose focus or confidence, or both, at this point. We had to face our responsibility for this as designers of the learning experience.

Little was overtly systematic about the way this design effort unfolded, although we did produce whiteboard diagrams along the way to examine the alignment of program features with our goals and assessments. The most striking feature of our sessions, however, was that we used frame experiments (Schön, 1985) as our primary tool for designing. One or more of us would posit a possible feature or configuration for the program, and we would play out how that might work and how it might serve our goals. Any number of these frame experiments failed to be adopted, but we used them all to explore the boundaries of what we wanted to accomplish and what we were willing for the program to be. As an example, the notion of a "500-item true/false, multiple choice, short answer exam" was floated as a frame experiment for how to achieve a key goal—breadth of knowledge regarding the field. It ran counter to our desire to engage the students in activities authentic to professional scholarship, but we gave it a hearing because the breadth-of-knowledge goal was considered so important. Repeatedly returning to this frame was part of the impetus for deciding that students should be required to join more than one research group early on. Participating in multiple groups should address the connections between their own research and major concepts in the field during their dossier reviews, what we call the "breadth-and-integration" requirement for Dossier2.

Key Decisions

Our first decision was to scrap the qualifying exam in its earlier form, of course, but this led to something of a cascade of others. If the exam looked more like a completed research study, we reasoned, and not just a "toy" study conducted in a methods course, students would need support for conducting such a study. Reflecting that some of the most successful students were those who had been lucky enough to participate directly with faculty on research projects, and lacking the funds to assign a research assistantship to every student, we decided to leverage the faculty's ongoing, required research activity by instituting a formal, albeit loose, set of research groups led by the faculty. Students are required to find a home in one or more such groups. To encourage intellectual exploration and discourage any locked-in perceptions on the part of students, we required participation in more than one group early on and declaration of a "primary" group later on. This may have been the part of the design of most concern to the faculty; most of us did not work with students in this way, so we were signing up for more than just a change in curriculum. We all had to agree to this experiment; leaving the actual format of research groups wide open allowed us to do so.

As we played out the frame experiment of the research group, we considered the structuring elements of the program that could help keep students on target. This required that we question what "on target" meant. Realistically, we agreed, most of our students aspire to academic careers and we could use a version of the tenure structure as long as we kept it flexible for students with different goals; thus, the dossier was introduced. Those of us who had assembled dossiers knew, however, that the requirement to do so does not automatically get the job done. We needed a component of the program that would serve to move students through the development of their dossier. We contemplated a series of courses for each stage of that development, but due to the complications of such a plan, we eventually collapsed the idea into a single, repeated seminar attended jointly by students at all stages. This afforded additional mentoring from peers, a mechanism for faculty to record assessment of participation in research groups via its contribution to their seminar grade, milestone requirements for the first-authored study requirement, practice for students in presenting research, and—prosaically—faculty credit (through teaching the seminar) for the additional time that would be required to lead a structured research group.

Finally, once we had redesigned the program, we returned to the qualifying exam and decided to leverage the features of that new design to construct the exam. It was now a complex, authentic assessment with a pivotal role in each student's program. We divided the qualifying exam into three parts: Dossier1 is a developmental review with the advisory committee; a semester later comes the public, pass/fail Dossier2 event; Dossier3 then serves as a checkpoint for any conditions from Dossier2 and a bridge to the dissertation proposal, again with the advisory committee. By this time, we had a program in which all the pieces had to work together, but within which we hoped that the learning experience would be richer and better supported for students than it had been in previous years.

Design Failure

Design failure, defined as points at which the design did not function as desired or led to unexpected and unwanted problems, played several roles in this project. The first was to shape our collective understanding of what the PhD should be as we prototyped and discarded multiple versions of program features before the design was ever completed. Such frame experiments drove our design sessions, as previously discussed.

The second group of design failures might be characterized as complexities in the design that had not been anticipated as we worked, but which became apparent fairly quickly when our design hit the real world. We had thought that requiring every member of faculty to join in the doctoral seminar sessions would provide rich input to the students and keep the faculty up to speed on every student's progress. However, the faculty, who sincerely wanted to give input and challenge students' thinking, overpowered the seminar and made it stressful in a way that we felt was not conducive to learning. Similarly, in trying to provide multiple paths to success in dossier development, we originally listed 80–90 individual artifact types that could be included in the dossier. This was counterproductive. It terrorized some students, who were inclined either to scramble and assemble more artifacts than was appropriate, or to become paralyzed and stall out on the activities they should have been undertaking.

Lastly, we continue to manage the kind of design failure that can result from entropy and from overall success. Entropy sets in when faculty lose the thread of the integrated whole, through rotation of teaching responsibilities in seminar, changes in research group practices, or failure to frequently calibrate between ourselves. Failure stemming from success is most visible when the strong performance of many well-prepared students results in rising expectations on the part of the faculty; we have to remind ourselves at dossier defense deliberations to keep our expectations pinned to "ready to conduct independent research" rather than allowing them to creep upward. Seminar and research group participation brings most of the students in the program together regularly. On the positive side, this results in a strong group identity and awareness on the part of all students about what the others are doing in their programs. In terms of design failure, however, misunderstandings can spread quickly through the seminar grapevine, for example, "no one fails the quals; everyone gets pass with revisions," and disruptive competition, for example, "students in that research group get more publications."

Summary

Over the 15 years this program has been in place, it has been possible to observe a shift in the learning experience we offer our doctoral students. Previously, the experience was rightly understood to be one in which coursework was intended to provide perspective, knowledge, and skill as well as enculturating students into an academic mode of thought and action—but we saw that this did not always happen. Many students arrived at the dissertation phase having forgotten or not understood the earlier learning that was intended to prepare them. Currently, while the start of the program is arguably more challenging than it used to be and the qualifying exam is undeniably stressful, we see fewer doctoral candidates who get lost on the way to a successful dissertation. The experience we have designed for them is a program with multiple interdependent elements, each of which requires regular maintenance as well as the understanding and participation of the entire faculty in order to function effectively. The strengths of the design's structure could easily become its weaknesses if we do not recognize what it demands from us as a faculty and continue to meet those demands. New challenges will also arise, the most evident to date being the global pandemic of 2020.

Acknowledgments Thanks is extended, with gratitude, to all the members of faculty who participated in the original design—Bob Appelman, Barbara Bichelmeyer, Tom Brush, Ivor Davies, Ted Frick, Mike Molenda, Jim Pershing, and Charlie Reigeluth.

Reference

Schön, D. A. (1985). *The design studio: An exploration of its traditions and potentials*. International Specialized Book Service Incorporated.

Current and Evolving Views of Learner Experience from the Field of Learning Design and Technology

Matthew Schmidt and Rui Huang

Introduction

This chapter highlights the need for greater semantic and conceptual clarity around the concepts and language of user experience (UX) and learner experience (LX) that increasingly are gaining prominence in the field of learning design and technology (LDT). We approach this need through a content analysis of a corpus of recently published literature by active LX researchers. Increasingly, user-centered design (UCD) and UX methods are being applied in learning design contexts. This signals a shift in the field of LDT, moving the field toward more human-centered approaches to designing digital environments for learning. Human-centered approaches seek to provide learners pleasing and effective digital learning tools that are easy to use and that efficiently propel them toward their learning goals. While considerations of user experience (UX) are core to many of the sister disciplines of learning/instructional design and technology [e.g., human–computer interaction (HCI), information technology (IT)], little attention historically has been given to LX or to the practice of LX design in LDT.

Heralding the move toward more human-centered methods of design in LDT, the field has distanced itself from the term *instructional* design, which historically has focused on the creation and delivery of educational and training materials. In its place, the field in general has adopted the term *learning* design. Concurrently, practitioners have begun adopting the title *learning experience designer* and are applying UX and design thinking methods and processes to design the *learning experience*. When encountered by learners, their perceptions of these learning experiences contribute to their overall *learner experience*. These terms and concepts have emerged

M. Schmidt (✉) · R. Huang
University of Florida, Gainesville, FL, USA
e-mail: matthew.schmidt@coe.ufl.edu

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*,
Educational Communications and Technology: Issues and Innovations,
https://doi.org/10.1007/978-3-030-85078-4_9

rapidly in our field and have been readily accepted by practitioners and researchers alike into common parlance as well as professional and scholarly discourse. However, these terms and concepts are more often than not used in relaxed, imprecise, and sometimes contradictory ways (Dalziel et al., 2016). Efforts to meaningfully and precisely differentiate the myriad permutations of terms are impossible without semantic and conceptual clarity. Use of colloquial discourse confuses efforts to situate and connect the established traditions of our field with related methods and processes from other disciplines (e.g., HCI, UCD, UX).

While brushing off these issues as purely pedantic might be tempting, the implications on the field of semantic and conceptual confusion warrant further consideration. Use of terms and concepts imprecisely, interchangeably, reductively, etc., introduces validity threats and could contribute to conflicting findings. Further, and as others have pointed out, the continually evolving nature of the LDT field presents challenges for practitioners and researchers in establishing common definitions and terminologies (Lowenthal & Wilson, 2010; Moore et al., 2011; Volery & Lord, 2000). A common foundation of lexical congruence and conceptual transparency is therefore essential as it allows researchers to "perform meaningful cross-study comparisons and build on the outcomes from the previous studies" (Moore et al., 2011, p. 129). This chapter speaks to this need.

Key Terminology

This chapter seeks to provide clarity around terms and concepts associated with LX. Therefore, we begin by providing a series of brief definitions both to contextualize the work presented here and to provide sufficient background to distinguish LX from associated concepts. Specifically, we focus on the following three related, but distinct, concepts: (a) user-centered design, (b) user experience design, and (c) learning design. These are discussed in the following sections.

User-Centered Design User-centered design is an offshoot of human-centered design that can trace its origins to the seminal work of Norman and Draper (1986). It is an umbrella term that is used to describe iterative design practice that actively seeks user validation across all phases of design. The term applies both to an underlying philosophy, as well as to the process and associated methods of designing in a user-centered manner (Abras et al., 2004). Philosophically, UCD recognizes that users' needs, abilities, and desires should drive design at each stage of the process. UCD does not prescribe specific methods; however, a variety of investigative and generative methods have been applied in UCD to develop an understanding of user needs and to inform design—for example, ethnographic methods (e.g., observation), cognitive walkthroughs, and usability testing. For a more comprehensive overview of UCD methods, readers are referred to Schmidt et al. (2020a).

User Experience Design Since Donald Norman coined the term *user experience design* (Norman, 2013), there has been increasing focus and recognition of the importance of how individuals experience designed products and solutions. However, the exact origins of UXD and a precise definition remain the subject of some debate. Generally speaking, UXD is a design practice that seeks to consider all aspects of user experience in the design of products, systems, etc. Much like the rapid uptake of terms such as LX and learner experience design (LXD) in our field, the term UX has become common parlance in sister disciplines while not being well understood (Law et al., 2009). In its original intent as described by Norman and Draper (1986), UX is a broad concept that encompasses every aspect of the relationship between the user-in-context and product. This broad conceptualization of UX is not strictly adhered to in modern contexts of praxis, which tend to take a narrower view of UX as the user's immediate experience of using a technology product's user interface. This has been criticized by some as a conflation of UXD with user interface design (IxD: Marcus, 2002). For further information, readers are referred to the 2010 ISO 9241-210 human-centered design for interactive systems standard.

Learning Design Serious efforts to define *learning design* can be found in Koper and Olivier's (2004) oft-cited work and the *Larnaca Declaration on Learning Design* (Dalziel et al., 2016). Both of these efforts sought to develop formal methods to develop and share instructional artifacts (Koper, 2005). Conceptualization by others (e.g., Alonso et al., 2008; Hummel et al., 2004) continues the tradition of learning objects and the Educational Modeling Language—a formal description of educational materials and/or pedagogical scenario-seeking to allow for creation of formal, reusable elements that can be meta-tagged, searched for, and shared widely. Similarly, the *Larnaca Declaration* emphasizes the importance of sharing efficacious teaching practices and underscores the need for a standardized method for describing these practices. Koper and Olivier's (2004) model conceives of "a learning design" as the artifact of a designer engaging in a design process by applying a rule-set to describe the teaching–learning process from the instructor's perspective. This model distinguishes "a learning design" from learning design knowledge, method, and task, as well as learning designers. The perspective offered in the *Larnaca Declaration* conceives of "Learning Design" as a proper noun used to describe a discrete field of study, not as the activity of design (Conole, 2018). Arguably, neither of these interpretations of learning design aligns well with how the term is commonly used in LDT, which begs the question of how this and other terms associated with LX are used in practice.

To conclude, the phenomena of LX and LXD appear to be gaining prominence in the field of LDT. However, a number of gaps are readily identifiable, which are in many ways related to a general lack of clarity around LX and associated concepts. Therefore, we engaged in a qualitative content analysis so as to explore how authors in the field of LDT conceive of and characterize LX. Details of our approach are provided in the following section.

Methodology

The purpose of our qualitative content analysis was to articulate the phenomenon of LX as portrayed in a corpus of 15 book chapters that were recently published in the edited volume *Learner and User Experience Research: An Introduction for the Field of Learning Design & Technology* (Schmidt et al., 2020b). Over 40 authors contributed to these 15 chapters. These authors are from 18 universities and organizations across three countries, with the majority (35 out of 38 authors) currently working in the United States. Specifically, our research explored how authors conceived of LX as evidenced by the definitions, characteristics, parameters, and contexts found in their book chapters. We selected the *Learner and User Experience Research* edited volume as our data source because, to our knowledge, this volume is currently the only published resource that specifically addresses the phenomenon of LX and UX in the LDT field. The research questions that guided our inquiry were.

RQ1: What growth and trends can be found in the educational literature of the past 20 years related to terms associated with LX?
RQ2: What key terms and concepts are used across the corpus of book chapters and with what prevalence?
RQ3: How do authors characterize LX within their book chapters?

The current research was performed by the first and second authors of this chapter, a lead researcher (a university professor), and an assistant researcher (a trained doctoral student), respectively. Two analyses were performed, a bibliometric analysis and a qualitative content analysis. Our bibliometric analysis queried the Clarivate Analytics Web of Science database for publication and citation data to evaluate growth and trends related to LX. Our qualitative methods borrowed from the tradition of grounded theory in our application of open-coding techniques (Glaser & Strauss, 2017; Strauss & Corbin, 1998). Our coding process unfolded across three phases. In Phase 1, we performed a systematic, iterative open-coding process to develop a preliminary coding scheme and procedures. In Phase 2, we conducted a second round of coding using the coding scheme and procedures from Phase 1 and made refinements iteratively over the course of the coding effort. In Phase 3, we performed a frequency analysis on all terms that were coded as *key terminology*. We discuss our procedures in detail in the following sections.

Bibliometric Analysis Procedures

Published articles relating to LX terms in education were searched to identify growth and trends. The database selected was Web of Science as it offers the ability to access all SSCI and other important indexed journals (Akcayir & Akcayir, 2018). The time span was limited to the period of 1999–2020. The language was selected as "English" and the document type was determined as "journal articles" for highest

Table 1 Bibliographic analysis of key terminology in the educational literature over 20 years

Term	Sum of publications, 1999–2020	Total times publications cited, 1999–2020
User-centered design	193	2426
User experience design	507	6795
Learner experience design	1495	20,840
Learning experience design	6724	78,096

quality. Four sets of keywords were used, with individual searches performed on each: (1) *user-centered design*, (2) *user experience design*, (3) *learner experience design*, and (4) *learning experience design.* Keywords were entered in the topic section using the advanced search function. In the first search, a high number of articles was returned for each search. Search results were then refined to the following categories: *education/educational research* and *education scientific disciplines* (access date: May 2020). Final sums of total publications and sums of times those publications were cited were recorded (Table 1).

Phase 1: Qualitative Procedures

In Phase 1, we performed a preliminary review of our data set and recorded our impressions in field notes. We began by systematically reviewing four chapters to orient our inquiry and identify characteristics such as definitions, operationalizations, and problem statements. Using an iterative process, preliminary categories emerged that first were recorded in a spreadsheet, then refined, and finally used to create a structure for systematically annotating all book chapters. Following this, all chapters were annotated using a structured process.

Phase 2: Qualitative Procedures

Phase 2 used the computer-aided qualitative data analysis software (CAQDAS) tool Dedoose (https://www.dedoose.com/). The initial open-coding scheme from Phase 1 was imported into Dedoose and used to code excerpts of book chapters. The lead researcher coded one book chapter and made refinements to the coding scheme while the assistant researcher observed. The assistant researcher then applied the coding process from the first stage to one chapter while the lead researcher observed, provided guidance, and answered questions. Both researchers then collaboratively coded one book chapter as a dyad, after which the assistant researcher coded another chapter independently. Finally, the lead and assistant researchers independently coded book chapters using the finalized coding scheme.

Coding Reliability

Mentoring and dyad coding approaches were employed to promote coding reliability as described above. We also performed inter-rater reliability calculations to contribute to the rigor of our coding results. Thirty-seven percent of the entire corpus of excerpts were coded by both the lead and assistant researcher and compared, yielding a Cohen's kappa estimate of 0.765. These results fall in the category of good agreement according to Landis and Koch (1977) or excellent agreement by Cicchetti (1994).

Phase 3: Qualitative Procedures

In Phase 3, we generated a precise list and frequency count of key terminology. We stripped all references from chapters to avoid inflation of the terms' frequency count and combined them into a single document. We then ran searches on all coded terms and established corresponding frequency counts. Results were reviewed and pruned, with coding categories that only described one or two terms being collapsed into existing categories or removed. Category descriptors were revised accordingly. Frequency counts also were updated as the refinement process unfolded.

Findings

RQ1: Bibliographic Analysis

In this section, growth and trends related to the terms *user-centered design*, *user experience design*, *learner experience design*, and *learning experience design* are presented (Table 1). Results from bibliometric analysis show that these terms began to gain prominence in the educational research literature starting between 2005 and 2008, with a substantial increase in publications using these terms starting in 2015. The term *learning experience design* is widely used in the literature (Fig. 1), with more publications and citations than any of the other terms that were reviewed. Prevalence of this term is increasing substantially, with over a 22% increase between 2018 and 2019. The second-most prevalent term from our analysis is *learner experience design*. This term also shows a steadily increasing trend in citations and publications, with a 17% increase in 2019 over the previous year. Although UCD is used widely in the field of human–computer interaction, its usage in educational research contexts is more limited. More loosely defined than UCD, the term *user experience design* sees broader uptake than UCD in education and educational research contexts.

Fig. 1 20-year Web of Science growth and trend data for the topic *learning experience design*

RQ2: Prevalence of Key Terms and Concepts

LX Attributes

The coding category *LX Attributes* represents the terms used by authors that contribute to the overarching gestalt of LX. These are terms that serve to shape and form the general concept of LX. Figure 2 presents terms we assigned to the LX attributes category and their corresponding frequencies in a descending order. Among all 11 terms in this category, two closely related terms *user experience* (31.3%) and *usability* (20.4%) have the highest frequencies. The third most-mentioned term in this category is *learning design* (12.6%). Two terms worth special notice are *learning experience* (8.3%) and *learner experience* (7.5%), which are sometimes used interchangeably. The remaining terms are used less frequently relative to those discussed above, collectively comprising less than 20% of term frequency in this category.

Disciplinary Contexts of LX

The coding category *Disciplinary Contexts of LX* represents the terms that authors used in their chapters for the various academic disciplines related to LX. These included disciplines that contributed to LX, disciplines within which LX was practiced, or how authors described LX itself. Figure 3 illustrates frequency of terms related to LX disciplinary contexts in descending order. The three terms used with highest frequency are *instructional design* (38.1%), *human–computer interaction* (24.8%), and *user experience design* (13.1%). The terms *learning experience design*

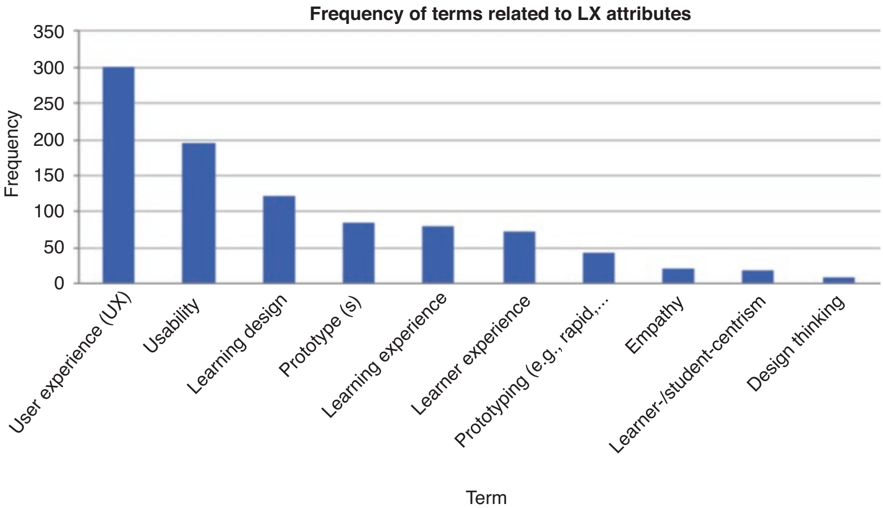


Fig. 2 Frequency of terms related to LX attributes

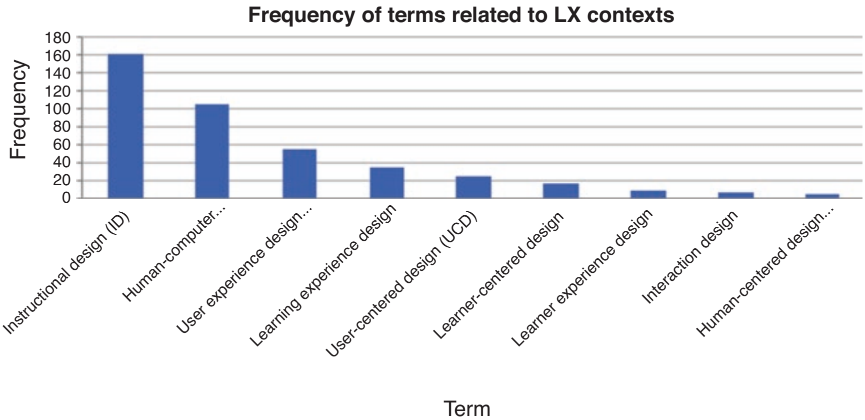


Fig. 3 Frequency of terms related to disciplinary contexts of LX

(8.3%) and *learner experience design* (2.4%) are evident in this category, with the term *learning experience design* being used more frequently. Another set of related terms in this category includes *user-centered design* (6.2%), *learner-centered design* (4%), and *human-centered design* (1.4%).

LX Research and Evaluation Methods

The coding category *LX Research and Evaluation Methods* represents the research and evaluation methods that authors used or discussed related to LX design practice. Figure 4 depicts the frequencies of terms categorized as LX research and evaluation methods. Twenty terms were assigned to this category. Of these, the top five most frequent terms are *personas* (16%), *analytics* (14.8%), *think-aloud* (13.7), *requirements* (9.9%), and *scenarios* (5.3%). The next five most frequent terms are *cognitive interview, focus group, contextual analysis, card sorting,* and *cognitive walk-throughs,* all of which have similar frequencies (3.8–4.6%) and, combined, account for 16.7% of the terms in this category. In aggregate, the remaining 10 terms' frequencies account for 19.4% of the total frequencies.

RQ3: Authors' Characterizations of LX Within Their Book Chapters

Research question two focused on authors' characterizations of LX within their book chapters. Analysis of authors' portrayals of LX suggests that it is (1) human-centric, (2) theoretically grounded, (3) informed by UX methods, and (4) socioculturally sensitive. These themes are discussed in the following sections.

Human-Centric Authors' descriptions and definitions of LX reveal that, much like UX, human experience is the central focus in the LX design process. However,

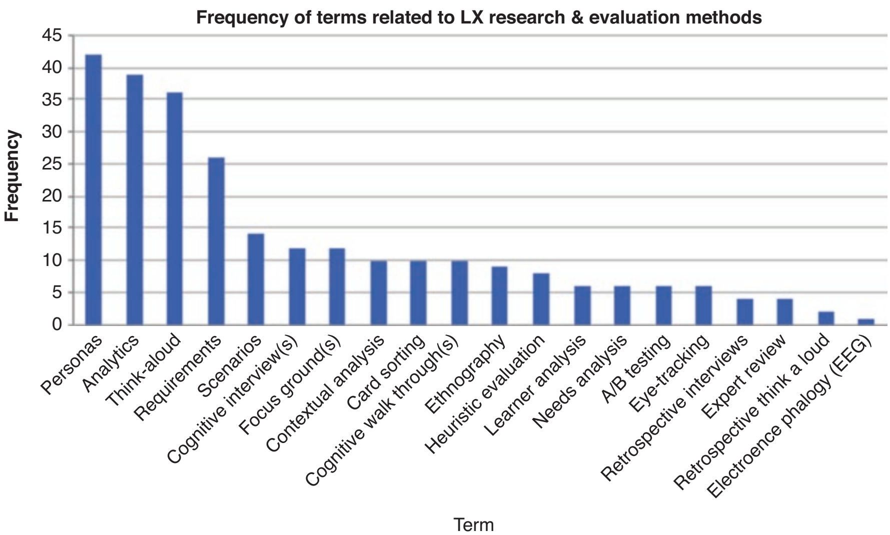


Fig. 4 Frequency of terms related to LX research and evaluation methods

in a LX design context, key differences are evident. Raza and colleagues state, "[T]he field has started exploring and adopting human-centered or user experience design methods" (2020, p. 2). While Raza uses the term *human,* terms such as *learner* and *instructor* were used with more prevalence. For example, Abbott emphasizes the learner: "[W]ithin LXD the learner's needs, experiences, desires, and emotions are crucial" (2020, p. 2). McCarthy et al. emphasize the teacher: "[T]eachers play an important role in the success of educational technology in the classroom, yet instructors are often ignored as both facilitators and end-users" (2020, p. 2). Many authors seem to conceive of *users* as being a general term and *learners* being a unique category of user, as illustrated by Jahnke and her colleagues: "The focus of UX is […] quite broad, with applicability to any technology in any context for any user. Learner experience design (LXD), however, has a narrower focus on improving the usability and LX of only one type of technology—learning technology—from the perspective of only one type of user—the learner" (2020, p. 1).

Theoretically Grounded Findings suggest the theories that guide LX design draw not only from the tradition of LDT, but also from outside disciplines such as HCI and UCD. For example, Kimmons (2020) discusses a theory that receives little attention outside of the visual arts—color theory. Importantly, he carefully connects color theory to learning theories of motivation and self-regulation: "Though the connection between color and learning may not be obvious at first, by influencing learner emotion, attitude, and interest, color can influence learner behaviors and attitudes, which in turn will influence their learning" (p. 5). Multidisciplinary theoretical perspectives seem necessary in LX design because "[D]esigners that approach the interface from only a learning theory perspective may encounter unforeseen obstacles due to user experience (UX) challenges" (Vann & Tawfik, 2020, p. 1). Across chapters, learning theory was consistently privileged over UX design. Bowen et al. (2020) explain, "[W]hile important to user experience (UX) and eventual product viability, [engagement, likability, and usability] should not be the sole focus of early testing. When developing tools intended to foster learning, it is paramount to explicitly define and test the learning theories on which those tools depend through deliberate learning experience (LX) design" (p. 3).

Informed by UX Methods LX design applies various UX design techniques and methods, such as participatory design, co-design, think-aloud, cognitive walkthrough, etc. Across all book chapters, authors described application of UX design methods in learning design contexts (for an overview, see Fig. 3). Of these, a method that was prominently discussed and applied was usability evaluation. However, conceptions of usability in learning design contexts deviated from more traditional views (e.g., International Organization for Standardization, 2019). Traditional usability perspectives focus on technological usability, which is principally concerned with ease-of-use, effectiveness, efficiency, and user satisfaction. While these aspects of usability were acknowledged as important, technological usability was conceived of as a prerequisite to or a conduit for learning. For example, Oprean and

Balakrishnan' (2020) framework for immersive learning underscores the importance of usability in promoting learner engagement.

Furthermore, the traditional foci of technological usability were seen as insufficient to inform learning design. As Quintana et al. (2020) argue, not all technological usability heuristics "[A]re directly relevant to an educational context […] they require an integrated approach, one that does not artificially separate usability and learning considerations" (p.3). Gregg et al. (2020) state, "[O]nline learning design requires more than the implementation of technical usability strategies and techniques" (p. 3). Given the inadequacy of technological usability alone to inform learning design, some authors advocated for the application of alternative forms of usability that specifically target learning design, such as pedagogical usability. According to Gregg et al. (2020), pedagogical usability "[r]efers to a category of usability strategies meant to operationalize learning-centered design principles in online learning environments" (p. 3). Extending this, Jahnke et al. (2020) argue that "usability evaluation of technology-enhanced learning should embrace a broader conceptualization of usability, considering (a) the social dimension, (b) the technological dimension, and (c) the pedagogical dimension" (p. 2), which they label sociotechnical–pedagogical usability. LX design is informed by UX design methods, but these methods tend to be adapted and extended for more appropriate and effective application in learning design contexts.

Socioculturally Sensitive While sociocultural theory is widely used to inform the design of learning and instruction in LDT (e.g., social constructivism, activity theory, distributed cognition), sociocultural sensitivity is not necessarily intrinsic to the methods and processes of instructional and learning design. In contrast, sociocultural sensitivity is central to LX. Gray (2020) asserts: "[r]ather than assuming that learners have similar characteristics and experiences, which often advantages certain types of students in powerful structural ways, [learning designers should] identify mechanisms whereby learning experiences can value unique and subjective learner qualities" (p. 10). This can be a challenge in learning design contexts in that, as Schmidt and colleagues (2020a, b) maintain, "Learning design teams tend to be small (2–3 members) or consist of an individual learning designer. Such teams can lack sufficient sociocultural perspective to design for a culturally sensitive and diverse learner experience" (p. 6). Key to developing sociocultural sensitivity is empathy. Chang and Kuwata (2020) state, "Human-centered LXD includes empathetic understanding of the learner, the sociocultural and technical context in which they are embedded, and the individual and socially mediated meaning-making process as driven by the learners" (p. 3). Development of such empathetic understanding is central to questions of equity. According to Raza and colleagues, such understanding can uncover students' perceptions and help designers in their "noticing and understanding situations in which learners' experiences differ based on their race and gender and in turn how these differences impact overall classroom culture" (p. 5). A variety of methods to promote sociocultural sensitivity were employed by authors. For example, development of personas was prominent, which "can provide context for designers to consider […] sociocultural perspectives more intentionally in their learning designs" (Schmidt et al., 2020a, p. 6). Other methods, such as participatory design and co-design, were employed by other authors, which is notable in that such approaches are "discussed infrequently in an LDT context, and […] almost completely lacking in explicit support through design processes and methods" (Gray, 2020, p. 9).

Discussion

This chapter presents current and evolving views of LX from the field of LDT. Taken together, our results provide a condensed snapshot of the conceptual boundaries that circumscribe the phenomenon of LX within the frame of the 15 book chapters we analyzed. Analysis of the key terminology and frequencies provides insight into the prevalence of terms across the book chapters. Our intent with presenting frequencies of terminology usage is not to suggest that certain terms are more or less important to LX, but instead to present in a categorical manner a lexicon of prominent nomenclature used by a segment of the LX discourse community. However, this lexical repository has limitations in that it was drawn from a narrow sample of only 15 book chapters and is therefore incomplete and biased. Hence, we are cautious in our interpretation lest we conflate the signifiers (the terminology) with what they signify.

Analysis of how authors characterized LX within their book chapters led to the emergence of four broad thematic categories. These thematic categories represent a confluence of traditions, methods, and processes that influence LX. LX design, as embodied in the analyzed book chapters, can be characterized as a human-centric, theoretically grounded, and socioculturally sensitive approach to learning design that is informed by UX methods. This human-centrism speaks to the influence of HCI on LX, but also highlights how LX explicitly delimits the personification of the human-as-user in the specific role of a user of learning technology (i.e., learner, teacher, administrator). The focus of LX on the learner also speaks to the influence of learner-centered design (LCD: Guzdial et al., 1995; Soloway et al., 1994), but extends the LCD frame of learner to include additional roles, including facilitation (i.e., instructor) and support (e.g., LMS administration). Further, although LX is informed by theories from outside traditions such as HCI and UCD, it predominantly foregrounds and privileges theories of learning over others. That is, theories of perception and motivation that might be used in UX with such goals as spurring market growth or increasing click-through rates would be applied in LX with goals such as promoting learning efficiency, effectiveness, and appeal (Honebein & Honebein, 2015; Reigeluth & Carr-Chellman, 2009). Similarly, LX positions considerations of learning as paramount to concerns of usability, likeability, engagement, etc. While UX methods and processes certainly can influence the efficiency and appeal of a learning technology, they cannot independently influence understanding, performance, and expertise.

The field of LDT is shifting toward a more human-centered approach, but the concept of LX and related studies is still emerging. Given the findings outlined above, it is clear that although LX is gaining traction in the field of learning design, further work is needed. While the lexical and conceptual foundations of outside fields such as HCI and UX are established, the same is not yet true of LX. There has been little work to date in the way of systematically defining LX in a broad sense, operationalizing LX in a way that could prove useful from the perspectives of research and practice, or aligning this concept with the theoretical foundations of our field. This chapter firstly presented data to support increasing prominence of terms associated with LX and LXD and secondly summarized and synthesized current and emerging views of LX in the field of LDT. Findings provide a preliminary characterization of LX, which may contribute to a better scoping of this concept. Further, the thematic categories that emerged in this study may serve as a signpost for future studies toward conceptually defining and operationalizing LX, as well as better aligning LX with the theoretical foundations of our field.

References

Abbott, D. (2020). Intentional learning design for educational games: A workflow supporting novices and experts. In *Learner and user experience research*. EdTech Books. Retrieved from https://edtechbooks.org/ux/11_intentional_learn

Abras, C., Maloney-krichmar, D., & Preece, J. (2004). User-centered design. In W. Bainbridge (Ed.), *Encyclopedia of human-computer interaction*. Sage.

Akçayır, G., & Akçayır, M. (2018). The flipped classroom: A review of its advantages and challenges. *Computers & Education, 126*, 334–345. https://doi.org/10/gfcsb9

Alonso, F., López, G., Manrique, D., & Viñes, J. M. (2008). Learning objects, learning objectives, and learning design. *Innovations in Education and Teaching International, 45*(4), 389–400. https://doi.org/10/fnsbb4

Bowen, K., Forssell, K., & Rosier, S. (2020). Theories of change in Learning Experience (LX) Design. In *Learner and user experience research*. EdTech Books. Retrieved from https://edtechbooks.org/ux/ucd_methods_for_lx

Chang, Y. K., & Kuwata, J. (2020). Learning experience design: Challenges for novice designers. In *Learner and user experience research*. EdTech Books. Retrieved from https://edtechbooks.org/ux/LXD_challenges

Cicchetti, D. V. (1994). Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology. *Psychological Assessment, 6*(4), 284. https://doi.org/10/ds968s

Conole, G. (2018). Learning design and open education. *International Journal of Open Educational Resources, 1*(1) https://doi.org/10/ggxvq4

Dalziel, J., et al. (2016). The Larnaca declaration on learning design. *Journal of Interactive Media in Education, 1*(7), 1–24. https://doi.org/10.5334/jime.407

Glaser, B. G., & Strauss, A. L. (2017). *Discovery of grounded theory: Strategies for qualitative research*. Taylor & Francis. https://books.google.com/books?id=GTMrDwAAQBAJ

Gray, C. M. (2020). Paradigms of knowledge production in human-computer interaction: Towards a framing for learner experience (LX) design. In *Learner and user experience research*. EdTech Books. Retrieved from https://edtechbooks.org/ux/paradigms_in_hci

Gregg, A., et al. (2020). Think-aloud observations to improve online course design: A case example and "How-to" guide. In *Learner and user experience research*. EdTech Books. Retrieved from https://edtechbooks.org/ux/15_think_aloud_obser

Guzdial, M., Kafai, Y. B., Carroll, J. M., Fischer, G., Schank, R., & Soloway, E. (1995). Learner-centered system design: HCI perspective for the future. *DIS '95*, 143–147. https://doi.org/10/dfwn4p

Honebein, P. C., & Honebein, C. H. (2015). Effectiveness, efficiency, and appeal: Pick any two? The influence of learning domains and learning outcomes on designer judgments of useful instructional methods. *Educational Technology Research and Development, 63*(6), 937–955. https://doi.org/10/gg5wx3

Hummel, H., Manderveld, J., Tattersall, C., & Koper, R. (2004). Educational modelling language and learning design: New opportunities for instructional reusability and personalized learning. *International Journal of Learning Technology, 1*(1), 111–126. https://doi.org/10/bs7cjs

International Organization for Standardization. (2019). *Human-centred design for interactive systems (ISO/DIS Standard No. 9241–210)*. https://www.iso.org/standard/77520.html

Jahnke, I., Schmidt, M., Pham, M., & Singh, K. (2020). Sociotechnical-pedagogical usability for designing and evaluating learner experience in technology-enhanced environments. In *Learner and user experience research*. EdTech Books. Retrieved from https://edtechbooks.org/ux/sociotechnical_pedagogical_usability

Kimmons, R. (2020). Color theory in experience design. In *Learner and user experience research*. EdTech Books. Retrieved from https://edtechbooks.org/ux/color_theory

Koper, R. (2005). An introduction to learning design. In R. Koper & C. Tattersall (Eds.), *Learning design: A handbook on modelling and delivering networked education and training* (pp. 3–20). Springer. https://doi.org/10.1007/3-540-27360-3_1

Koper, R., & Olivier, B. (2004). Representing the learning design of units of learning. *Educational Technology & Society, 7*(3), 97–111.

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics*, 159–174. https://doi.org/10/dtzfj3

Law, E. L.-C., Roto, V., Hassenzahl, M., Vermeeren, A. P. O. S., & Kort, J. (2009). Understanding, scoping and defining user experience: A survey approach. CHI '09, 719–728. https://doi.org/10/dxtf84

Lowenthal, P., & Wilson, B. G. (2010). Labels DO matter! A critique of AECT's redefinition of the field. *TechTrends, 54*(1), 38–46. https://doi.org/10/b839j7

Marcus, A. (2002). Dare we define user-interface design? *Interactions, 9*(5), 19–24. https://doi.org/10/br9cz4

McCarthy, K. S., Watanabe, M., & McNamara, D. S. (2020). The design implementation framework: Guiding principles for the redesign of a reading comprehension intelligent tutoring system. In *Learner and user experience research*. EdTech Books. Retrieved from https://edtechbooks.org/ux/9_the_design_impleme

Moore, J. L., Dickson-Deane, C., & Galyen, K. (2011). E-learning, online learning, and distance learning environments: Are they the same? *The Internet and Higher Education, 14*(2), 129–135. https://doi.org/10/fnvdjr

Norman, D. (2013). *The design of everyday things: Revised and expanded edition*. Basic books.

Norman, D. A., & Draper, S. W. (1986). *User centered system design: New perspectives on human-computer interaction*. L. Erlbaum Associates (CRC Press).

Oprean, D., & Balakrishnan, B. (2020). From engagement to user experience: A theoretical perspective towards immersive learning. In *Learner and user experience research*. EdTech Books. Retrived from https://edtechbooks.org/ux/10_from_engagement_t

Quintana, R. M., Haley, S. R., Magyar, N., & Tan, Y. (2020). Integrating learner and user experience design: A bidirectional approach. In *Learner and user experience research*. EdTech Books. Retrieved from https://edtechbooks.org/ux/integrating_lxd_and_uxd

Raza, A., Penuel, W. R., Jacobs, J., & Sumner, T. (2020). Supporting equity in schools: Using visual learning analytics to understand learners' classroom experiences. In *Learner and*

user experience research. EdTech Books. Retrieved from https://edtechbooks.org/ux/supporting_school_equity
Reigeluth, C. M., & Carr-Chellman, A. A. (2009). *Instructional-design theories and models, volume III: Building a common knowledge base* (Vol. 3). Routledge.
Schmidt, M., Earnshaw, Y., Tawfik, A. A., & Jahnke, I. (2020a). Methods of user centered design and evaluation for learning designers. In *Learner and user experience research*. EdTech Books. Retrieved from https://edtechbooks.org/ux/ucd_methods_for_lx
Schmidt, M., Tawfik, A., Jahnke, I., & Earnshaw, Y. (Eds.). (2020b). *Learner and user experience research: An introduction for the field of Learning Design & Technology*. EdTech Books. Retrieved from https://edtechbooks.org/ux
Soloway, E., Guzdial, M., & Hay, K. E. (1994). Learner-centered design: The challenge for HCI in the 21st century. *Interactions, 1*(2), 36–48. https://doi.org/10/d2kw7v
Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (2nd ed.). Sage.
Vann, S. W., & Tawfik, A. A. (2020). Flow theory and learning experience design in gamified learning environments. In *Learner and user experience research*. EdTech Books. Retrieved from https://edtechbooks.org/ux/flow_theory_and_lxd
Volery, T., & Lord, D. (2000). Critical success factors in online education. *International Journal of Educational Management, 14*(5), 216–223. https://doi.org/10/c7p4bt

Learning to Learn Lifelong Across Domains and Disciplines: Heutagogy and Movement Toward Triple-Loop Learning

Marisa Exter and Iryna Ashby

Introduction

The concept that one must *learn to learn* may seem unwarranted; after all, the human ability to learn evolved as a means for survival (Illeris, 2002). Bounded in time and scope, formal education cannot provide all the skills and knowledge students will need across their lifetime, a point that has long been made by lifelong learning scholars (Dellarocas, 2018; Knapper & Cropley, 2000; Lengrand, 1989; National Research Council [NRC], 2012; Rascoff & Johnson, 2016). Yet, the need for professionals to learn on the job is steadily increasing due to technological change, globalization, the need to tackle complex problems that require an interdisciplinary skillset, and the likelihood of pursuing multiple careers across a lifetime (Bear & Skorton, 2019; NRC, 2012). Students rarely enter higher education with all of the skills needed for independent "just-in-time learning," especially on unfamiliar topics. This chapter opens discussion on the question "how can higher education prepare lifelong learners capable of traversing domains to meet their professional and personal needs?"

We now accept the fact that learning is a lifelong process of keeping abreast of change. And the most pressing task is to teach people ***how to learn***—Peter Drucker

M. Exter (✉) · I. Ashby
Purdue University, West Lafayette, IN, USA
e-mail: mexter@purdue.edu

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*, Educational Communications and Technology: Issues and Innovations,
https://doi.org/10.1007/978-3-030-85078-4_10

Heutagogy: A Theory of Self-Determined Lifelong Learning

Depending on the type of problems we face on a regular basis, adjusting learning practices on a problem-by-problem basis is not a sufficient basis to develop lifelong learning skills. Heutagogy, the theory of self-determined lifelong learning, suggests that to be effective at determining what to learn and how to learn it we must be "capable learners." In other words, we should have the ability, competence, and self-efficacy to use nonlinear approaches to access information and develop skills to meet our own learning goals in novel and uncertain situations (Hase, 2009, 2011; Stumberg & Farmer, 2009). Thus, learning happens when we are ready for it to happen (both mentally and emotionally), not when it is planned (e.g., based on an instructor's syllabus in a traditional classroom environment).

Creating a Targeted Heutagogical Environment

There are six key design elements to creating a heutagogical environment rooted in self-determined learning, namely:

- Opportunities for exploration of diverse knowledge pathways.
- Creation of their own knowledge and skills by using diverse media and approaches.
- Collaboration that is key to social learning, making connection with existing and new knowledge and skills.
- Sharing the newly acquired knowledge and skills with peers and the world.
- Reflection that will help internalize new knowledge and skills and help grow intellectually. (Blaschke & Hase, 2016).

However, the question remains: How can faculty and instructional designers support learners, when they have not only diverse backgrounds, but may also differ in how they perceive their own abilities and potential for performance (i.e., self-efficacy and actual ability; Bandura, 1986)? This may be particularly true when individuals cross into new, unfamiliar territory.

Multiloop Learning: From Addressing Problems to Learning How to Learn

Single-Loop Learning

It is human nature to find the most satisfactory solution to a problem that aligns with our individual governing values (Reychav et al., 2016). While learning is involved—and necessary—to modify how we define a problem and the actions we take to

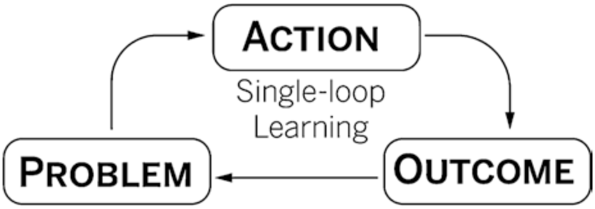


Fig. 1 Single-loop learning

resolve it, this largely occurs based on what Schön (1987) calls "reflection-in-practice," namely, reflecting on a just-in-time basis on the immediate problem and tentative solutions. We also tend to develop *decision shortcuts* (heuristics) Cialdini (2007) that we may unconsciously use. Naturally, sometimes the behavior needs to be adjusted, but such adjustments need not impact our governing values.

Thus, *single-loop learning* refers to learning that happens within the problem–action–outcome triangle, where learning new techniques does not violate preexisting schema, for example, learning how to fix a broken phone through trial and error, or with an existing learning strategy, such as finding resources or YouTube tutorials. Single-loop learning is not costly or risky to adopt, as it addresses an immediate problem without questioning our own values, actions, or even learning practices (Fig. 1).

Double-Loop Learning

Learning is impossible without change. "It requires us to explore new ideas, acquire new skills, develop new ways of understanding old experiences, and so on. No one is the same after learning something" (Brookfield, 2006, p. 214). *Double-loop learning* occurs when we realize that our decision shortcuts are flawed. Therefore, a problem cannot be addressed by simple modification to a strategy, but rather requires an adaptation of one's own governing beliefs and values (Argrys & Schon, 1974; Reychav et al., 2016). For example, we may not realize that our attitude toward people of a different gender, race, or orientation may be offensive as these attitudes are the result of deep subconscious biases. However, experience working with people with backgrounds other than our own can help us reevaluate our underlying values.

Thus, double-loop learning envisions questioning the status quo and analyzing and modifying the system, structure, or purpose. Naturally, double-loop learning is more costly in terms of effort and tradeoffs because we have to change the rules. This will likely require both reflection-in-practice, allowing us to adapt to the problem, and reflection-on-practice (Schön, 1987), often resulting in changes to our beliefs and values (or schemas) and development of understanding of how such modifications can impact our future practices (Fig. 2).

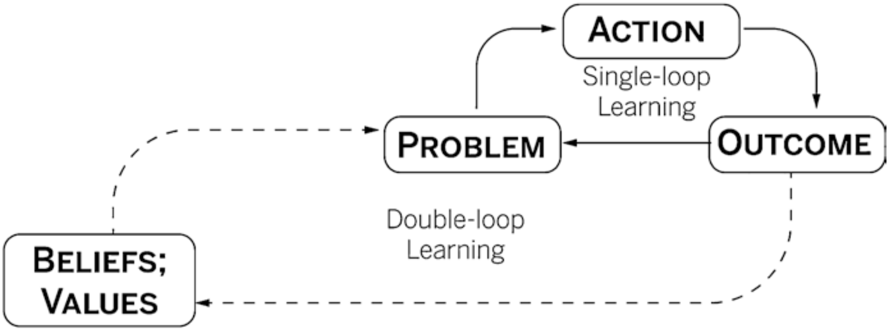


Fig. 2 Double-loop learning

Triple-Loop Learning

Although not discussed in heutagogy literature, the concept of *triple-loop learning* is not new, particularly in medical and business fields. We face a world that favors globalization, advancement of technology, and working on problems that do not have a single correct solution, or even a single optimal solution. Situations that arise are often unique and require a novel creative approach that goes beyond the need for a change in our own governing beliefs and values. Furthermore, addressing such problems often requires the use of skills and knowledge from multiple fields or domains. We propose that triple-loop learning—or *learning how to learn*—may be an important mechanism within heutagogy, to equip individuals with tools and strategies on how to acquire new knowledge and skills, evaluate information, and align new knowledge, skills, and information with what is already known (Kwon & Nicolaides, 2017; Tosey et al., 2012) (Fig. 3).

Interlacing of the Three Loops

Double- and triple-loop learning build upon basic problem-solving through single-loop learning. However, this does not mean that we always must achieve the triple-loop learning. Each of the loops has value; one is not "better" than the other. Rather, the level needed is based on the nature of the problem and the individual's existing beliefs, values, processes, and learning strategies.

Current heutagogical research and practice focus on single- and double-loop learning (e.g., Blaschke, 2012; Hase, 2009). This model seems adequate to most learning that takes place within a domain one is familiar with—or already *capable* in. Therefore, we pose the question: How capable are learners to pursue learning across domains, especially domains with which they have no prior familiarity? The following section examines some hypothetical scenarios in which self-determined learning goals are supported by single-, double-, and triple-loop learning.

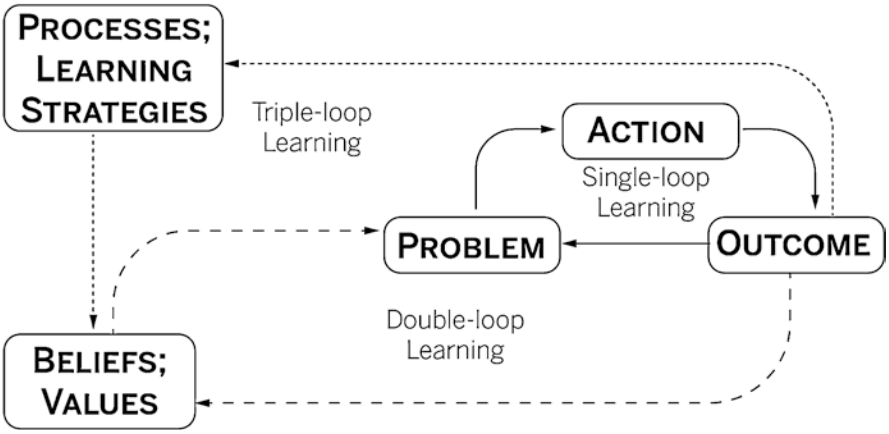


Fig. 3 Triple-loop learning

Illustrative Examples: Moving to a New Domain

Mary recently moved from her position as an instructional designer in a large corporation, with a well-defined structured role and functions, to a small nonprofit that requires each employee to take on multiple roles. This frequently involves switching hats in an attempt to address challenges that range from instructional design to data analysis, PR, and marketing. She has faced more new challenges in the last few weeks than she had in years.

- Mary is very experienced with using expensive photo editing software, which her new employer cannot afford. She has identified a free software application with similar features. She plays around with different features to determine what they do. When she tries to use a similar technique to one she used in a previous project, it does not come out quite as she expects. She finds a YouTube video that demonstrates how to create the effect she desires, then applies it to her project. She has used single-loop learning to address the problem.
- Mary has never done marketing work before. As she reads up on ways to promote awareness about a "brand," she balks. She likes educating people, but some of these techniques seem manipulative. Using only techniques she feels comfortable with does not bring in website visitors or donors. A co-worker who points out that appropriate marketing will help both the nonprofit and its intended recipients, and donors who want to donate to a cause they are passionate about. Now that Mary has shifted her beliefs about marketing, she is more open to learning about new marketing techniques and trying them out. She is using double-loop learning to address the organization's needs.
- Mary must conduct and publicize an evaluation of the nonprofit's efforts. She realizes that she will need to use inferential statistics to analyze existing data and make a case to funders. She has never used statistics before. She begins with her

usual strategy for learning new things: finding out what the director wants, locating precedents of similar reports online to guide her design, searching for recommendations of software tools for beginners, and just trying things out. However, after opening the statistical analysis software she realizes she does not even know where to start, and videos and blog posts focus on how but not why of the statistical analyses. Thus her "go-to" strategy of trial and error (single-loop learning) will not be sufficient. She further realizes that her usual just-in-time learning strategy will not work for this topic either as it is too large to grasp "here and there" on her own without any feedback or support from a coach or instructor. She feels she needs a more systematic approach, the why along with the how. An immediate solution that came to mind, namely enrolling in a university course, had too many tradeoffs like cost and time needed. Some workshops that she attended either did not go into the detail she needed or were above her current level of understanding. After further exploration online, she learned about Massive Open Online Courses (MOOCs) that are affordable and allow the flexibility she needs while still being similar to a college course in terms of the materials covered and the availability of feedback from instructors and peers. While not being sure what it will look like, she decided to try as she felt that with a bit of guidance and structure set by the course she can be successful in learning at her own pace. She used triple-loop learning to assess her needs, discover a learning approach that will work for her in a domain that is new to her, and evaluate her own capability to reach the goal she set out, while adapting to a novel challenge and modifying her learning skills and values.

Transfer of Learning Across Domains

Transfer of learning refers to the "effective and continuing application by learners—to their performance of jobs or other individual, organizational, or community responsibilities—of knowledge and skills gained in the learning activities" (Broad, 1997, p. 2). However, the transfer process depends on multiple circumstances as well as the preparedness of learners. Research has shown that near or *horizontal transfer*, or transfer to a similar situation, is relatively easy for learners once they have mastered the requisite skills and knowledge (Day & Goldstone, 2012). However, far or *vertical transfer*, in which the individual attempts to apply skills and knowledge to a new and unfamiliar situation, may cause challenges and require more scaffolding along the way as a learner may not be able to see immediate connection between what has been learnt and how to apply it in a seemingly completely different situation (Barnett & Ceci, 2002; Detterman, 1993; National Academies of Science, 2018).

Barriers to learning transfer, especially across domains, can be encountered before (e.g., lack of foundational knowledge), during (e.g., lack of motivation or confidence in being able to master a topic), or even after the learning situation (e.g., lack of support afterward) (Foley & Kaiser, 2013; Thomas, 2007). Illeris (2009) suggested that barriers to learning can be particularly obvious when needing to cross learning boundaries (e.g., transfer from one domain to another or from school to workplace), requiring scaffolding and supports for integration of knowledge and skills to encourage crossing the boundaries. Thus, an important role for educators is to assist beginner learners in learning to apply familiar concepts in new ill-structured situations (Grieff et al., 2014). This would require a learner to use deeper analogies to reflect in a more abstract way about what was learned and the situation and how it could be addressed in other situations, including those that may emerge in other disciplines (Foley & Kaiser, 2013; Perkins & Salomon, 1989). This can be achieved through reflection-on-practice, as suggested by Schön (1987). We posit that a heutagogical environment that fosters triple-loop learning can be an effective tool for this type of situation.

Becoming a Capable Learner: Self-Efficacy and Ability

Hager and Hodkinson (2009) suggested that learning transfer is a more linear view of learning and application. Instead, we should think about it as "becoming within a transitional process of boundary crossing" (p. 635). Indeed, a modern learner needs to be able to grow professionally and personally in a nonlinear manner to face the rapid changes across multiple boundaries that range from job change to school advancement to retirement. In other words, we should become *capable learners*.

As discussed earlier, the concept of being a capable learner is central to being a self-directed learner. Capable learners possess "justified confidence in [their] ability to take appropriate and effective action to formulate and solve problems in both familiar and unfamiliar and changing settings" (Cairns & Hase, 1996). They can direct their own learning and address and manage complex and nonlinear challenges across different domains (Hase & Kanyon, 2003; Phelps & Hase, 2002; Phelps et al., 2005). While heutagogy literature suggests ways for educators to promote the development of self-directed learners, it does not discuss the degree to which ability and self-efficacy may vary based on familiarity with a domain, or the ability to transfer skills and knowledge, beliefs and values, and learning processes acquired from experience to a new domain.

In Fig. 4, we propose four possible combinations of actual ability and self-efficacy, with potential thoughts and behaviors individuals in each category might have. These are currently based on our own "thought experiments" related to the examples below and our prior experience with individuals moving into new domains, rather than empirical study.

The following section describes a set of scenarios that form one such thought experiment.

Fig. 4 Comparing ability and self-efficacy

Illustrative Examples: Preparing Doctoral Student Researchers

Most students enter a doctoral program with one or more areas of deep expertise. Let us imagine that I am the adviser for four second-year doctoral students. While these individuals are likely highly capable learners in domains they have significant prior experience with, educational research is new to each of them. They are all currently enrolled in a course that requires them to write a brief research proposal, including a literature review, problem statement, and research questions. Each of them comes to me to discuss this project.

- Huian has a practitioner-oriented master's degree in instructional design and 5 years of professional experience. She is well versed in educational theory and regularly applies it in her work. However, when asked to write a literature review on a topic of her choice, she has no idea what topic she should select and quickly becomes overwhelmed about the quantity of literature available on any term she tentatively begins plugging in to Google Scholar. She comes to my office, and tells me that she worries she will be a failure in this degree program and has no idea how to even begin on her research project. I spend some time reassuring her that this is a common feeling for new doctoral students and that her faculty understand she is still learning, before we move on to discuss her project. She does not consider herself a capable learner any more—she has *low ability* and *low self-efficacy* as a learner in terms of educational research, although she is a capable individual in many other areas.
- Daksh has degrees in physics and engineering. Although he has not worked professionally, he has worked as teaching assistant in engineering classes and a

research assistant on several engineering projects. He knows little about educational research but already has many topics he would like to conduct research on. He quickly assembles a list of five papers he finds interesting. He writes several paragraphs about his prior personal experience and a few sentences about each of the five papers. He confidently turns this in for the research proposal assignment, and is shocked by the low score he receives from his instructor. He arrives at my office upset with his professor and looking for advice on how to talk to her about his low grade. Although Daksh has skills in the field of engineering research, he has relatively *low ability* but *high self-efficacy* in terms of educational research.

- Aref has two prior degrees in education but little professional experience. He has assisted me with an earlier study, including producing a literature review on one of the core concepts, participating in discussions about research questions, helped develop an instrument, and helped collect data. He appears to have a good grasp of the research process and has contributed meaningfully to the team. Aref has an idea for his research proposal and has already read a number of papers in this area. He has listed a dozen potential research questions and starts reading about possible research methods that might allow him to address each. He has a study design in mind, but he is worried that it won't be "big enough" and wants to ensure that he is doing the right thing. During our hour-long discussion, I give him advice but primarily listen to him and point out where he is on the right track, asking him what he believes his next steps should be. Aref has *high ability* for a student at his level, but *low self-efficacy*.
- Amelia has degrees in several fields, including English literature, psychology, and instructional design. She has worked as a research assistant in a psychology lab, but all of those studies were quantitative and utilized experimental designs. She frequently engages in just-in-time learning as well as seeking out resources to learn for fun. Before she even began our program, she took a MOOC on educational research methods. She has several ideas of general areas of research that she is interested in. She reads several articles in each area and discovers an article that describes an important gap in the literature. She then continues to search for additional literature in the area and comes up with several topics she would like to investigate. She writes a tentative list of research questions and asks to meet with me to discuss them. As we hone in on the question of most interest to her, it appears that a qualitative approach might be a good match for her topic. I give her a book on qualitative research methods that she says she will read and then come back to talk about further. She has both relatively *high ability* in tackling research in a field that has connections to one she is familiar with (psychology), as well as *high self-efficacy* related to her ability to learn what she needs to know to succeed in this project.

An adviser will and should have very different approaches to these four students. For example, Huian and Daksh may be very capable of determining what to learn and how to learn it to meet their goals in their own prior professional domains. However, their knowledge about their own learning process has not transferred over to this new domain. In addition, Daksh' beliefs about his own current level of ability, as well as the applicability of methods learned in other disciplines to educational research tasks, are not well founded. Both Huian and Daksh need to gain more experience in a *scaffolded environment* through engaging in educational research projects and learning from their experiences—single-loop learning—before they are ready to move on without significant support. They still need assistance in adjusting their own beliefs about themselves as learners and doers or researchers (double-loop learning) and *learning how to learn* to develop new processes and learning strategies that would allow them to succeed as educational researchers (i.e., triple-loop learning).

Aref has the ability to learn and structure his knowledge about research methods, identify and absorb new literature, and come up with potential research topics on his own. However, due to his low self-efficacy, he requires help in selecting what to learn first without getting overwhelmed with the body of knowledge available. Although he has had enough experience with the research process to come up with a problem, take action, and learn from the outcomes, and has some values and beliefs consistent with those in the field, his beliefs about himself may actually be hindering his ability to be a self-determined learner. Until he has the self-efficacy to proceed on his own, he should work closely with the adviser and instructor before setting learning goals and proceeding with his project. This might be done through talking through ideas, mapping them out, and discussion pros and cons of each, helping him to adjust his beliefs about what an "acceptable" research project might look like. In addition, the adviser may spend a portion of a meeting with Aref discussing his existing skills and knowledge and reassuring him that he is capable of succeeding in the research methods class. He requires support to develop beliefs and values (double-loop learning), which impact his ability to develop learning strategies related to educational research (triple-loop learning).

Amelia is already engaging in triple-loop learning. She understands the problem space of "creating a research proposal" well enough to set her own learning goals and proceed with actions in several areas (literature review, creating tentative research questions, investigating appropriate research methods). Her practice of purposeful reflection has been successful in enabling her to create relevance, tie in with previous experiences, and embark on new topics and directions. At this point, her adviser becomes a partner in planning her research initiatives and remains available as a just-in-time learning resource when she needs it by providing examples, books, etc. She truly engages in self-determined, triple-loop learning.

Recommendations for Educators

With heutagogy being grounded in several learner-centered theories, including social constructivism, self-regulated learning, self-determination theory, self-efficacy, and transformational learning (Blaschke, 2019; Moore, 2020), the approaches to help learners to gain lifelong learning skills along the single-, double-, and triple-loop should also be learner-centered. However, unlike pedagogical and andragogical approaches, where much control is still within the power of instructors, within heutagogy, instructors do not limit students in how or what they learn (Blaschke, 2019; Exter & Ashby, 2021). Rather, the instructor's role moves to that of a coach (Blaschke, 2019). Thus, the scaffolding strategies used need to align with learner agency and reflection/metacognition, while providing nonlinear learning pathways that may differ for each individual student (Blaschke, 2019).

Such strategies should include flexibly scaffolded environments, where students can explore precedents, engage in trial-and-error activities, and develop their own learning strategies while working on ill-structured real-life problems. Approaches aimed at the development of metacognition can vary from concept mapping of new ideas and concepts to purposeful reflection. Finally, the use of a cognitive apprenticeship model can help create a scaffolded, yet flexible, environment to help graduate students develop skills with the support of an advisor or instructor (see Exter & Ashby, 2019).

References

Argyris, C., & Schon, D. A. (1974). *Theory in practice: Increasing professional effectiveness*. Jossey-Bass.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Prentice-Hall.

Barnett, S., & Ceci, S. (2002). When and where do we apply what we learn? A taxonomy for far transfer. *Psychological Bulletin, 128*(4), 612–637.

Bear, A., & Skorton, D. (2019). The world needs students with interdisciplinary education. *Issues in Science and Technology, 25*(2), 60–62. Retrieved from https://issues.org/the-world-needs-students-with-interdisciplinary-education/

Blaschke, L. (2012). Heutagogy and lifelong learning: A review of heutagogical practice and self-determined learning. *The International Review of Research in Open and Distributed Learning, 13*(1), 56–71. Retrieved from http://www.irrodl.org/index.php/irrodl/article/view/1076/2087

Blaschke, L. M. (2019). The pedagogy–andragogy–heutagogy continuum and technology-supported personal learning environments. In I. Jung (Ed.), *Open and distance education theory revisited: a implications for the digital era* (pp. 75–84). Springer. https://doi.org/10.1007/978-981-13-7740-2_9

Blaschke, L. M., & Hase, S. (2016). Heutagogy: A holistic framework for creating twenty-first-century self-determined learners. In The future of ubiquitous learning (pp. 25–40). Springer, Berlin, Heidelberg.

Broad, M. L. (1997). Transfer concepts and research overview. In M. L. Broad (Ed.), *Transferring learning to the workplace* (pp. 1–18). American Society for Training and Development.

Brookfield, S. (2006). *The skillful teacher: On technique, trust, and responsiveness in the classroom*. Jossey-Bass.

Cairns, L. G., & Hase, S. (1996) *Capability and re-engineering in educational change*. Paper presented at the Second ACEID—UNESCO International Conference, Re-engineering for Change: Educational Innovation for Development, Bangkok, August.

Cialdini, R. (2007). *Influence: The psychology of persuasion*. Harper Collins.

Day, S., & Goldstone, R. (2012). The import of knowledge export: Connecting findings and theories of transfer of learning. *Educational Psychologist, 47*(3), 153–176. https://doi.org/10.1080/00461520.2012.696438

Dellaroas, C. (2018). *Higher education in a world where students never graduate.* Retrieved on May 1, 2020 from https://www.insidehighered.com/digital-learning/views/2018/08/01/role-university-world-where-students-never-graduate-opinion

Detterman, D. K. (1993). The case for prosecution: Transfer as an epiphenomenona. In D. K. Detterman & R. J. Sternberg (Eds.), *Transfer on trial: Intelligence, cognition and instruction* (pp. 1–23). Ablex.

Exter, M., & Ashby, I. (2019). Using cognitive apprenticeship to enculturate new students into a qualitative research. *The Qualitative Report, 24*(4), 873–886.

Exter, M., & Ashby, I. (2021). Lifelong Learning of Instructional Design and Educational Technology Professionals: a HeutagogicalApproach. *TechTrends*. https://doi.org/10.1007/s11528-021-00657-x

Foley, J. M., & Kaiser, L. M. (2013). Learning transfer and its intentionality in adult and continuing education. New Directions for Adult and Continuing Education, 2013(137), 5–15.

Greiff, S., et al. (2014). Domain-general problem-solving skills and education in the 21st century. *Educational Research Review, 13*, 74–83. https://doi.org/10.1016/J.EDUREV.2014.10.002

Hager, P., & Hodkinson, P. (2009). Moving beyond the metaphor of transfer of learning. *British educational research journal, 35*(4), 619–638.

Hase, S. (2009). Heutagogy and e-learning in the workplace: Some challenges and opportunities. *Impact: Journal of Applied Research in Workplace E-Learning, 1*(1), 43–52. https://doi.org/10.5043/impact.13

Hase, S. (2011). Learner defined curriculum: Heutagogy and action learning in vocational training. Southern Institute of Technology Journal of Applied Research, 1–10.

Hase, S., & Kenyon, C. (2003). Heutagogy and developing capable people and capable workplaces: Strategies for dealing with complexity. In *Proceedings of The Changing Face of Work and Learning conference*. 25–27 September, University of Alberta, Alberta, Canada.

Illeris, K. (2002). *Three dimensions of learning*. Roskilde University Press/NIAC.

Illeris, K. (2009). Transfer of learning in the learning society: How can the barriers between different learning spaces be surmounted and how can the gap between learning inside and outside schools be bridged? *International Journal of Lifelong Education, 28*(2), 137–148. https://doi.org/10.1080/02601370902756986

Knapper, C., & Cropley, A. (2000). *Lifelong learning in higher education*. Stylus Publishing Inc.

Kwon, C., & Nicolaides, A. (2017). Managing diversity through triple-loop: A call for paradigm shift. *Human Resource Development Review, 16*(1), 85–99.

Lengrand, P. (1989). *Lifelong education: Growth of the concept lifelong education for adults: An international handbook*. Pergamon.

Moore, R. (2020). Developing lifelong learning with heutagogy: Contexts, critiques, and challenges. *Distance Education, 41*(3), 381–401. https://doi.org/10.1080/01587919.2020.1766949

National Academies of Sciences, Engineering, and Medicine. (2018). *How people learn II: Learners, contexts, and cultures*. The National Academies Press. https://doi.org/10.17226/24783

National Research Council. (2012). *Education for life and work: Developing transferable knowledge and skills in the 21st century*. The National Academies Press. https://doi.org/10.17226/13398

Perkins, D. N., & Salomon, G. (1989). Rocky roads to transfer: Rethinking mechanisms of a neglected phenomenon. *Educational Psychologist, 24*(2), 113–142.

Phelps, R., & Hase, S. (2002). Complexity and action research: Exploring the theoretical and methodological connections. *Educational Action Research, 10*(3), 507–524.

Phelps, R., Hase, S. & Ellis, A. (2005). Competency, capability, complexity and computers:exploring a new model for conceptualising end-user computer education. *British Journalof Educational Technology, 36*(1), 67–85. https://doi.org/10.1111/j.1467-8535.2005.00439.x

Rascoff, M., & Johnson, E. (2016). *Reimagining college as a lifelong learning experience.* Retrieved on May 3, 2020 from https://www.chronicle.com/article/Reimagining-College-as-a/237588

Reychav, I., Kumi, R., Sabherwal, R., & Azuri, J. (2016). Using tablets in medical consultations: Single- loop and double-loop learning processes. *Computers in Human Behavior, 61*, 415–426.

Schön, D. (1987). *Educating the reflective practitioner* (1st ed.). Wiley.
Stumberg, J. P., & Farmer, L. (2009). Educating capable doctors—A portfolio approach. Linking learning and assessment. *Medical teacher, 31*(3), e85–e89.
Tosey, P., Visser, M., & Saunders, M. (2012). The origins and conceptualizations of 'triple-loop' learning: A critical review. *Management Learning, 43*(3), 291–307.
Thomas, E. (2007). Thoughtful planning fosters learning transfer. *Adult Learning, 18*(3-4), 4–8.

Social Media for Connected Learning and Engagement in Online Education

Angelica Pazurek

Introduction

Learner engagement has long been reported in the literature to be critical for meaningful experiences and the retention of learners in online courses in higher education (Dunn & Kennedy, 2019; Tight, 2019). It is imperative that online instructors and learning designers gain a deeper understanding of how learners experience engagement online in order to help support it and design for it. Thus, the integration of novel strategies to foster engagement in online courses must be explored, and this includes research about the potential of social media for learning as it grows in popularity and utility (Dragseth, 2019).

Global market research suggests that social media use remains one of the most popular online activities around the world, with worldwide adoption reportedly estimated at 4.2 billion users (DataReportal, 2021), representing approximately 54% of the world population. In the United States, traditional college-age students are using social media now more than ever. According to the Pew Research Center (2019), approximately 70% of American adults use at least one social media platform for interpersonal connections, access to news content, sharing information, and entertainment, with the highest use among young adults in the 18–29-year-old age range.

Dabbagh and Kitsantas (2012) broadly define social media as "a variety of networked tools or technologies that emphasize the social aspects of the Internet as a channel for communication, collaboration, and creative expression" (p. 3). Social networking platforms are connected technologies that are transforming the way we live, learn, play, and work. As these technologies continue to proliferate, many college students are actively involved in participatory cultures (Jenkins, 2009) that

A. Pazurek (✉)
University of Minnesota, Minneapolis, MN, USA
e-mail: apazurek@umn.edu

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*,
Educational Communications and Technology: Issues and Innovations,
https://doi.org/10.1007/978-3-030-85078-4_11

have implications for education and learning. This includes the online communities students engage in, the creative ways they shape and share digital media, and the ways they collaborate with others online to complete a task or crowdsource knowledge. Active engagement in today's world and workplaces requires a critical understanding of the educational implications of social media.

One way this insight can be gained is through the authentic integration of these tools in online college courses. Concerns have been raised about social media's negative effects on education, and it is often dismissed as a distraction to learning that lures students off-task (Neiterman & Zaza, 2019). However, research also suggests that social networking platforms are transforming possibilities for learning both inside and outside of formal schooling through the ability to access resources, communicate with others, create digital artifacts, and participate in personal learning networks online (Kumar & Nanda, 2020). Thus, educators are called to consider how social media can be reframed as a valuable academic resource, and more research is necessary to understand how it can support more meaningful forms of learning and engaging online learning experiences.

This phenomenological study investigated the lived experience of engagement when using social media as a learning resource during an online college course. The purpose of this research is to help online instructors and designers in higher education better understand how learners experience engagement when learning online with social media. Connected learning served as a conceptual framework to critically analyze meaningful connections within the learning experience and to address the following research questions: What is it like to experience engagement when using social media for learning in an online college course? And how do various elements of learning with social media influence learners' feelings of engagement?

Review of the Literature

Huang et al. (2019) highlighted the critical importance of the learner experience as a key factor in both teaching and design efforts by asserting that "effective learner experiences result in engaging and memorable educational experiences" overall (p. 91). Prior research also argued that college educators must intentionally design for the learner experience in online college courses and imbue a design framework with pedagogical sensitivity meant to support an experience that is both personally meaningful and engaging (Pazurek, 2014). This research extends and builds upon that work.

To maximize learner engagement, more open conceptions of learning must be considered. The ubiquity of technology is now shaping learning as mobile, open, and networked. Learning is not just confined to classrooms or formal education programs. Rather, it is an everyday occurrence that happens lifelong and life wide, formally and informally, both inside and outside of school. So it must be framed as much more fluid than traditional, formal conceptions of education often imply. The connected learning framework has been proposed in seminal research by Ito et al.

(2013) as a learning, design, and technology model based on such open, inclusive, and fluid conceptions of learning. It focuses on illuminating diverse learning pathways that move across formal and informal settings to transform the very nature of learning, including what it means, how it is defined, how it occurs, and where it takes place.

The connected learning framework is informed by sociocultural learning theory, which assumes learning is embedded in and informed by social and cultural contexts. According to Garcia et al. (2014), it "depicts core values at the foundation of engagement [including] equity, social connection, and participation" (p. 9). Connected learning environments weave together learning activities that are interest-driven, peer-supported, and academically oriented (Ito et al., 2013). Thus, connected learning experiences prioritize and leverage learners' personal interests and peer networks as a means to open up new opportunities for learning.

Connected learning may be uniquely accomplished through social engagement and creative expression with technology. Ito et al. (2013) contended that online technologies and new media "amplify" opportunities for connected learning by fostering engagement and self-expression, increasing accessibility to information and relationships that advance learning, and expanding social supports (p. 12). Connected learning experiences are intentionally designed to be production-centered and openly networked with a shared purpose among learners. Thus, this framework can serve as an ideal conceptual and practical lens to explore meaningful connections when using social media to advance educational opportunities in higher education according to values of openness and inclusion. When implemented in online college courses, this can potentially result in more equitable, participatory, creative, and engaging learning experiences.

Phenomenological Methods

This study was conducted using Vagle's (2018) post-intentional phenomenological research design. A post-intentional approach to phenomenological methodology places a pragmatic emphasis on contemporary elements of hermeneutic phenomenology by identifying tentative manifestations of the phenomenon under investigation and its meanings. Hermeneutic phenomenology qualitatively explores how a phenomenon is actually lived and experienced, and this can lead to rich pedagogical insight and sensitivity (van Manen, 2016) that can help support student-centered teaching and design.

A post-intentional approach draws from post-structural philosophy to identify the phenomenon in its multiple, partial, and varied contexts (Vagle, 2018). As such, it assumes that phenomena are not static as they are lived and experienced; rather, they are dynamic and continuously change over time according to influential factors. For example, the feeling or experience of engagement is not static and unchanging; learners may feel engaged one moment and disinterested or bored the next, until something catches their interest, and they are once again engaged. In this way, a phenomenon like learner engagement online is challenging to study as manifestations of it are fleeting and tentative.

Post-intentional phenomenology helps capture and reveal such tentative manifestations because it acknowledges the challenge that phenomena are always, already undergoing constant change. While focusing on the phenomenon as the unit of analysis, phenomenology seeks to understand experience based on the theory of intentionality as it was originally proposed by Edmund Husserl, which refers to the meaningful connections within the experience (van Manen, 2016). However, the post-structural framing of intentionality in post-intentional phenomenological research assumes that these meaningful connections or relationships may shift and change over time because of their dynamic nature. Meaningful connections can refer to influential relationships among personal, social, or cultural factors affecting the learning experience. When analyzed through the lens of connected learning, intentionality in phenomenological research can also explore relationships among essential principles of this framework such as personal interests, peer support, novel opportunities, and creative production.

Study Context and Participants

The context for this study was a completely online undergraduate course titled Social Media and Connected Learning at a midwestern public university. Participants selected for this research were undergraduate students enrolled in this course. This included a total of 20 college students from two different semesters in one academic year, representing 13 females and 7 males between the ages of 19–28.

In addition to comprising the conceptual framework for the study, principles of connected learning were also overarching constructs framing the course content. In addition to gaining an understanding of participatory practices in spaces of connected learning, students also develop skill in using a variety of social media applications for creative expression, forming connections, and interacting as global digital citizens. The aim of this course is to help students become critical consumers and ethical producers of new media in various forms for learning purposes. Broadly, the key intention of this course is to elevate the use of social media from merely an entertainment source to a productive space for learning. So while this course is an academic pursuit of social media practices that include their use in both formal education as well as informal learning contexts, the research inquiry conducted in this context was an investigation of students' experiences while they were learning about these very issues and their feelings of engagement throughout the process.

Social media and digital publishing platforms such as Twitter, Medium, and Adobe Spark were used extensively during this course for class assignments and as spaces to promote interaction among class peers and with broader public networks. Participants' authentic use of these tools for social interaction in required, optional, or self-pursued class activities provided references to draw upon to understand their learning experiences and the ways in which these experiences either generated or detracted from feelings of engagement when using social media for learning online.

Data Collection

Vagle's (2018) process for collecting, analyzing, and interpreting phenomenological data provided a flexible but systematic approach while lending to the methodological rigor of the research. He contends that data collection should be an open process that can include any material deemed valuable in gaining access to the phenomenon under investigation. In this study, data collection included (a) individual interviews, (b) written lived experience descriptions, (c) a variety of digital artifacts created by students as part of class activities and projects, and (d) unsolicited emails sent by students directly to the instructor.

Initial interviews were conducted at various points while the course was in progress with each participant about their experiences while using social media for learning. Each participant also wrote several blog posts using Medium throughout the class, which served as written lived experience descriptions (van Manen, 2016) of what it was like to use social media for learning. They were also encouraged to write about elements they felt contributed to and detracted from their feelings of engagement while learning with social media in the online course. Other digital artifacts created by participants during the course and collected as data included tweets and replies; reflection blog entries, annotations, and comments; and creative artifacts like Adobe Spark web pages students had designed for class projects. Subsequent interviews were also conducted with each participant at the end of the course for member checking and elaboration.

Data Analysis

Engagement is revealed in a phenomenological study like this in the ways that it manifests in participants' learning experiences. Access to such manifestations is gained through the ways students are able to describe and reveal their experiences in rich and vivid ways that best illuminate the phenomenon under investigation. Engagement has been defined numerous ways in the literature; however, this study did not seek to define learner engagement. Rather, in keeping with the aims of phenomenological inquiry, this study pursued the meaningful connections inherent in online learners' experience of engagement when using social media for learning according to dimensions of the connected learning framework that were intentionally designed into the course that served as the context for this study. Data analysis sought dimensions of learning with social media that illuminated diverse ways in which engagement was manifested in terms of meaningful connections between dimensions of learning such as the influence of personal interests, peers, opportunities, as well as active participation in social interaction or creative endeavors when using social media.

Data was inductively analyzed according to Vagle's (2018) "whole-parts-whole" (p. 108) phenomenological analysis process. This iterative process included a holistic reading of the entire corpus of data, followed by several rounds of line-by-line readings while keeping a reflexivity journal with research notes, analytic interpretations, and compelling highlights from participant narratives or data artifacts. This was followed by several subsequent holistic readings across phenomenological material once again to seek and identify tentative manifestations of the phenomenon of engagement. This was challenging because participants' experiences and feelings of engagement often changed and shifted throughout the online course. Ultimately, these tentative manifestations were analyzed for patterns of meaning or salient themes. Themes were then refined throughout the analysis process.

Research Findings

Data analysis revealed tentative manifestations of the phenomenon of engagement as it was experienced online in different ways. Findings offer a sense of what it may be like for undergraduate students to experience engagement online when learning with social media from the learner's perspective. Results of this study also offer some insights into factors that may affect feelings of engagement in both positive and negative ways.

According to participant narratives drawn from interviews, reflection blog postings, emails, and other digital artifacts generated for class activities, engagement in social media feels focused, purposeful, and self-driven. It often develops naturally as students gain more comfort and familiarity with this method of learning and the use of different platforms. When using social media in an online course, it doesn't usually feel engaging right away and can actually feel stressful and unfamiliar. Participants often commented that they initially experienced some tension and discomfort with this new approach to learning online. Early in their experience they remarked that they preferred to use learning strategies like discussion forums in a traditional Learning Management System because this medium was often used in their previous online courses. However, for every participant, engagement evolved over time as more familiarity was established and comfort was developed. It continued to heighten as the course went along and as they discovered new ways of communicating and participating with it through interactions with the instructor and classmates.

Participants also indicated that engagement was a very personal feeling. Although social engagement was a learning goal or design feature of the course, students did not describe it as being a social feeling or attribute, even when using social media. Students most often discussed their own personal connections with course topics and with others through Twitter activities, reading or responding to classmates' blog postings on Medium, or sharing the Adobe Spark artifacts they created. But they were reticent to frame this as social engagement because it still felt very personal and individual to them.

Findings also suggest that engagement when learning with social media may also feel creative, unique, and artistic. This was also framed by participants as a personal rather than a social attribute, especially in class activities when social media was used for more than just relaying or sharing information. When students were encouraged to create something new like a web page or infographic using Adobe Spark based on a course topic, this was perceived to be much more engaging and meaningful. Several participants described this as feeling more fun, freeing, less constrained, and even inspirational as they wanted to do more and be even more involved in the process of creative production. Participants also indicated that formal requirements for class activities, including rubrics or exact specifications for a task or project, often felt limiting, forced, and even intimidating, which diminished feelings of engagement.

For most participants, more freedom and more choices during class activities felt more engaging because online technologies and social media present a lot of information and resources to draw from. For example, for some class projects students were able to pursue a topic related to their own interests and create a digital artifact of their choice (e.g., a web page, video, or blog post) to demonstrate their understanding and skills. However, some participants also indicated that more freedom to make choices about what they wanted to do or how they could do it sometimes also felt very overwhelming and intimidating. These were described as elements that detracted from their feelings of engagement. It was also disengaging when there was too much information or too many things to read and respond to. In these situations, participants often weren't sure how to wade through and make sense of an overabundance of resources. They stated that instructor guidance and help in these instances was necessary and beneficial.

When discussing dimensions of the experience in terms of particular learning activities that they felt were most meaningful, students often discussed or wrote about how what they were learning in this class was being used in other areas of their life outside of school. For example, some students were using Twitter beyond class activities to try to establish a professional network by following and tweeting with more established professionals in the career field for which they were preparing. Other students described the ways they were using the digital skills they gained with Adobe Spark or podcasting tools in their jobs and internships. One student even explained that he was a pottery artist and was now using a variety of new media he learned from this class to develop a social media presence using YouTube and Instagram to create an online market for sharing and selling his art. These manifestations of engagement support assertions in other connected learning research that this method of learning with new media has the potential to blur the imagined lines between formal and informal learning, and that such theoretical lines often don't exist in the reality of the way learning is actually experienced.

In summary, findings indicate that social media has the potential to positively impact learner engagement when integrated with connected learning principles and supported with pedagogical guidance. For example, instructor modeling and examples created by the instructor and shared with students were especially helpful in demonstrating how particular social media tools can be used for communication, collaboration, and creativity. Nearly all participants described the important influence of these supportive design elements, especially early in the course.

Implications

The findings of this study suggest that the use of social media for learning in online college courses has the potential to be more engaging and connections are more meaningful when social media use is elevated to be a source for interaction among classmates, leveraging personal interests, sharing new ideas, and creative expression within and beyond the class. Participants revealed dimensions of their experiences that offer visibility into the complexity of online learning design, as well as the pedagogical insight and sensitivity that online teaching demands. More research in this area is necessary, but these findings support that intentionally integrating social media using connected learning principles may also be valuable in establishing coherence between where and how people interact, communicate, and learn. This could also result in increasing educational opportunity when educators and learners resist boundaries between in-school and out-of-school learning and open up possibilities.

These research findings serve as examples for how social media can leverage some connected learning principles to better support engagement in online courses. Connected learning can be effectively applied to any age group (Ito et al., 2013); however, most of the published research thus far has focused on educational contexts for youth and adolescents. This research addresses a need for more studies on implications for learners at more advanced ages and levels of education.

In conclusion, the implications of this research can both inform and challenge new ways of thinking about the nature of learning, online pedagogy and design, as well as innovative approaches to socially and culturally situated learning in online environments in higher education using social media platforms. These findings are not intended to be a prescription for learner engagement with social media or a how-to guide. Phenomenological research is also not generalizable, nor is it meant to be. Rather, these findings are meant to offer insight for instructors and designers to rethink, iterate, and reassess how they can make educational experiences more accessible, engaging, and relevant to the contemporary needs and interests of learners. The study also supports a call for a re-envisioning of what online course designs can include beyond traditional conventions and to illustrate how meaningful it may be to open up possibilities for the potential that social media holds for learning, both during a formal course and beyond.

References

Dabbagh, N., & Kitsantas, A. (2012). Personal learning environments, social media, and self-regulated learning: A natural formula for connecting formal and informal learning. *Internet and Higher Education, 15*(1), 3–8.

DataReportal. (2021). *Digital 2021: Global overview report*. https://datareportal.com/reports/digital-2021-global-overview-report

Dragseth, M. R. (2019). Building student engagement through social media. *Journal of Political Science Education, 16*(2), 243–256. https://doi.org/10.1080/15512169.2018.1550421

Dunn, T. J., & Kennedy, M. (2019). Technology enhanced learning in higher education: Motivations, engagement, and academic achievement. *Computers & Education, 137*, 104–113.

Garcia, A., Cantrill, C., Filipiak, D., Hunt, B., Lee, C., Mirra, N., O'Donnell-Allen, C., & Peppler, K. (2014). *Teaching in the connected learning classroom*. Digital Media and Learning Research Hub.

Huang, R., Spector, J. M., & Yang, J. (2019). Learner experiences with educational technology. In *Educational technology: A primer for the 21st century* (pp. 91–105). Springer.

Ito, M., Gutiérrez, K., Livingstone, S., Penuel, B., Rhodes, J., Salen, K., Schor, J., Sefton-Green, J., & Watkins, S. C. (2013). *Connected learning: An agenda for research and design*. Digital Media and Learning Research Hub.

Jenkins, H. (2009). *Confronting the challenges of participatory culture: Media education for the 21st century*. MIT Press.

Kumar, V., & Nanda, P. (2020). Social media as a tool in higher education: A pedagogical perspective. In L. A. Tomei & D. D. Carbonara (Eds.), *Handbook of research on diverse teaching strategies for the technology-rich classroom* (pp. 239–253). IGI Global. https://doi.org/10.4018/978-1-7998-0238-9

Neiterman, E., & Zaza, C. (2019). A mixed blessing? Students' and instructors' perspectives about off-task technology use in the academic classroom. *The Canadian Journal for the Scholarship of Teaching and Learning, 10*(1). https://doi.org/10.5206/cjsotl-rcacea.2019.1.8002

Pazurek, A. (2014). *A phenomenological investigation of online learners' lived experiences of engagement* (Accession Order No. AAT 3667747) [Doctoral dissertation, University of Minnesota]. ProQuest Dissertations Publishing.

Pew Research Center. (2019). *Social Media Fact Sheet*. https://www.pewresearch.org/internet/fact-sheet/social-media/#find-out-more

Tight, M. (2019). Student retention and engagement in higher education. *Journal of Further and Higher Education, 44*(5), 689–704.

Vagle, M. (2018). *Crafting phenomenological research* (2nd ed.). Routledge.

van Manen, M. (2016). *Researching lived experience* (2nd ed.). Routledge.

Design of Learning Experience to Engage Learning in Instructional Design and Technology Graduate-Level Classes: Digital Game-Based Learning (DGBL) Cases

Suzanne Y. Ensmann, Penni Eggers, Brittany Bing, and Linlin Li

This project-based learning (PBL) activity stemmed from the professor of graduate-level courses having witnessed impoverishment in Haiti. Witnessing a need, however, without a systematic collaborative process to create a comprehensive sustainable infrastructure is not enough to make an impact. Rather, change calls for a systematic process beginning with education (Rogers, 2010). To improve usefulness and sustainability, service-learning projects need community involvement. A rapport with the communities who are familiar with the needs of the target audience places the sense of ownership in the hands of those who can drive the direction for improvement, potentially enhancing design decisions to improve effectiveness. For example, while traveling in Haiti, the professor observed that prior relief efforts from outside countries provided a valley of colorful homes for those whose homes were destroyed in the natural disasters, but a glance into the mountains displayed barren hills with no foliage. Without transportation to work, food, water, or relief from the heat, not one home was used. Having formed harmonious connections and working with efforts already in place, the professor selected CARHA (Christian Action and Relief for Haiti) as the nonprofit organization committed to the goal of education. They agreed to foster the symbiotic relationship by communicating the needs of their children and using the instruction designed and created by the students enrolled in the private southeastern university in the USA. This chapter will focus on the design of the learning experience of graduate-level students who designed instructional games for the Haitian children. CARHA requested beginner English instruction for their children at the orphanage who ranged in age from 7 to 17 and had limited exposure, if any, to English.

S. Y. Ensmann (✉) · P. Eggers · B. Bing · L. Li
The University of Tampa, Tampa, FL, USA
e-mail: sensmann@ut.edu

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*,
Educational Communications and Technology: Issues and Innovations,
https://doi.org/10.1007/978-3-030-85078-4_12

The real-world project was incorporated into The Introduction to Instructional Games and Simulations and Media for Instruction courses to connect relevance and meaning with the theories, methods, and applications introduced in the Instructional Design and Technology (IDT) classes. The intent was to most effectively engage the students in the IDT learning experience. Unfamiliar with the native Creole language of the children for whom they were designing instruction, the IDT students were motivated in this quest to capture the children's attention and motivate their learning. When the students asked the CARHA teacher (who traveled to Haiti to teach during summers) what the hardest part of teaching English to the children was, she replied that it was capturing their attention. She also shared her experience that games achieved this. The question this project originally sought to determine was: What impact does a real-world project such as designing digital interactive games for English-language learners (ELLs) in a developing country have on graduate students learning IDT concepts?

Literature Review

Theoretical Framework to Engage Learning

ARCS Model of Motivation (Keller, 2010) suggests that there are four key elements to engaging learners: attention, relevance, confidence, and satisfaction. Mastery of learning versus performance-based evaluation may be credited for the motivation for and transfer of learning (Bereby-Meyer & Kaplan, 2005). Studies reflect that multimedia environments can encourage problem-solving transfer of learning (Mayer, 1999). Digital game-based learning (DGBL) offers multimedia designed to capture attention within a game and transfer learning between cultural contexts (Squire, 2002). One cannot assume that the connection to the educational merits of a game will be transferred to learning simply because players engage in the situated learning. The concept of educational content taught within a game to affect behavior may be seen as the "transfer problem" (Detterman & Sternberg, 1993).

Myerson (2013) credits mathematicians John von Neumann and Oskar Morgenstern to have birthed Game Theory using mathematical equations to offer ongoing engagement and opportunities for problem-solving. This theory applies algorithms to digital devices to offer endless branches for players to make decisions that invite the possibilities of capturing players' attention in an environment that fosters critical thinking and problem-solving. DGBL provides a fail-safe environment to test new and different suppositions (Gee, 2008; Justice & Ritzhaupt, 2015) building upon the ARCS elements of confidence and satisfaction as learners win or lose and try again rather than simply fail as they might with an exam. Using DGBL to offer competitive and collaborative opportunities in a digital game stimulates player motivation and performance (Burguillo, 2010).

Incorporating games into curricula is simply a natural fit for learners to acquire, apply, and retain new skills. Educating with games, therefore, may seem to be a motivational solution for students and teachers. However, if the gameplay is not grounded on sound educational pedagogy and instructional design (ID) models the developer can plan on stamping the games developed under the entertainment genre. The RETAIN model (Gunter et al., 2008) was "developed to aid in the evaluation of how well academic content is endogenously [part of the story vs. an addendum to the curricula] immersed and embedded within the game's fantasy and story context, promotes transfer of knowledge, and encourages repetitive usage so that content becomes available for use in an automatic way" (p. 511).

Elaboration Theory to Construct Learning

The Elaboration ID theory (Reigeluth, 1983, 1999) suggests that to build learning we must begin with the simple and move to the complex. This theory uses sequencing and chunking elements to provide learners with room to consume and build upon each section rather than trying to provide them with all the content at once. Educational pedagogy complements the concept of chunking instruction with scaffolding methods that essentially offer a safety net structure for learners to grasp the content as the instructor steps back (Erben et al., 2008; Alber, 2011).

Materials and Methods

The professor and IDT students reviewed the design of the learning process that the IDT graduate-level students went through to develop two DGBL cases and the children's formative evaluation of the games.

The IDT graduate-level students applied the theories they learned to create the real-world instruction and collected formative evaluations to improve game effectiveness and player motivation. This became an iterative process as these IDT student designers would revise the academic product after each round of testing. The games were first tested by IDT students in an *Inquiry and Measurement* graduate-level class (*n=19)*. The intention for this was to make certain the games functioned properly as the graduate-level student testers could articulate to the student designers' problem areas observed prior to introducing them to the children in a different country who spoke a different language. The student testers also recorded themselves playing the games to provide videos for the student designers to observe the game elements that evoked reactions and motivation during gameplay to use in determining the next design decisions to further improve the games.

A *Formative Evaluation Survey of Content (c) and Design (d) Checklist* was then offered to ELL subject matter experts (SMEs) at the university and CARHA teachers as the final beta-testing of test game content and design before some of the

Haitian children tested the games. Further elaboration of how this instrument was developed is currently under peer review to be published in the *Tech Trends* journal. The final evaluative observation was completed by having some of the children (*n=7)* in Haiti for whom the games were designed play the games while also having their teacher record their faces. This provided the last round of formative evaluation whereby the children's expressions were examined and used to improve game design.

Lastly, a survey was offered to the IDT student designer participants (*n=7)* to gather responses to answer the overarching summative question: What impact does a real-world project, such as designing digital interactive games for English-language learners (ELLs) in a developing country, have on graduate students learning IDT concepts?

Design of the DGBL Process

The first core course of the IDT program covers basic ID theories and models. These consecutive Media for Instruction and Introduction to Instructional Games and Simulations elective courses provide students PBL with which they may experience the ID theories and models coming alive. The university also provides the students with popular authorware licenses, such as Articulate, used in the field of IDT and the Media for Instruction course teaches the students the basic authorware technical skills that may be used to develop digital games. The following steps identify the strategies used to motivate the IDT students through the DGBL activities using Keller's ARCS Model of Motivation, subcategories, process questions, and main supporting tactics (2010).

Step 1: Capturing Attention.

A1. Perceptual arousal to capture the learner's curiosity with personal and emotional material (Keller, 2010) began with the following introductory activities. First, the students were introduced to the children in Haiti through a webinar. The students recognized the need for strategies to gain the children's attention when simply speaking to them in another language did not capture their attention.

Next, using DGBL to frame the transfer problem design, the graduate-level students were directed to go on a quest to explore and actually play games designed to teach. Games along with DGBL literature were provided on a class guide through the library (LibGuide) and included content about real-world needs such as *That Dragon, Cancer,* or serious games hosted on *GamesforChange.org*.

A2. Inquiry arousal to ignite curiosity and thinking (Keller, 2010) was then offered by having the IDT students examine if games labeled as "educational" were actually aligned to sound educational principles and theories. To determine this, students used the RETAIN model rubric (Gunter et al., 2008) to crosswalk game elements with educational pedagogy, ID, and motivational models (inclusive of Keller's ARCS model), and rate the educational value of the endogenous games they played.

A3. Variability to sustain the students' attention and interest (Keller, 2010) included various game types (i.e., adventure, simulations), perspectives (i.e., first person, second person), and designs (i.e., 2D, 3D, static, animated) listed on the LibGuide. Once students reflected upon elements that made a game educational and motivational, they were introduced to the end goal of building their own game (or a prototype) with content geared for the beginner ELL.

Step 2: Making It Relevant

R1. To relate to the goals of the students and meet their needs (Keller, 2010), the next activity offered the students a real-world PBL for specific content to serve a population but also included a brainstorming discussion to determine what goals they wanted to achieve. For example, one student wanted to acquire technical skills for using a 3D platform; all planned to use the game for their portfolio to enhance their job opportunities. Students were invited to share their ideas and goals in class to facilitate Keller's next subcategory of relevance.

The R2. A motive matching (Keller, 2010) strategy was planned by bringing in experts in the field as guest speakers. Based upon the goals (and needs) of the students, guest speakers included a graduate student with experience with the 3D Unity platform, a professor well versed in creating 2D DGBL, and an ELL professor offering expertise with scaffolding the content.

R3. Familiarity introduced with concrete examples (Keller, 2010) included strategies whereby students had to demonstrate games they had played prior to enrollment in this class. Students in the Introduction to Instructional Games and Simulations course were then directed to explore gaming platforms to use (also listed on the LibGuide), such as Scratch to conceptualize basic coding; Unity, an open-source free option where students could create first-person games, three-dimensional games capable of networking with other players; and, Articulate, popular for drill and practice or two-dimensional games. All students selected Articulate, having had the experience and familiarity of using the authorware in the Simulations and Media for Instruction.

Step 3: Instilling Confidence

C1. Learning requirements (Keller, 2010) were clearly delineated on the syllabus with specific outcomes and rubric, introduced by the professor at the beginning of class, and within the learning management system. This PBL activity, however, needed to offer flexibility and checkpoints to affirm that students were making the connections between each task that built upon the next from the small to the complex, continuing to build positive expectations for success (Keller, 2010). Faced with a real-world need, this strategy called for personal interaction with the students and adaptability. For example, when students shared that technical skills were taking longer than anticipated, the schedule was adjusted to meet the needs of the whole while partnering up students with peer support.

C2. Success opportunities (Keller, 2010) were offered at each varied step of the instruction but may be categorized into two challenging experiences. The first was building the persona and story for the ELL. Grounded on the Elaboration ID theory (Reigeluth, 1983, 1999), students were charged to construct the content from the simple to the complex, first researching their target audience to build relatable characters for their games. CARHA provided the IDT students with names, ages, and genders of the children (called players from this point forward). Next, they would need to consider the premise on which their game would be built. What was the story they would tell?

The next activity was for them to make gameplay decisions. The IDT students were charged with building turn-key strategies (for players with or without a teacher) and to scaffold the ELL instruction to offer guidance and support for players along the way.

C3. Personal control (Keller, 2010) strategies to reaffirm student successes along the way included students using the RETAIN model (Gunter et al., 2008) to now measure the game elements they included that aligned with the ARCS Model of Motivation (Keller, 2010) to meet the need of capturing and retaining players' attention, and to build confidence each time they won a level of gameplay. Each iterative step of designing, developing, and formative evaluation afforded them the ability to customize and personalize the learning experience building their confidence level based upon the feedback about their design of what would be most effective and what would not.

Step 4: Promoting Satisfaction

S1. Intrinsic reinforcement (Keller, 2010) was retuned through the formative evaluations whereby students were able to see how their efforts directly triggered player engagement. Most notably, returning the formative video observations of the children playing the games was designed to elicit the students "intrinsic enjoyment of the learning experience" (Keller, 2010, p. 159).

S2. Extrinsic rewards (Keller, 2010) included peer required reviews and professor feedback that were designed with the sandwich approach to begin with the positive about the work, add areas of improvement, and end with another positive. Strategies also included having students show the stages of their progress each class and final presentation was showcased to judges (other professors).

S3. Equity (Keller, 2010) was established by offering students the opportunity to offer their own plan if at any time they felt they were not able to fulfill the requirements of the course. The only caveat was that the plan had to be made in advance and be equitable to the work of the others for full credit.

Two DGBL Cases as Designed by the IDT Students.

Areas corresponding to how they incorporated Keller's ARCS Model of Motivation subcategories for their players are designated with the corresponding alpha and number.

Case Study 1: Farm Quest

Narrative The game follows the story of Emmanuel, the farmer, and his dog Hunter, real characters who endeavored to find the victims during the earthquake of 2010. The characters ask the player to help find the animals who have playfully decided to hide from Emmanuel and Hunter. Emmanuel and Hunter do not realize the animals are hiding behind the fence. The player is asked to find the animal based on the sound the animal makes. The animals jump up and down from behind the fence to add to the playful game of hide and seek. Once the correct animal is selected, the animal sits on top of a bale of hay. This process is repeated until each animal is correctly selected.

Gameplay Emmanuel and Hunter's Animal Farm Quest was developed as a single-player game designed to teach basic English vocabulary with cartoon images using Articulate Storyline. Common farm animals (cat, chicken, cow, and pig) caricatures that would be easily recognizable to the children were used as secondary characters to build in the ARCS element of relevance. The premise of the game is a quest to find the hiding animals. The player chooses the correct animal based on the sound the animal makes. Once the correct animal is selected, a picture of the animal, the English word, and audio of the English pronunciation of the animals, in concert with a corresponding English text, appears on the slide. Positive reinforcement in the form of audio cheers and clapping is applied. If the incorrect animal is chosen, the player has to go back to the start to try again. The text for instructions is in Haitian Creole to engage the learners who currently do not read or speak English. Instruction slides play automatically once the players enter the game. The players have to self-initiate the start of play by clicking on the hidden button trigger on Hunter. See Figure 1.

The animals begin jumping up and down from behind the fence once gameplay begins. The first animal to be found is the cow. The native sound of a cow plays. The

Fig. 1 Farm Quest homepage

player correctly identifies the animal by clicking on the box (button link) on the fence in front of the correct animal. If the player chooses correctly, the layer titled "*correct"* displays. The correctly selected animal disappears from the fenced area and appears in an upward direction to sit on a bale of hay. An audio narration of the English pronunciation plays twice, and English text appears above the correctly selected animal simultaneously. Furthermore, in the background, audio of clapping and cheering plays as positive reinforcement. Players can choose to continue by clicking over Hunter. If the player chooses the wrong animal, the incorrect layer displays with negative audio feedback. Instructions to click on Hunter to try again are in text. The storyline decision component continues until each of the four animals is chosen correctly. Once the animal is correctly chosen and is moved to the hay bales, it is no longer in play behind the fence, thereby continuing to focus the game on teaching English vocabulary and not just choosing animals. Once all the animals are correctly chosen, the play advances to the congratulations slide.

Motivation Motivational elements added to this game were embedded within the gameplay beginning with the request for players to help the main characters find the animals (Attention: A2. Inquiry arousal). The main characters selected were chosen based on animals that are indigenous to Haiti and easily identifiable by the pictures and the sounds (Attention: A1. Perceptual arousal, Keller, 2010). Emmanuel's character was created to be culturally relatable (Relevance: R3. Familiarity, Keller, 2010). The name Emmanuel was chosen using a list of common Haitian boys' names. Hunter's character was created from a real canine who rescued hundreds of trapped victims after the devastating earthquakes and was the first nonhuman to win Firefighter of the Year Award (National Disaster Search Dog Foundation, n.d.). Many motivational modalities are incorporated into the gameplay (Attention: A3. Variability, Keller, 2010), but the game also includes slides automatically advancing to the end slide thanking the player for helping find the animals. The player then may collect a treasure by clicking on Hunter to collect a reward badge (Confidence: C2. Success opportunities, Keller, 2010). The player has the option to play again or exit the game.

Cultural and English Literacy To construct the instruction, the IDT students immersed themselves in researching their target audience and their location. They soon learned that they had to rethink everything they knew to contextualize the instruction based on the cultural context for which they needed to design their instruction. For example, the first design that emerged was a game-based on farm animals that the designer thought would be appropriate for children. The imagery used of a farm and barnhouse was familiar to children known to the student, but once diving deeper into analyzing this target audience realized this was far from their reality. The redesign contextualized the instruction with imagery and a story to provide meaning to which the Haitian children could relate. This step was necessary to motivate the players and set the stage for learning. Children love units connected with animals, and farm animals can provide lots of fun opportunities to practice sounds and phonics. A way to look at language learning is to treat it like learning a new skill. The learning theory of language acquisition suggests that children learn a language through repetition and reinforcement (Vetter & Howell, 1971) like they learn to tie their shoes or how to count. This game design is a simple drill and practice game to establish a baseline for further scaffolding opportunities.

Cultural and Digital Literacy Similarly, the IDT students had to rethink how these children would travel through the digital game, especially considering that they had little experience with a digital device. Buttons with words such as "*Start here"* needed more contextual clues embedded within the game to gain the learners' attention in order to navigate through the game. Highlights, sound, and mouse-over elements were incorporated to guide the learner.

Case Study 2: The Alphabet Jungle

Narrative The Alphabet Jungle takes place in an environment where there are rainforests, rivers, and rope vines. The environment changes as the player progresses throughout the game. The first level begins at the edge of a jungle, closer to the shore. The player is introduced to a fellow adventurer to show the player how to play. Once shown how to play, through modeling that demonstrated what the players were to do, audio that sounded out the letters and words to begin the gameplay, the user can progress to other areas in the jungle to find animals. They will find a colorful bird, a snake, and a frog that is closer to a river (Attention: A1. Perceptual arousal, Keller, 2010). The player is provided with a journal of animals they have found throughout their quest in the forest.

Gameplay The game begins with upbeat jungle music and a "*start game/quit game"* option. The player is introduced to instructions that are modeled for them with a video moving the cursor through gameplay options (see Figure 2).

The player is introduced to an avatar of the game when they select "*Start Game.*" The avatar walks them through game mechanics and controls. The player then selects the first animal, an ape. Once they successfully find the ape, the ape gets added to a journal of animals found throughout the journey. Throughout the game, the player must locate other animals inclusive of a bird, snake, and frog (Attention: A2. Inquiry arousal). The player wins the game successfully after completing all four of the levels, without losing all of their lives. If they lose all of their lives, the player will "*get lost*," and they are prompted to start over.

In addition, the lives in the game are also a point value system. If the player keeps all their lives, then they will rank in the first place. One life lost will rank the player in second place. If the player loses two lives, then they will place in third (Attention: A3. Variability).

Motivation In addition to visual and audio cues, players are also prompted to compete with three lives in the game (Confidence: C2. Success opportunities, Keller, 2010); essentially, this is a point value system, but to the players, it is a matter of winning and losing. If the player keeps all their lives, then they will rank in the first place. One life lost will rank the player in second place. If the player loses two lives, then they will place third. The end scene of the game awards the player a gold medal for first place, silver for second, and bronze for third (see Figure 3).

Fig. 2 The Alphabet Jungle instructional model screen. (*Note*: The player is prompted via narration to click on the ape as part of the tutorial)

Fig. 3 The Alphabet Jungle end-game award screen. (*Note:* If the player wins, without losing lives, they will receive a first place medal)

Cultural and English Literacy The game includes scaffolding elements to help players gain confidence to learn English. Audio within the game offers repetitive pronunciation of the vocabulary words in English when triggered. Players get to practice the names of animals they may or may not have seen before.

Cultural and Digital Literacy The music selections along with the narration from a child were selected to immediately grab the player's attention as the players can relate as children. Each correct answer allows the user to add an animal to their journal. If they get an incorrect answer, they have to try again to get the correct animal. All of these features, even losing a life, were designed to prompt the player to continue trying until they get the correct answer in this fail-safe environment. If they fail the game, they can always start over.

Formative Evaluation by IDT Student Testers

To guide the IDT student designers regarding their design decisions, formative evaluation testing was performed by IDT students in the Inquiry and Measurement class (referred to as IDT student testers from this point forward). Students recorded their faces while testing the games and provided feedback to the student designers regarding their experience. The majority of IDT student testers had minimal changes in facial expression. The lack of expressions can be attributed to the initial intent of why the student participants were playing the game. The intent of playing the game was to critique the game for evaluation rather than playing the game for fun. This positioned the participants to view the game through a more critical lens and focus less on the fun and more on the educational nuances. However, it was observed at specific times in the videos (that most likely corresponded with the task of trying to click on the correct animal response) that facial expressions of the participants indicated possible frustration. The possibility of frustration in playing the game was a significant finding in the feedback process, which required significant changes in the gameplay triggers before releasing the final version of the game. Feedback ranged from suggestions to improve clarity of technical writing to game design. For example, the game that included a narrative in the native language of French Creole appeared to be a minor distraction to the IDT student testers. It was determined that since these student testers were not the intended audience for the game that the issue of the native language should not be an issue for the actual players of the game but actually supportive. The most significant challenge for all the student testers was the difficulty and the frustration in finding the correct place to click on the targeted animal. The testers overwhelmingly liked the positive reinforcement of the clapping and cheering that the audio provided. Positive feedback was also submitted regarding game characters' appearance and relatability. Feedback on the possibility of learning transfer was positive as long as it was properly reinforced.

Farm Quest Sample Revisions Based on Formative Evaluation Result.

IDT student designers used the evaluative feedback to make revisions like those displayed in Figure 4.

Based upon the feedback revealing the difficulty in locating the correct place to click to select an animal, changes made to the original versions included revisions below.

Fig. 4 *Original* version compared to final version

1 Two slides that contain visual cues (scaffolding) and text box directions (contextualization) on how to choose the correct answer.
2 Clearly outlined trigger buttons that mark the area that the player needs to select to reveal the correct answer.
3 Additions made to enhance the game included a downloadable badge. The player will be able to collect game badges as new games are created to support motivation.
4 Based on feedback suggesting there were too many words for beginner English language (even with translations), words were reduced and simplified further.

Alphabet Jungle Sample Revisions Based on Formative Evaluation Results

Overall, the IDT student testers enjoyed the original concept of The Alphabet Jungle. One tester who learned English as a second language mentioned that the talking bubbles that were spaced out can cause an issue for an ELL to understand the sentence. She suggested limiting spacing between sentences to allow easier readability. Feedback also included changing the font of questions to something more legible by using sans serif font for easier readability.

Other feedback found technical issues and confusion caused by clicking on the outline of the animal in the higher levels. Technical issues also existed at the end of the game with the final award screen whereby testers were unable to quit the game or start the game over. The feedback prompted the IDT student designer to completely revamp the game, which was again shared and tested with peers who found the content more age-appropriate for the intended audience. All of these issues were corrected by the IDT student designer.

Beta-Testing

Beta-testing was performed by SMEs from CARHA organization and educators from the university to measure the design, content, and contextualization of games using a *Formative Evaluation Survey of Content (c) and Design (d) Checklist*. This checklist offered a three-point scale of (1) unsatisfactory, (2) satisfactory, (3) excellent in both design and content, with all games scoring satisfactory to excellent in all categories. Table 1 reflects results of the two DGBL cases.

Table 1 Data result of Formative Evaluation Survey of DGBL Content (c) and Design (d)

#	Farm Quest game	Min	Max.	Mean	SD	Variance
	Overall content			**2.78**		
1	A. Recognition of the symbol: colors and letters are clearly recognizable	3.00	3.00	3.00	0.00	0.00
2	B. Identification of symbol meaning: letters or colors are clearly connected to form meaning	2.00	3.00	2.67	0.47	0.22
3	C. Pronunciation of symbol: audio offers clear pronunciation for letters or colors.	2.00	3.00	2.67	0.47	0.22
	Overall design			**2.73**		
1	Design build and quality: all interactivity, functions, links, buttons, states, and menus work	2.00	2.00	2.00	0.00	0.00
2	Grammar and writing: all content is grammatically correct and in a legible format	3.00	3.00	3.00	0.00	0.00
3	Engagement: content includes interactive elements	3.00	3.00	3.00	0.00	0.00
4	Cultural contextualization: content is designed with context and images that the audience is familiar with	3.00	3.00	3.00	0.00	0.00
5	Accessibility: multimedia available (audio narration, images, text)	2.00	3.00	2.67	0.47	0.22
#	**Alphabet Jungle game**	**Min**	**Max.**	**Mean**	**SD**	**Variance**
	Overall content			**2.83**		
1	A. Recognition of the symbol: colors and letters are clearly recognizable	3.00	3.00	3.00	0.00	0.00
2	B. Identification of symbol meaning: letters or colors are clearly connected to form meaning	3.00	3.00	3.00	0.00	0.00
3	C. Pronunciation of symbol: audio offers clear pronunciation for letters or colors.	2.00	3.00	2.50	0.50	0.25
	Overall design			**3.00**		
1	Design build and quality: all interactivity, functions, links, buttons, states, and menus work	3.00	3.00	3.00	0.00	0.00
2	Grammar and writing: all content is grammatically correct and in a legible format	3.00	3.00	3.00	0.00	0.00
3	Engagement: content includes interactive elements	3.00	3.00	3.00	0.00	0.00
4	Cultural contextualization: content is designed with context and images that the audience is familiar with	3.00	3.00	3.00	0.00	0.00
5	Accessibility: multimedia available (audio narration, images, text)	3.00	3.00	3.00	0.00	0.00

Note: Rating scale is (1) unsatisfactory, (2) satisfactory, and (3) excellent.

Formative Evaluative Observations of Haitian Children Playing the Games

The formative evaluative observation was then completed by watching the expressions of the children (for whom the game was actually designed) playing the games. The IDT student designers observed the recordings and examined facial expressions to see what, if any, design elements evoked various emotions and observable motivation (see Figure 5).

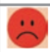
Fig. 5 *Formative evaluative observation sample of Haitian child playing the games*

The observations of the children playing the games appeared to display attention based upon perceptual and inquiry arousal as the players leaned into the screen with concentration and continued to select or sound out answers based upon previous prompts. They can be seen sounding out the letters, repeating the process, and joyfully exuding confidence in their body language with clapping and cheering when they identify the correct response and advance in gameplay. Based upon these observations, the student designers then developed the final *IMMS Adapted to Measure ARCS for Haitian English Language Learner 1.4 Readability* instrument to measure the motivation of the players upon final delivery.

Final Assessment to Measure Games.

After all formative evaluation was completed, a post-game instrument was then designed to measure players' attention, relevance, confidence, and satisfaction. The instrument was developed by adapting Charsky and Ressler's (2011) adapted Instructional Materials Motivation Scale (IMMS) (Keller, 1987; Keller, 2010) to a 1.4 readability level. Specifically, this IMMS was adapted to measure ARCS for the Haitian ELL at a 1.4 readability level to assess the motivation of players using digital game-based learning. While both Keller's IMMS instrument and Charsky and Ressler's adaptation used a 5-point Likert scale, the question type used in this instrument was simplified to a binary answer format of Yes or No options to lessen the chance of miscommunication due to the English Language Learning content. Although a Likert scale may offer detailed information, a binary question may reduce noise and instability of responses (Dolnicar & Grün, 2013). Since the majority of the ELL level and age of the children in this study were much lower than Charsky and Ressler's (2011) 14–15-year-old population, the decision was made to simplify the options to gain the overall impression of the children vs. risk instability trying to capture a broader level of detail. Likewise, the original IMMS instrument developed by Keller was reduced from 36 items to 10, and items were reworded to

Table 2 IMMS adapted to measure ARCS (Attention, Relevance, Confidence, Satisfaction) for Haitian English Language Learner 1.4 Readability

Question		
IMMS reworded for ELL		
A. *Did you want to play this game when you first saw it?* A. Did you like the game?		
R. Did you see things you know? R. Do you understand the game?		
C. Can you do it?		
S. Do you want to play it again?		
C. Is the game easy to use?		
S. Did you do well?		
C. Did you learn something?		
S. Do you want more games?		

mirror the questions designed for children in Charsky and Ressler's IMMS (tested for reliability). Emoji happy and sad face images were included with translations in the players' native language to support recognition and clarity. Ensmann offers further elaboration about the design decisions for this instrument, validity, and ambiguity testing in the TechTrends article (2021) (Table 2).

The IMMS surveys (n = 23) offered greater than 95% positive responses for areas of attention, relevance, and satisfaction. Questions regarding confidence level were divided almost equally regarding how easy the games were to use, while 65% were confident that they could play the games and 35% struggled. The confidence question regarding if they wanted to play it again was rated with 100% (Ensmann, 2021).

Final Survey Completed by the IDT Student Designers

Table 3 reflects the survey response completed by the IDT student designers who participated in this DGBL case study in answer to the overarching question: What impact does a real-world project such as designing digital interactive games for English-language learners (ELLs) in a developing country have on graduate students learning IDT concepts?

Limitations

Notable limitations delayed the timeframe for the final deployment and summative final data collection of the games the IDT students designed for the children in Haiti. The pandemic of COVID-19 first halted the trip of the professor who was going to hand deliver the tablets with the games to personally assure the children

Table 3 Final survey offered to IDT students

Questions	Answers				
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
My existing skills were used during the project design	0.00%	0.00%	0.00%	16.67%	83.33%
In agreement				**100.00%**	
I acquired new skills or knowledge during the project design	0.00%	0.00%	0.00%	16.67%	83.33%
In agreement				**100.00%**	
The real-world project engaged my attention through active participation	0.00%	0.00%	0.00%	0.00%	100.00%
In agreement				**100.00%**	
This real-world project captured my own interests	0.00%	0.00%	0.00%	0.00%	100.00%
In agreement				**100.00%**	
This real-world project was challenging enough without being overwhelming	0.00%	0.00%	33.33%	50.00%	16.67%
In agreement				**66.67%**	
I was motivated to complete the design	0.00%	0.00%	0.00%	16.67%	83.33%
In agreement				**100.00%**	
The new skills or knowledge learned through this real-world project will be useful for me in the future	0.00%	0.00%	0.00%	16.67%	83.33%
In agreement				**100.00%**	
Total results	0.00%	0.00%	4.76%	14.29%	66.67%
				94.44%	

were able to play them and complete the final IMMS-adapted instrument. The alternative plan was for the local Haitian vendor to download the game platform onto the tablets. Political unrest caused distress as the vendors had to travel off-road to divert from physical harm, delaying production. Finally, the Internet connectivity to collect the final assessment results to measure motivation as per the ARCS model the students focused their efforts on was too unstable; thus, simplified efforts (asking students to rate each game with stars) were used as another method of formative data collection until such time as the organization could return the final results from the IMMS-adapted survey.

Discussion

By using the formative evaluation results of the testers, the IDT design students were able to redesign and improve their instruction. The results of the *Formative Evaluation Survey of Content (c) and Design (d) Checklist* for both design and content returned that all elements were rated as satisfactory or excellent. This was the minimal standard the professor required be achieved before these games could be sent to the children.

Although the images in Figure 6 display images of player expressions, these observations were only intended to provide further improvement of the games with formative evaluation as part of the systematic iterative approach to instructional design. For example, student designers perceived the players' actions of demonstrating air-typing on the keyboard as a display of confidence and pride in their accomplishments, but this does not suggest an assumption can be made about motivation without the data from the final survey.

Based upon the final survey results provided by the IDT students, 94% of the IDT students agreed with being engaged, applying skills and knowledge learned in this transfer problem design case and expect to use these skills in future careers. As they intended on creating games using the ARCS Model of Motivation, so too did they attest to engaging in these motivational elements. With this real-world cross-cultural project, the IDT students found relevance to capture their attention and attested to confidence and satisfaction in their work as they watched the children enjoying, learning, and engaging in their games. This practical real-world PBL experience to create DGBL designed to engage graduate-level students in mastering the application of ID theories proved to be beneficial for this design case study as the transfer of learning was demonstrated. One area of improvement would be to add strategies to support the students in an effort to make the PBL challenging without being overwhelming. Although no one selected disagreeing that the PBL was challenging without being overwhelming, 33% selected neutral on the topic that leaves room for improvement.

Conclusion and Future Studies

The goal for this project was to pair the university students with real-world class projects to serve the needs of the Haitian children who have successfully completed this charge to date. The role of applying technology, specifically gamification of educational material, is to engage and motivate while learners acquire knowledge, and build upon that knowledge to transfer the learning as they apply it through an iterative process. Having the graduate-level students create instructional games motivated them by encouraging a hands-on approach to learning. It is critical to understand why (for what purpose) and how one designs a game in the first place. It is also vital to know who the project is being created for and how it can be assessed. The task of designing a game to teach basic vocabulary words to Haitian children in another country, with limited technologies, during political unrest, and a worldwide pandemic was quite an undertaking. Nevertheless, this undertaking has been a worthy enterprise.

This project created the opportunity to connect a population with limited availability to education to an ample beginning of digital games to teach English while also giving graduate-level students an appreciation of the dedication and effort that goes into the iterative design process of DGBL. Creating instructional games infused with a model of motivation to capture players' attention and confidence to win the game, while ultimately learning, offers opportunities for further studies expanding across cultures.

We acknowledge the 2019–2020 University of Tampa Research Innovation and Scholarly Excellence (RISE) Award/Dana Foundation Grant for funding this project. This study lends itself to not only be a success story for the partnership with this Haitian organization, US professors, and students but also to continued advancement in partnerships between higher education and communities in need, such as impoverished area businesses, educational systems, and the nonprofit sectors.

References

Alber, R. (2011). Six scaffolding strategies to use with your students. *Teacher Leadership, 30*(45), 5.

Bereby-Meyer, Y., & Kaplan, A. (2005). Motivational influences on transfer of problem-solving strategies. *Contemporary Educational Psychology, 30*(1), 1–22.

Burguillo, J. C. (2010). Using game theory and competition based learning to stimulate student motivation and performance. *Computers & Education, 55*(2), 566–575.

Charsky, D., & Ressler, W. (2011). "Games are made for fun": Lessons on the effects of concept maps in the classroom use of computer games. *Computers & Education, 56*(3), 604–615.

Detterman, D. K., & Sternberg, R. J. (1993). *Transfer on trial: Intelligence, cognition, and instruction*. Ablex Publishing.

Dolnicar, S., & Grün, B. (2013). "Translating" between survey answer formats. *Journal of Business Research, 66*(9), 1298–1306.

Ensmann, S. (2021). Digital Games to Improve Learning in Haiti. *TechTrends, 65*(5), 884–895.

Erben, T., Ban, R., & Castaneda, M. (2008). *Teaching English language learners through technology*. Routledge.

Gee, J. P. (2008). Video games and embodiment. *Games and Culture, 3*(3 4), 253–263. https://doi.org/10.1177/1555412008317309.

Gunter, G. A., Kenny, R. F., & Vick, E. H. (2008). Taking educational games seriously: Using the RETAIN model to design endogenous fantasy into standalone educational games. *Educational Technology Research and Development, 56*(5-6), 511–537.

Justice, L. J., & Ritzhaupt, A. D. (2015). Identifying the barriers to games and simulations in education creating a valid and reliable survey. *Journal of Educational Technology Systems, 44*(1), 86–125.

Keller, J. M. (1987). *Instructional materials motivation scale (IMMS)*. Tallahassee: FL. Florida State University.

Keller, J. M. (2010). *Motivational design for learning and performance: The ARCS model approach*. New York: Springer Science & Business Media.

Mayer, R. E. (1999). Multimedia aids to problem-solving transfer. *International Journal of Educational Research, 31*(7), 611–623.

Myerson, R. B. (2013). *Game theory*. Cambridge, MN: Harvard University Press.

National Disaster Search Dog Foundation, retrieved from https://searchdogfoundation.org/haiti-earthquake/.

Reigeluth, C. M. (1983). Lesson blueprints based on the elaboration theory of instruction. In *Lesson Blueprints Based on the Elaboration Theory of Instruction, Instructional Theories in Action: Lessons, Illustrations, Theories and Models* (pp. 245–288). New York: Routledge.

Reigeluth, C. M. (1999). The elaboration theory: Guidance for scope and sequence decisions. In D. H. Jonassen & C. Reigeluth (Eds.), *Instructional-Design Theories and Models (Volume II): A New Paradigm of Instructional Theory* (pp. 425–453). New York: Routledge.

Rogers, E. M. (2010). *Diffusion of innovations*. New York: Simon and Schuster.

Squire, K. (2002). Cultural framing of computer/video games. *Game studies, 2*(1), 1–13.

Vetter, H. J., & Howell, R. W. (1971). Theories of language acquisition. *Journal of Psycholinguistic Research, 1*(1), 31–64.

Incorporating Interest Development, Self-Determination Theory, and Flow into Guided Inquiry Design in STEM Environments

Bruce DuBoff

In an information science context, inquiry is related to information seeking. When problems are encountered, there are personal or professional motivations to fill them. Inquiry-based learning is a student-centered pedagogy in which students question and explore situations, charting their own paths toward solutions (Maaß & Artigue, 2013). Inquiry becomes *Guided Inquiry* (*GI*) when Kuhlthau's six-stage, three-domain information search process (ISP) model is used as the theoretical backbone of developing instructional supports for the inquiry process of learners, often in classroom or library settings. Kuhlthau's (1991) ISP is a widely used and broadly accepted interpretation of the information search process in a constructivist learning environment. *GI* is a pedagogy derived from the ISP featuring a pattern of discovery that aligns with the stages of the ISP and that includes specific instructional scaffolds and activities, designed by the educator/school librarian, to elicit a set of practices, behaviors, and learning outcomes in students. I hypothesize that it can be complemented by interest development models such as Hidi and Renninger's *Four Phases of Interest Development* (2006), and psychological theories such as *Self-Determination Theory* (Ryan & Deci, 2017), and *Flow* (Csikszentmihalyi, 1990).

Kuhlthau, Maniotes, and Caspari (2015) published the definitive work on *Guided Inquiry*, the educational pedagogy developed from Kuhlthau's ISP, incorporating "third space," the learning space in which the curriculum meets the personal experiences of the students. This is the constructivist realm in which students dwell, hopefully working in the psychological state of *Flow* (Shernoff, et al., 2014; Csikszentmihalyi, 1990), engaging each other and the content, beginning to scaffold relevant knowledge and understanding (Kuhlthau, 1991; Kuhlthau, Maniotes, & Caspari, 2015; Reiser & Tabak, 2014). *Guided Inquiry* is collaborative, engaging, reflective, and iterative, as students explore new ways to solve problems, answer

B. DuBoff (✉)
Rutgers University, New Brunswick, NJ, USA

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*, Educational Communications and Technology: Issues and Innovations,
https://doi.org/10.1007/978-3-030-85078-4_13

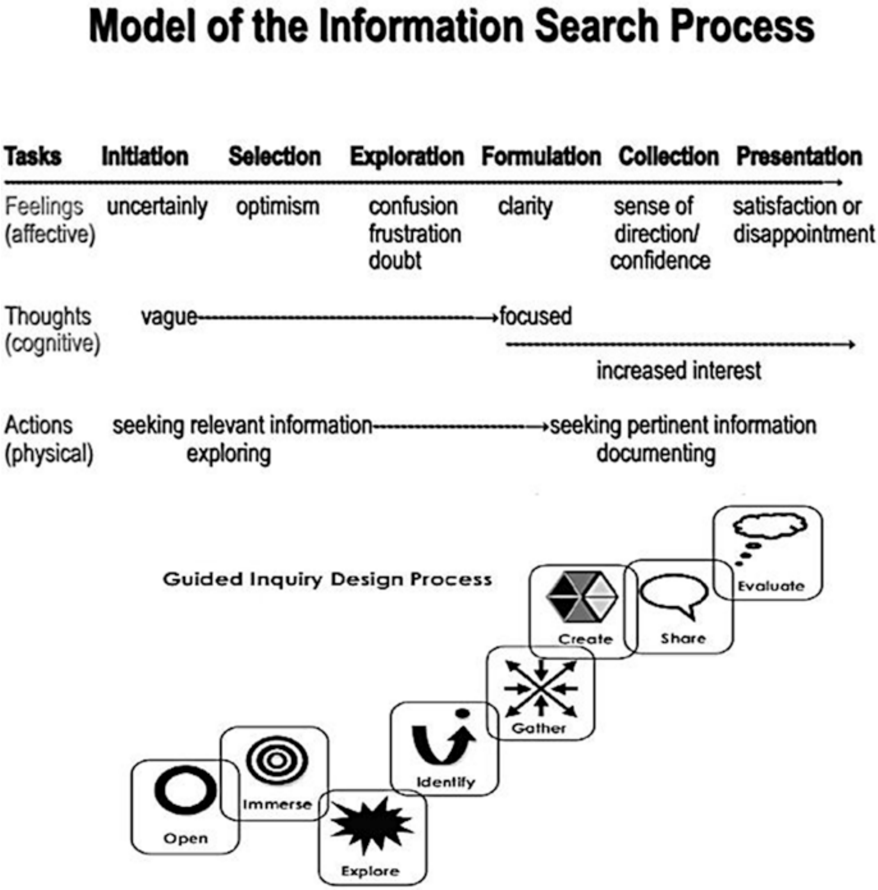


Fig. 1 Kuhlthau's (1991) Information Search Process model aligned with the Guided Inquiry Model (Kuhlthau, Maniotes, & Caspari, 2012)

questions, and create authentic artifacts. Motivation, interest, and engagement are primary factors in engaging in GI-based learning. Figure 1 below displays the development from the six-stage, three-domain ISP to the *Guided Inquiry Design* (GID) pedagogy. The tasks in the ISP are closely aligned with the stages of the GID, and they flow in the same direction, sharing many of the same qualities. The GID is different from the ISP in that it is a pedagogical innovation, a full educational unit designed to successfully engage in an inquiry-based project. The ISP provides the theoretical backbone for the GID.

Motivation, interest, relevance, and affect are primary factors in engaging in *GI* learning, especially since personal relevance to content is one of the tenets of *GI*. However, interest and affect, especially as it relates to social relatedness (Ryan & Deci, 2017), could play an even more central role in *GI* and the *GID*, with continued research. I will propose three general observations/conjectures on these potential intersections. Overall, I conjecture that interest, motivation, and engagement intersect with ISP, the *GI*, and the (*GID*) models in the following ways:

Firstly, situational interest-driven searches for information and individual interest-driven searches for information will look and operate differently, with different processes unfolding that are not accounted for by the present ISP. Situational interest may or may not include engagement, while individual interest always does (Renninger & Hidi, 2016). Situational interest usually involves facilitation (Abbott, 2017) and may or may not be interesting to the searcher, while individual interest is intrinsically motivated or internally regulated and produces self-efficacy leading to expertise. However, the ISP treats all information searches the same, unable to account for issues such as low motivation due to lack of social relatedness or amotivation and "going through the motions" (Deci & Ryan, 2008). The ISP characterizes all searches as experiencing the ups and downs of the extended search experience charted across the ISP model. The ISP assumes engagement will be persistent throughout the search and retrieval process, motivation differentials will not enhance or interfere with the process, and interest will increase as students become more knowledgeable about their topics through formulation and collection.

For situational interest, much more emphasis would have to be placed upon the beginning of the ISP. Much of the impact of situational interest is at the beginning, the hook or novelty that catches students' attention. There would have to be a trigger or Open phase to the ISP during which an anticipatory set can activate schema, and knowledge would have to be built and contextualized before the main inquiry began. However, if individual interest were tracked, I hypothesize that the first stages of the ISP would be virtually unnecessary since students know what they like. The affective track would change in that feelings of uncertainty, optimism, confusion, frustration, and doubt would be replaced by the confidence and sense of direction of the later stages of the ISP. The physical realm would have less of a transition between relevant and pertinent information since the student already knows and likes the material.

Secondly, perceived competence, autonomy, and relatedness interact at several points with the ISP-process aspects of cognition/affect/behavior. Most research projects begin with an external assignment, in this case an external regulation (Ryan & Deci, 2017; Cook & Artino, 2016). As students work through information search and retrieval, Kuhlthau (1991) predicts they will achieve increased interest cognitively and confidence and direction affectively while physically moving from finding relevant information to finding pertinent information. *SDT* aligns with these movements through competence and somewhat through autonomy, but not through relatedness; there is little accommodation in the ISP for student collaboration in teams. Words like clarity and focus on the ISP align to competence—and autonomy-related concepts such as challenge, performance, and explanation/rationale in *SDT*. Also, students are predicted in *SDT* to feel better about themselves and the process (or worse) through the search and retrieval process, as the ISP suggests. However, the ISP does not provide for a nurturing learning environment and lacks learning design consideration.

Thirdly, Shernoff's (2013) work on *Flow* and engagement reveals that conceptualizing engagement solely through school-based behaviors is inadequate; the psychological student must be acknowledged and nurtured as well. Engagement is an environmental interaction (Shernoff, 2013), and students operate at top efficiency when they approach *Flow* in their activities (Csikszentmihalyi, 1990; Shernoff, 2013; Shernoff, et al., 2014). *Flow* is closely related to social relatedness, competence, and autonomy, the primary element of *SDT*, and the elements of engagement and interest that produce *Flow* can be introduced into the *GID*.

These intersections and cross-pollinations can be integrated into an enhanced, hybrid, *GID*, and interventions can be designed that incorporate interest, *SDT*, and *Flow*. Although this design is intended for a project using science fiction to motivate STEM interest in middle schoolers, it can be adapted for almost any subject. However, since STEM workers now and in the future are currently so vital during the COVID-19 pandemic, I suggest that interventions revolve around STEM subjects following Luokkala's (2014) seven science fiction-Science intersections:

- Nature of space and time (Astronomy, Physics, History of Science, Gravitation).
- Composition of the Universe (Geology, Matter, Light, Energy).
- Machine consciousness (HCI, Artificial Intelligence).
- Aliens (Anatomy, Biology, Zoology).
- The meaning of being human (Scientific Method/Taxonomy, Ethics, Values).
- Solving future problems (Hydrology, Meteorology, Technology).
- What does the future hold? (Computer Science, Genetics, Astronautics) (Luokkala, 2014).

Since some types of school-based research have been halted due to US-based, pandemic-related school closures, actual data may not be available at time of publication. However, the theoretical implications of the described cross-pollinations can be useful by themselves as lesson and learning scaffolds.

Interest Development Theory

Interest can be seen as an information behavior, e.g., the large body of empirical work on choosing a book at the library (Case & Given, 2016). Interest, engagement, and motivation (all 3) are covered in the fields of psychology and educational psychology. Engagement is a result of interest. *Interest* is a predisposition to return to an activity and is triggered either intrinsically or extrinsically; it can be fleeting or long-lasting. It is cognitive and affective. It shares reciprocity with similar motivational variables like goals in *Achievement Goal* and *Goal Complex Theory* (Senko, 2016), and self-efficacy and self-regulation in *Self-Determination Theory* (Ryan & Deci, 2017). Engagement is active involvement in an activity and includes some interest, even if that interest is avoidance-based (e.g., not failing the project). It is cognitive, affective, or behavioral. One can be engaged but not actively interested (e.g., disliking physical education class but participating due to extrinsic controls like grades and assessment), but one cannot be interested without being engaged. Triggering establishes engagement (Renninger & Hidi, 2011).

Hidi and Renninger's model explains the complex psychological, cognitive, affective, and behavioral elements comprising the development of interest. The interest trajectory spans two levels of extrinsic interest, also called situational or "catch," to two levels of intrinsic interest, also called individual or "hold" (Hidi & Renninger, 2006; Renninger & Hidi, 2016; Renninger & Bachrach, 2015; Harackiewicz, et al., 2000). Extrinsic interest is initiated by a trigger appealing to the natural tendencies of students and empowering them to internalize new objects, concepts, or ideas. The more students personalize them to make them more authentic, the more effective they become as educational scaffolds (Arnone & Reynolds, 2009; Durik & Harackiewicz, 2007). In the early stages of interest, learners may not even know that their interest has been triggered; the power of interest is manifested when behavior changes based on the interest (Renninger & Bachrach, 2015). However, triggered situational interest can also be fleeting (Renninger & Riley, 2013; Renninger & Hidi, 2016); a volcano eruption or worm dissection can be exciting today but forgotten tomorrow (Crouch, et al., 2018). Fostering interest development requires engagement to get past triggered, situational interest (Abbott, 2017). In deeper interest levels, learners often provide their own triggers (Renninger & Bachrach, 2015), and they persevere with tasks related to the task and are increasingly likely to see themselves performing the task as part of their career. Although people tend to have four or five well-developed interests, there is always room for shifting and changing; focus on interest changes regularly (Renninger & Bachrach, 2015; Renninger & Hidi, 2016; Renninger & Riley, 2015). As Fig. 2 suggests, the arc of interest development follows the same general trajectory as the ISP and, hence, the G*uided Inquiry Design* model. As students engage more deeply in their inquiry-based projects, they potentially deepen their interest in the content and subject (DuBoff, 2019).

There are two psychological theories that parallel many of the affective, cognitive, and behavioral elements of the ISP, the *GID*, and the *Four Phases of Interest Development* (Hidi & Renninger, 2006): *Self-Determination Theory* (*SDT*) (Ryan & Deci, 2017) and *Flow* (Csikszentmihalyi, 1990; Shernoff, et al., 2014).

Self-Determination Theory

Self-Determination Theory (*SDT)* offers a psychological lens through which to view the multiple, disparate, sometimes warring impulses and actions that comprise the whole person, defining self-determination through the lens of the continuum of autonomous motivation and controlled motivation (Deci & Ryan, 2008). The goal of instructors and designers is to create learning ecologies in which students, ". . . have identified with an activity's value and ideally will have integrated it into their sense of self" (Deci & Ryan, 2008, p. 182). Autonomous motivation (Deci & Ryan, 2008; Ryan & Deci, 2017) is similar to individual interest (Hidi & Renninger, 2006;

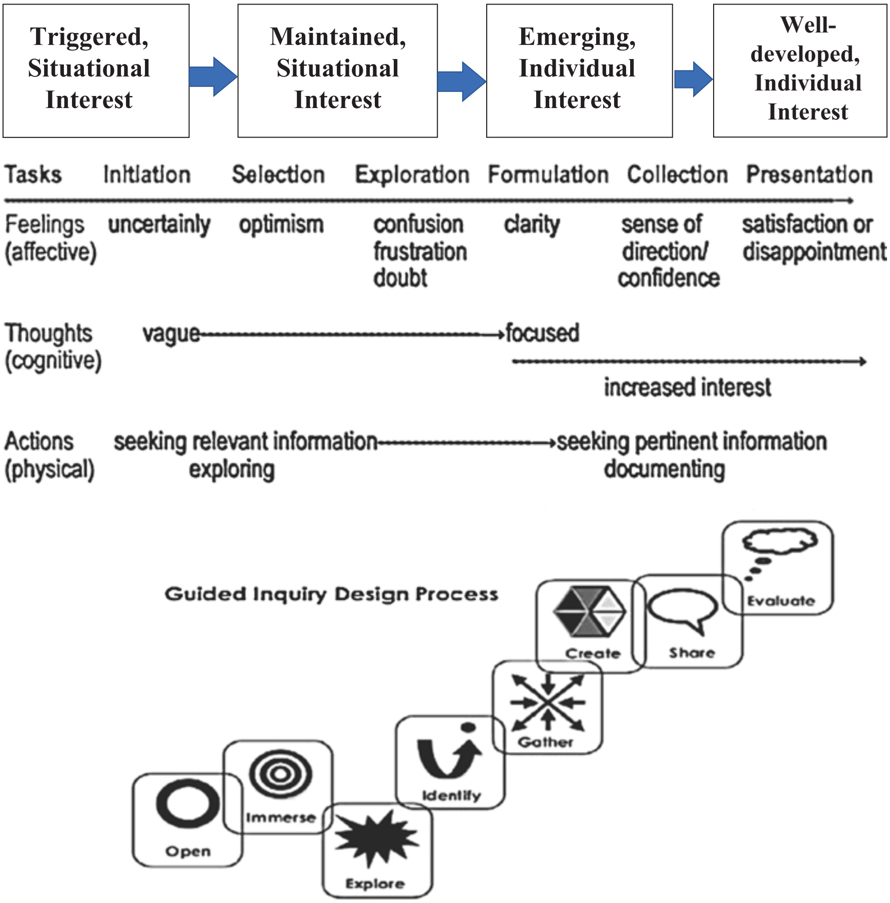


Fig. 2 Model of cross-pollination of Kuhlthau's (1991) *six-stage, three-domain ISP* model and Kuhlthau, et al.'s (2015) *GID* with Hidi and Renninger's (2006) *Four Phases of Interest Development*

Renninger & Hidi, 2016): students are self-motivated, have intrinsic interest, and do not require prompting; they are working toward autonomy and intrinsic motivation. Controlled motivation, commonplace in P-12 education, places outside requirements and pressures on students to perform in proscribed ways (Deci & Ryan, 2008). Both intrinsic and controlled motivations promote students to action, even though they may feel differently about each method, e.g., taking a standardized test for 4 days (controlled motivation) versus creating a cool racecar with Legos (intrinsic motivation). Both activities cause action, but students will approach each with a different set of feelings, thoughts, and motivations.

SDT acknowledges the importance of the satisfactions that are associated with autonomy, competence, and social relatedness and asserts an inherent human capacity for reflective, reflexive behavior leading to self-awareness and hence to self-regulation (Deci & Ryan, 2008; Ryan & Deci, 2017). Human nature is experience-dependent, formed through the decisions to meet or not meet needs and desires, and humans are therefore in constant conflict with their environments. Meeting basic needs leads to a greater likelihood of achieving satisfaction, while thwarting basic needs, whether from extrinsic or intrinsic forces, leads to fragmentation, dysfunction, and vulnerability. Need satisfaction is linked to vitality, while need frustration leads to amotivation. The theory comprises three domains: *autonomy* (Ryan & Deci, 2017), the state in which one feels volitional, congruent, integrated, and self-endorsed, in tune with one's authentic interests and values; *competence* (Ryan & Deci, 2017; Deci & Ryan, 2008), the basic need to feel effectance and mastery; operating in harmony, productively within one's environment; and *social relatedness*, feeling socially connected, belonging, homonomy. This is much like Lave and Wenger's *legitimate peripheral participation* (1991), in which people who share and build communities around an activity move closer to the central, control-wielding group for the activity.

The organismic drive that draws the elements together is dynamic wellness; *SDT* suggests that when one feels the appropriate amount of autonomy, competence, and relatedness that person will flourish, operating with harmony and growth. It is assumed in *SDT* that people want certain levels of wellness attained through affective, behavioral, and cognitive experiences and goals. In fact, *SDT* is the framework current researchers use for conceptualizing goal complexes (e.g., Senko, 2016).

According to *SDT*, learners innately desire to explore their environments in order to grow, learn, and develop. Curricula should address this and promote environments fostering motivation (Haarens, 2020). Successful schools model a tangible enthusiasm for learning and accomplishment, and their students and staff display a genuine desire to want to learn (and teach) well (Deci, et al., 1991). It is this motivational design consideration, not the merging of school and personal space suggested by *GI* and *GID*, that aids students during inquiry in critical thinking, enhanced knowledge acquisition, and most importantly in *SDT*, ". . . a strong sense of personal worth and social responsibility" (Deci, et al., 1991, p. 326). Contrary to the requirements for social construction and collaboration in the *GID*, which not every student likes or desires, *SDT* suggests that simply moving with the crowd without any "buy-in" can be considered amotivational and may even act against personal and social growth (Deci, et al., 1991).

Overall, the value of autonomy and autonomous motivation and/or working toward them is the primary feature in this application. Autonomy is much like well-developed individual interest (Renninger & Hidi, 2016), while controlled activity is more like mandatory performance goal achievement (Senko, 2016). Autonomy is based on intrinsic motivation like personal interests and exciting activities, while control is based on extrinsic motivation like taking corporate-style assessments and performing tasks in specific, predetermined ways with little or no personal input. Autonomy is not independence and vice versa (Ryan & Deci, 2017). Also, one can be autonomous emotionally but controlled behaviorally. The concepts of autonomy and relatedness seem to be opposites in this vein, but they grow and diminish apart from each other.

Students are most creative and productive when they are invested in their own destinies. Additionally, the move toward autonomy through social relatedness and competence is well aligned with both the inquiry-based *GID* and the more general *Four Phases of Interest Development*.

Flow

Flow (Csikszentmihalyi, 1990) is a psychological state in which participants are "in the zone," operating with autonomy and confidence, fully immersed in an activity, oblivious to outside details. It is highlighted by intense concentration, a merging of action and awareness, feelings of control and lack of self-consciousness, and time transformation (Strati, Shernoff, & Kackar-Cam, 2018). *Flow* is a theory of engagement; the state is defined by the fully engaged participant, not necessarily by what brought her there. *Flow* can be utilized, like the ISP and its pedagogical offspring, *GI*, as a roadmap to peak performance. In the classroom, like interest and motivation, engagement is profoundly affected by learning ecologies and working conditions (Shernoff, et al., 2014); students work better when they are offered the affordances that enable successful conditions, such as open participation, free exchange, and appropriate technology.

Flow (Csikszentmihalyi, 1990; Shernoff, et al., 2014) claims its origins in the *autotelic* experience, ". . . a self-contained activity, one that is done not with the expectation of some future benefit, but simply because the doing itself is the reward" (Csikszentmihalyi, 1990, p. 67). The term *exotelic*, conversely, means tasks done for external, controlled reasons. Autonomy and intrinsic motivation (Ryan & Deci, 2017) are represented by autotelic experience, while control and external regulation are represented by exotelic experience. *Flow* is also directly related to engagement; in the initial research leading up to the theory's publication, subjects were asked about their peak experiences, how they felt and performed in optimal environments (Csikszentmihalyi, 1990; Shernoff, et al., 2014). Additionally, *Flow* is associated with *learning goal orientation* theory, the study of the reasons for student engagement in a learning activity (Senko, 2016; Shernoff, et al., 2014). Performance goals in this context represent extrinsic, controlled activities, while mastery goals represent intrinsic, autonomous activities. Mastery goals have shown to be a predictor of Flow state, while performance goals have not (Shernoff, et al., 2014).

In *Guided Inquiry*, performance goals align with the first two stages of interest, triggered, situational interest, and maintained, situational interest, while mastery goals align with the deeper interest levels, emerging, individual interest, and well-developed, individual interest. As students successfully engage in inquiry-based research, the controlled elements of the project can be removed, allowing for increasing autonomy and hence increasing ease of operation.

Implications of the Incorporation of *SDT* and *Flow*

Table 1 (above) suggests the potential influence of interest development on elements of *SDT* and *Flow*. Interest development can be the glue that binds information into students' knowledge bases. The implications should not be underestimated; this is not merely "letting the kids do what they like" and then finding out that 90% of them "like" video games. Interest development has cognitive, affective, and behavioral elements, and these can and should be leveraged into interest in important societal subjects like STEM research and innovation. Science fiction is an excellent choice to generate interest in STEM (DuBoff, 2019), and *Guided Inquiry Design* is an effective way to achieve that goal.

Pedagogy is the bridge between reflective practice, performing an action and then discussing it with others; these experiences become scaffolded knowledge (Shaffer, 2004; Reiser & Tabak, 2014). SF is ideal for a social constructivist environment like that in *GID* because students already create worlds with peers; SF-based and game-based clubs and organizations already thrive due to intercommunication out of school. Young people figured out transmedia (Jenkins, 2006) without adult supervision, and they seem to have amassed and socially constructed quite a bit of knowledge about their favorite television, movie, and/or book series, so interest can increase for some students through the type of multimedia environment of an online *GID* intervention.

The explosive rise in YA dystopian novels and films demonstrates the desirability for a stronger connection between SF and STEM to improve instruction. Appealing to student interests, the choice of a SF series like *The Hunger Games* (Collins, 2008), or uchronic literature like *The Man in the High Castle* (Dick, 1992), an Amazon online television series, is a logical one for adolescents, considering the connections between SF and the Bildungsroman, the "coming-of-age" novel. It is not surprising that many YA series have spawned popular film adaptations. The alienation "bright kids" experience in many fantasy and dystopian, the way characters feel out of place in their given environments, is a very common theme for adolescents, e.g., the characters in Dick's novel are existentially in the wrong reality and living a life that never should have existed; Luke Skywalker discovers his

Table 1 Alignment of interest development, *SDT*, and *Flow*

Interest development stage	*SDT* element	*Flow* element
Triggered, situational	Controlled motivation	Performance goals
Maintained, situational	Controlled motivation begins to evolve as student interest increases	Performance goals begin to evolve as student interest increases
Emerging, individual	Autonomous motivation	Mastery goals
Well-developed, individual	Autonomy	Mastery

special powers and gifts while on a bildungsweg, an educational path to self-formation (Hall, 1988) that often features enlightenment and/or rapid growth and change; e.g., Harry Potter literally wakes up one day to discover he is a wizard; Katniss Everdeen's life course is radically altered in the moment she is chosen to compete in the Hunger Games. It is a unique and singular experience in YA SF to be chosen for greatness, relevant to young adults who feel and live their struggles and triumphs uniquely and singularly.

Buckley (1974) describes the typical Bildungsroman plot as follows: a child gifted in some way is constrained and alienated at home and must leave, and his education in the ways of the world or in the methods of achieving success become equally or more important than school lessons. At the end of the journey, he has been exalted and debased, loved, and loathed; he ultimately loses his adolescence and begins his adult journey, sadder and wiser than when he began. Young SF protagonists are often gifted in some branch of STEM subject; examples in modern SF abound, such as *wunderkind* Andrew "Ender" Wiggin in Card's *Ender's Game* (Card, 2008), helmsman Wesley Crusher on Roddenberry's *Star Trek: The Next Generation* (Stewart et al., 2013), or even Alex Rogan, the video gamer whose mastery of *The Last Starfighter* sends him on a campy, 1980s-hair-filled journey to save the Universe (Betuel, 1985), replicated more recently in the character Wade Watts and the retro-1980s-style *Ready Player One* (Cline, 2011). They are true motivated learners: "They are enthusiastic, focused, and engaged. They are interested in and enjoy what they are doing, they try hard, and they persist over time. Their behavior is self-determined, driven by their own volition rather than external forces" (Garris, Ahlers, & Driskell, 2002, p. 444). It is the drama of the gifted child (Miller, 1990).

Once they find their bildungsweg, YA SF protagonists display well-developed individual interest (Hidi & Renninger, 2006; Renninger & Hidi, 2016) in their task. The need is exemplified by Katniss Everdeen's journey in *The Hunger Games* (Collins, 2008), a novel that invites lessons on genetics, light, sound, flammable and inflammable materials, weaponry, and an actual example of the media's "fake news" through the representation of the corrupt administration of President Snow (Collins, 2008). The "bright kid" is a powerful archetype that should be much more inclusive and appealing than malaise and misery. Although it is assumed ethically that no one wants to put undue pressure on students, expertise is best developed with a model that feels authentic and a personally significant reason to strive for it (Goldman, 2001). Every student has talents that can be built upon using this type of learning that may already appeal to student interests.

Figure 3 (below) demonstrates the addition of *SDT* and *Flow* into the model, providing more design background concerning interest generation and knowledge building, thereby capitalizing on the affective and behavioral elements of student learning behavior. Student interests should be leveraged into project-based artifacts that demonstrate the capacity to affect mastery and expertise, tying in the cognitive element of the learning; the creation process is an excellent crucible in which to grow and refine learning.

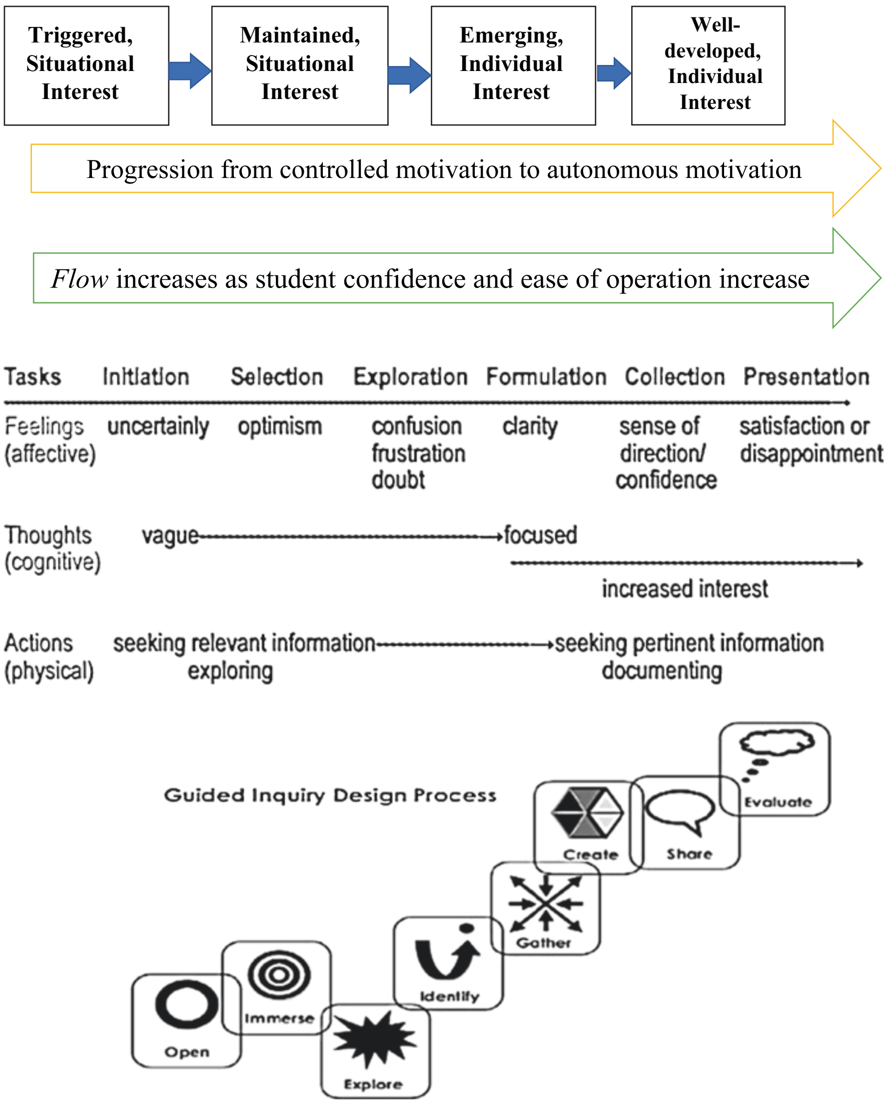


Fig. 3 Model of cross-pollination of Kuhlthau's (1991) *six-stage*, *three-domain ISP* model and Kuhlthau, et al.'s (2015) GID with Hidi and Renninger's (2006) *Four Phases of Interest Development*, Including Trajectories for *SDT* (Ryan & Deci, 2017) and *Flow* (Csikszentmihalyi, 1990; Shernoff, et al., 2014)

In Summary

In 2013, the Next Generation Science Standards (NGSS) Executive Summary assessed the current STEM educational system as a "leaky . . . talent pipeline" (NGSS Lead States, 2013, p.1) and concluded that more interest must be generated to stimulate today's K-12 students: "We need new science standards that stimulate and build interest in STEM. The current education system can't successfully prepare students for college, careers, and citizenship" (NGSS Lead States, 2013, p. 1). *Guided Inquiry Design* is one effective pedagogy that has great potential to generate STEM interest.

To maximize its effectiveness, the *GID* should contain more entrances for psychological theories like SDT and Flow. Instructional designers entering a *GID*-based unit or advising practitioners about the *Guided Inquiry Design* should give more consideration to the ways in which students interact, respect each other or not, and feel generally good or bad about their tasks and interactions. Interest, motivation, and engagement are key factors in student success or lack thereof. An autonomy-supportive approach to classroom and learning environment management has shown to be an effective method to generate motivation and interest (Cheon, Reeve, & Vansteenkiste, 2020). Instruction in a *GID*-based unit should be autonomy-supportive, funneling students toward intrinsic motivation. Issues such as competition, negativity, and clique-driven inclusion and exclusion can significantly undermine the *GI* process and the collaboration that is required to drive the *GID*. This becomes especially important especially during several phases: the open phase when the learning team is attempting to build an inquiry community composed of all students, the identify phase in which all students in an inquiry circle are supposed to agree upon an inquiry question and topic, and the create and share phases in which students must work together and support each other to produce thoughtful, interesting artifacts and presentations. The environment of a GI-based lesson and/or unit may be compared to an ecosystem, hence the term *learning ecology* (Gundogan, 2016). An ecosystem is healthy when its parts are operating in harmony with each other, and so is a learning environment. The *GID* should include more theoretical background from psychological theories like *Flow* and SDT to address the well-being of the students as they interact with the learning environment. Through ". . . questioning, modeling, listening, and encouraging" (Kuhlthau, et al., 2012, 363), the *GI* learning team can assist students in establishing the life-to-school-topic connections that foster third space in *GI*, and enabling them to feel good doing it, thereby building self-efficacy and confidence.

References

Abbott, A. L. (2017). Fostering student interest development: An engagement intervention. *Middle School Journal, 48*(3), 34–45. https://doi.org/10.1080/00940771.2017.1297666.

Arnone, M., & Reynolds, R. (2009). Empirical support for the integration of dispositions in action and multiple literacies into AASL's *Standards for the 21st Century Learner*. *School Library Media Research*, *12*. n.p.

Betuel, J. (1985). *The last starfighter. [video]*. MCA Home Video: Universal City, CA.

Buckley, J. H. (1974). *Season of youth: The bildungsroman from Dickens to Golding*. Cambridge, MA: Harvard University Press.

Card, O. S. (2008). *Ender's game*. New York: Tor Books.

Case, D. O., & Given, L. M. (2016). *Looking for information: A survey of research on information seeking, needs, and behavior* (4th ed.). Amsterdam: Elsevier/Academic Press.

Cheon, S. H., Reeve, J., & Vansteenkiste, M. (2020). When teachers learn how to provide classroom structure in an autonomy-supportive way: Benefits to teachers and their students. *Teaching and Teacher Education, 90*, 103004. https://doi.org/10.1016/j.tate.2019.103004.

Cline, E. (2011). *Ready player one* (1st ed.). New York: Broadway Paperbacks.

Collins, S. (2008). *The hunger games* (1st ed.). New York: Scholastic Press.

Cook, D., & Artino, A. (2016). Motivation to learn: An overview of contemporary theories. *Medical Education, 50*(10), 997–1014. https://doi.org/10.1111/medu.13074.

Crouch, C., Wisittanawat, P., Cai, M., & Renninger, K. A. (2018). Life Science students' attitudes, interest, and performance in introductory Physics for Life Sciences: An exploratory study. *Physical Review Physics Education Research, 14*(1), 010111–1–010111–0101-14. https://doi.org/10.1103/PhysRevPhysEducRes.14.010111.

Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience* (1st ed.). New York: Harper & Row.

Deci, E. L., & Ryan, R. M. (2008). Self-determination theory: A macrotheory of human motivation, development, and health. *Canadian Psychology, 49*(3), 182–185.

Deci, E., Vallerand, R., Pelletier, L., & Ryan, R. (1991). Motivation and education: The self-determination perspective. *Educational Psychologist, 26*(3–4), 325–346. https://doi.org/10.1080/00461520.1991.9653137.

Dick, P. K. (1992). *The man in the high castle* (1st Vintage Books ed). Vintage Books.

DuBoff, B. (2019). Using science fiction to stimulate and engage middle schoolers in STEM activities and topics. In M. Simonson & D. Seepersaud (Eds.), *AECT 42nd annual proceedings: Selected papers on the practice of educational communications and technology* (pp. 356–366). Las Vegas: Association for Educational Communications and Technology. Retrieved from https://members.aect.org/pdf/Proceedings/proceedings19/2019i/19_06.pdf.

Durik, A. M., & Harackiewicz, J. M. (2007). Different strokes for different folks: How individual interest moderates the effects of situational factors on task interest. *Journal of Educational Psychology, 99*(3), 597–610. https://doi.org/10.1037/0022-0663.99.3.597.

Garris, R., Ahlers, R., & Driskell, J. (2002). Games, motivation, and learning: A research and practice model. *Simulation & Gaming, 33*(4), 441–467.

Goldman, A. I. (2001). Experts: Which ones should you trust? *Philosophy and Phenomenological Research, 63*(1), 85–110.

Gundogan, M. (2016). Learning ecology. In S. Danver (Ed.), *The SAGE encyclopedia of online education* (pp. 647–648). Thousand Oaks, CA: SAGE Publications. https://doi.org/10.4135/9781483318332.n211.

Haarens, L. (2020). Education: Overview. *Center for Self-Determination Theory*. Retrieved from https://selfdeterminationtheory.org/application-education/.

Hall, P. C. (1988). "The space between" in space: Some versions of the bildungsroman in science fiction. *Extrapolation, 29*(2), 153–159.

Harackiewicz, J. M., Barron, K. E., Tauer, J. M., Carter, S. M., & Elliot, A. J. (2000). Short-term and long-term consequences of achievement goals: Predicting interest and performance over time. *Journal of Educational Psychology, 92*(2), 316–330. https://doi.org/10.1037/0022-0663.92.2.316.

Hidi, S. E., & Renninger, K. A. (2006). The four-phase model of interest development. *Educational Psychologist, 41*(2), 111–127. https://doi.org/10.1207/s15326985ep4102_4.

Jenkins, H. (2006). *Convergence culture: Where old and new media collide*. New York: New York University Press.

Kuhlthau, C. C. (1991). Inside the search process: Information seeking from the user's perspective. *Journal of the American Society for Information Science, 42*(5), 361–371. https://doi.org/10.1002/(SICI)1097-4571(199106)42:5<361::AID-ASI6>3.0.CO;2-#.

Kuhlthau, C., Maniotes, L., & Caspari, A. (2012). *Guided inquiry design: A framework for inquiry in your school*. Santa Barbara, California: Libraries Unlimited.

Kuhlthau, C. C., Maniotes, L. K., & Caspari, A. K. (2015). *Guided inquiry: Learning in the 21st century* (2nd ed.). Santa Barbara, CA: Libraries Unlimited.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge [England]: Cambridge University Press.

Luokkala, B. B. (2014). *Exploring science through science fiction*. New York: Springer.

Maaß, K., & Artigue, M. (2013). Implementation of inquiry-based learning in day-to-day teaching: A synthesis. *ZDM - The International Journal on Mathematics Education, 45*(6), 779–795. https://doi.org/10.1007/s11858-013-0528-0.

Miller, A. (1990). *The drama of the gifted child*. New York, NY: BasicBooks.

Lead States, N. G. S. S. (2013). *Introduction: Executive summary. Next generation science standards: For states, by states*. Washington, DC: The National Academies Press. Retrieved from https://www.nextgenscience.org/sites/default/files/Final%20Release%20NGSS%20Front%20Matter%20-%206.17.13%20Update_0.pdf.

Reiser, B. J., & Tabak, I. (2014). Scaffolding. In R. K. Sawyer (Ed.), *The Cambridge handbook of the learning sciences* (2nd ed., pp. 44–62). New York, NY: Cambridge University Press.

Renninger, K. A., & Bachrach, J. E. (2015). Studying triggers for interest and engagement using observational methods. *Educational Psychologist, 50*(1), 58–69. https://doi.org/10.1080/00461520.2014.999920.

Renninger, K., & Hidi, S. (2011). Revisiting the conceptualization, measurement, and generation of interest. *Educational Psychologist, 46*(3), 168–184. https://doi.org/10.1080/00461520.2011.587723.

Renninger, K. A., & Hidi, S. (2016). *The power of interest for motivation and engagement*. New York, NY: Routledge.

Renninger, K. A., & Riley, K. R. (2013). Interest, cognition, and the case of L- and science. In Kreitler, S. (Ed.). Cognition and motivation forging an interdisciplinary perspective. Cambridge: Cambridge University Press. 352–382.

Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. New York: The Guilford Press.

Senko, C. (2016). Achievement goal theory: A story of early promises, eventual discords, and future possibilities. In K. R. Wentzel & D. B. Miele (Eds.), *Handbook of motivation at school* (pp. 75–95). New York: Routledge.

Shaffer, D. W. (2004). Pedagogical praxis: The professions as models for post-industrial education. *Teachers College Record, 106*(7), 1401–1421.

Shernoff, D. J. (2013). Chapter 3: The nature of engagement in schools. In D. J. Shernoff's (Ed.), *Optimal learning environments to promote student engagement* (pp. 47–69). New York: Springer.

Shernoff, D. J., Abdi, B., Anderson, B. G., & Csikszentmihalyi, M. (2014). *Flow* in schools revisited: Cultivating engaged learners and optimal learning environments. In M. J. Furlong, R. C. Gilman, & E. S. Heubner (Eds.), *Handbook of positive psychology in schools* (2nd ed., pp. 211–226). New York: Routledge, Taylor & Francis.

Stewart, P., Frakes, J., Spiner, B., McFadden, G., Dorn, M., Burton, L., et al. (2013). *Star trek, the next generation*. [Television series]. Paramount Pictures Corporation.

Strati, A. D., Shernoff, D. J., & Kackar-Cam, H. Z. (2018). *Flow*. In R. J. R. Levesque (Ed.). *Encyclopedia of adolescence*. Switzerland: Springer. 1–14. Retrieved from: https://link-springer-com.proxy.libraries.rutgers.edu/referenceworkentry/10.1007/978-3-319-32132-5_173-2

Balancing Competing Goods: Design Challenges Associated with Complex Learning

Aatish Neupane, Kira Gedris, Jason K. McDonald, Derek L. Hansen, and Jonathon Balzotti

Introduction

Educational designers often wrestle with a long-standing tension from the history of education: How might we teach a domain so it is understandable for novices, without oversimplifying it to the point that it is no longer true to the underlying subject matter? This tension has emerged in interesting ways in our recent work on designing instructional simulations. While we believe this is an essential issue for all educators, it has become especially important in our work to prepare students for careers in technical, collaborative, and creative work environments. On the one hand, it would be easy to overwhelm students with the complexity and nuance common to the professional environments for which they are being prepared. On the other hand, simplifying the learning environment could be misleading and leave students unprepared for the legitimately difficult assignments they will be responsible for when they start a job. While there are general principles that have been explored in the literature about how educational designers might balance this tension (e.g., National Academies of Sciences, Engineering, 2018), translating these general guidelines into practice is a challenge (McDonald & Gibbons, 2009).

In this chapter, we report some of the difficulties we have encountered as we have attempted to design simulations that are authentic to a professional environment while also adequately scaffolding learning tasks so they are both achievable and motivating for students (Newmann & Wehlage, 1993). We specifically report

A. Neupane (✉) · K. Gedris · D. L. Hansen
School of Technology, Brigham Young University, Provo, UT, USA

J. K. McDonald
David O. McKay School of Education, Brigham Young University, Provo, UT, USA

J. Balzotti
College of Humanities, Brigham Young University, Provo, UT, USA

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*, Educational Communications and Technology: Issues and Innovations,
https://doi.org/10.1007/978-3-030-85078-4_14

our study of these tensions in the context of adding an ethical dilemma to a cybersecurity simulation. While the dilemma had some of the results we hoped for (with evidence suggesting that experiencing the consequences of a poor choice within the safe environment of the simulation taught at least some students lessons that would help them in professional practice), we encountered a number of design challenges as we pursued this admittedly modest aim. But we believe there is value in being open about the struggles we experienced. Design is not a simple process of making clear-cut choices in light of perfect information. It requires trade-offs, moving forward with fragmentary data, and often only being able to adjust after one has experienced the consequences of previous decisions (Nelson & Stolterman, 2014). In the absence of explicit and rational standards for navigating these tensions, stories of how designers cope in individual cases can serve as a source of practical wisdom for others attempting to address similar challenges (Yanchar & Faulconer, 2011).

We tell our story in three parts. First, we describe our simulation and the ethical dilemma we added. Second, we report our findings about students' responses to the dilemma. And third, we discuss the challenges we encountered, and some implications of these challenges, for the broader goal of designing learning environments that are both authentic to a subject matter domain and that also support students in their learning tasks.

Background and Context

Simulating Professional Practice Through Playable Case Studies

The simulation we describe was designed to provide students a focused cybersecurity experience, introducing them to the penetration testing (pentester) process and context. We call our simulation a playable case study (PCS) (Balzotti et al., 2017), which is a type of experiential simulation (Gredler, 2004) and epistemic game (Shaffer, 2005; Shaffer, 2006) designed to help players better understand and make connections between the skills, knowledge, identity, dispositions, values, and epistemology unique to a profession. PCSs allow players to take on the role of a professional before they have the expertise to do so in a professional setting. The Cybermatics PCS was built with the aim to help students develop their skills, increase cybersecurity self-efficacy, and help them decide whether cybersecurity is a good career choice for them or not (McDonald et al., 2019; Giboney et al., 2019). It is designed to be a 1–2 hour in-class or at-home activity for Information Technology and Cybersecurity majors taking an introductory class. Findings from our research showed that the PCS was successful in reshaping how students viewed the cybersecurity field and increasing students' interest in this field (Giboney et al., 2019; Winters et al., 2020) (Fig. 1).

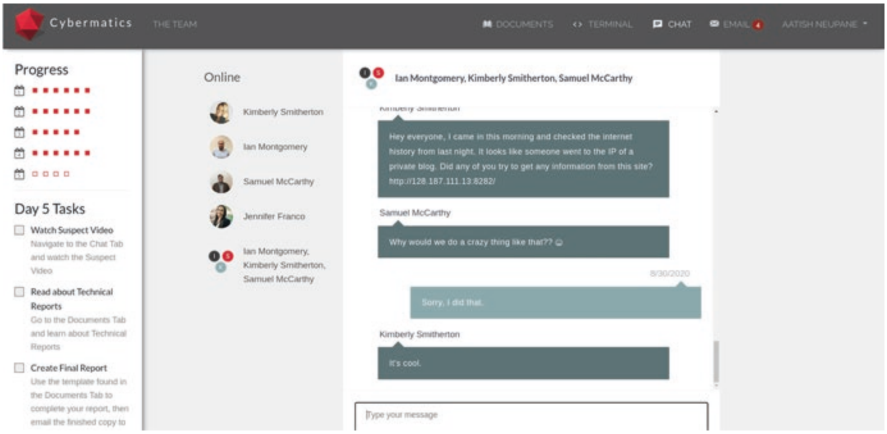


Fig. 1 Cybermatics chat interface showing the player chatting with fictional team members

The PCS allows students to take on the role of a junior cybersecurity professional as they conduct investigations based on evidence and clues associated with cyber intrusion incidents. Players complete 5 virtual days (average of 20 min each) as a new employee of the fictional Cybermatics cybersecurity company. Cybermatics has students perform a penetration test for a fictional company (RipTech) in order to find vulnerabilities in the system, which RipTech can then fix. Utilizing narrative elements from “who-done-it” mysteries, the student and fictional Cybermatics team members investigate the breach, collect and submit evidence, and, in the process, identify a cyber-criminal who planted a “backdoor” into the system.

Students receive tasks and report their progress to their fictional project manager, while interacting with other fictional Cybermatics’ team members who share their own findings and advice, and model positive and negative behaviors (which are identified as negative by the project manager and dealt with appropriately). Communication occurs through a realistic, yet simplified interface modeled after a corporate Intranet that includes email and group chat, which includes embedded emails. Dialog with fictional characters uses a chatbot system with time-released messages and responses based on messages sent from the player. The goal of the interface is to be as authentic as possible while also simplifying things and allowing students to easily track their progress.

Assignments, forensics tools, and educational scaffolding are integrated into the online simulation. The project manager assigns tasks for each of the simulation days (e.g., performing SQL injection, cracking passwords, searching for hidden files, writing email updates). Once completed, students click a “move to next day” button, which triggers the release of new content including new tasks, multimedia, chat messages, email messages, etc. Educational scaffolding is incorporated through character chat messages, a terminal “cheatsheet” with context-based hints, and Cybermatics documentation on topics relevant to the simulation.

Previous Work on Ethical Dilemma in Instructional Context

Ethical decision-making is an important part of cybersecurity careers but is underemphasized in cybersecurity education (White et al., 2013). Many current security curriculums only cover technical topics while not providing necessary philosophical background to students (Kwiatkowski, 2019). Although there is no hippocratic oath for cybersecurity professionals, it is implied that they make ethical decisions in stressful and morally troubling scenarios. One main challenge for cybersecurity educators is to integrate this expectation of ethical behavior as a core learning objective. Researchers acknowledge that introducing ethical reflection into a field that is perceived as purely technical is of critical importance (Blanken-Webb et al., 2018). However, introducing students to ethical dilemmas in authentic ways can be challenging, particularly in specific contexts such as cybersecurity education where research on novel approaches is limited. Blanken-Webb et al. developed a case study based cybersecurity ethics curriculum where students are given various case studies and they have to work through those dilemmas (2018). While this is a promising approach, there are many opportunities for novel approaches, such as the one outlined in this paper, which has students react to an ethical situation without knowing they are facing an ethical dilemma ahead of time.

Improving the PCS with a New Dilemma

After achieving early positive results from the simulation (see Giboney et al., 2019; Winters et al., 2020), we decided that designing additional complexity into the gameplay would provide further opportunities for students to experience the working environment of a pentester. We did this by adding an ethical dilemma: Would students violate the scope of their agreement with RipTech if a trusted colleague asked them to do so in the "service" of catching the bad guy? Although not going forward with the colleague's request is a clear solution to this problem in the eyes of experts, we frame this as an ethical dilemma specifically for novice learners as they are less aware of this fact and likely to have conflicting morals. The scenario we designed began after the penetration test findings were handed over to federal investigators (because the student found evidence of federal crimes perpetrated by the alias Kosmo). Sam, the pentest's social engineer, messaged the group chat, asking students to check for a private message he sent them. Students who read their messages found a request from Sam to look into a suspicious blog Sam had found (see Fig. 2).

This dilemma is found in the seemingly simple request to further investigate Kosmo, a hacker the team discovered. But if they had earlier read their scope document carefully, they should have noticed that using credentials found in the course of their investigation to try and access the blog is out of scope (see Fig. 3). Additionally, because they had already found evidence of illegal activity, they had

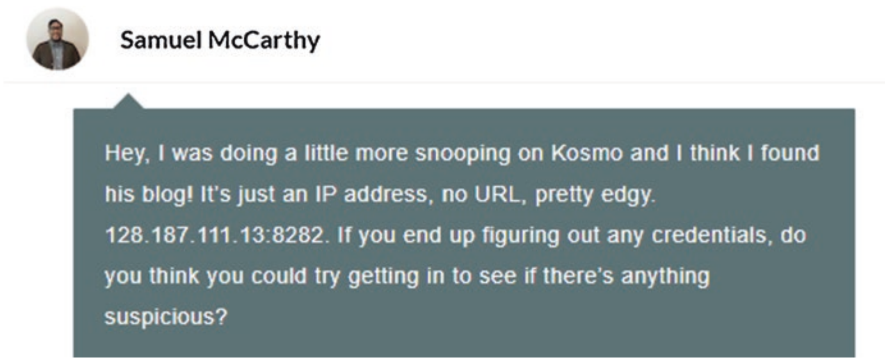


Fig. 2 Private message from Sam

Out of Scope:

- Breaking and Entering
    - This includes lock picking, destruction of RipTech property, and entry by violent means
- Accessing Unapproved Sites
    - Accessing any sites other than those listed above with credentials found during this penetration test

Fig. 3 Actions explicitly mentioned as "out of scope" in the scope document for the penetration test with RipTech that students sign off on early in the simulation

been directed to stop their work so agents could investigate. If students turn down Sam's request, he replies back that he knew the implications of what he asked. But if students agree, Sam does not mention either of these issues that make his request problematic.

The next simulated day, Kimberly (the students' supervisor) sends a group chat asking if anyone accessed the blog Sam found. If students report they did not, Kimberly is relieved and explains that doing so could have led to a lawsuit or jail time. So even if students are innocent (or, perhaps, if they visited the site but lied about it), they still receive instruction on this important topic. If students confess they did visit the blog, Kimberly replies with a similar message that also summarizes the mistakes students made, and, to reinforce the seriousness of the issue, directs them to email HR to explain why they acted as they did (see Fig. 4).

Playtesting the Dilemma

Our enhanced version of the Cybermatics PCS with this dilemma was used in our entry-level IT & Cybersecurity (IT&C) course at Brigham Young University (BYU), a required class for all IT & Cybersecurity majors. Some students in these classes already have a technical background and skills that could impact their experience,

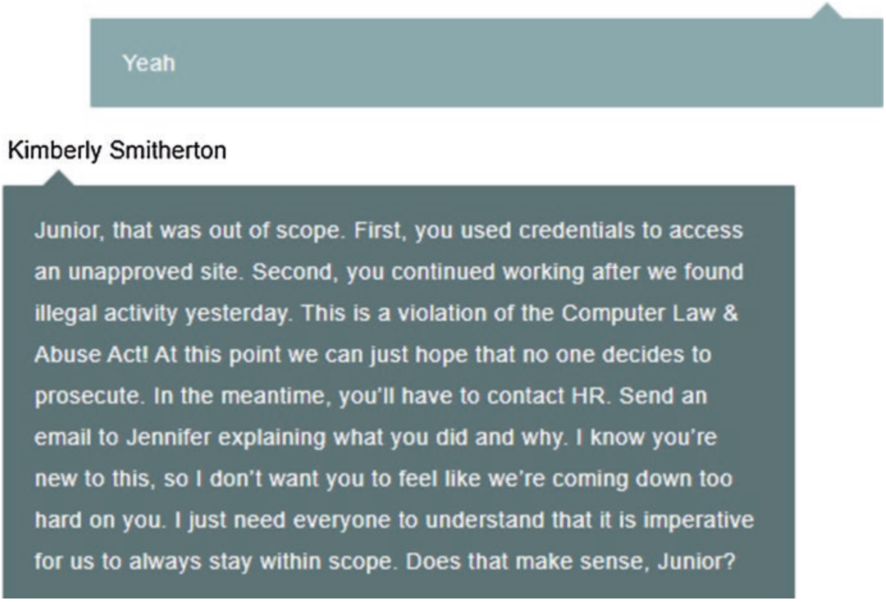


Fig. 4 Kimberly explains consequences for violating scope

while others are new to much of the material. Data from two classes (one per semester) was collected and analyzed, with a total of 54 (53.5% of class) students in the first class and 18 (37.5% of class) students in the second who gave permission to use their data. To analyze how students responded to the dilemma, their chat logs and emails sent through the system to other game characters were collected and coded for the following outcomes:

- Went out of scope – Yes/No.
- Lied about scope breach – Yes/No.

Two researchers independently coded the data and discrepancies on coding that arose due to unclear and indirect student responses were resolved through discussion until consensus was achieved.

Results of the Dilemma

Out of the student data analyzed (n = 72), 29% (21 students) went out of scope, while 69% (50 students) did not (we could not determine the outcome for one student). Of those who went out of scope, 19% (4 students) lied to Kimberly about it whereas 81% (17 students) did not.

Among the students who did not go out of scope, many did not reply at all when Sam asked them to breach scope. Of these, some ignored his request, while others may never have seen his message in the first place. But some students were very explicit with Sam about why they would not help out. One told Sam, “let’s stay in the scope,” and another told him, “no, sorry man I’ll let the feds do that.”

When Kimberly asked if anyone had breached scope, students responded in various ways. Some took it as a chance to reaffirm their commitment to the scope, represented by one student who replied, “we didn’t. The URL was found, and, while we considered trying to crack into that, we decided not to as it was outside the scope document. Trust us, Kimberly, we know where the limits are.” Other students took responsibility for their action and admitted their failure to stay in scope. One student wrote:

> I went outside the scope of the project and used credentials found on [RipTech’s] servers to access information about the malicious user we found. I did not pay proper attention to the guidelines of the scope and fell in violation of this. I am very sorry, it will never happen again.

Also apologizing, another student said:

> I wasn’t thinking and immediately went on to access the site, using these credentials which I had found, which was clearly against what I should have been doing. I apologize; it won’t happen again.

Some students, alternatively, tried to place blame on Sam, the character that encouraged them to breach scope, with phrases like, “Sam told me to” or “Samuel gave me the address and told me to check it out.” Some even implicated Sam more directly, by at least insinuating that he was the culprit. One student reported, “Samuel went to the site you mentioned,” while another said, “I didn’t but Samuel might have.”

The emails students sent to HR provide further evidence of the results the dilemma had for students, indicating that it was in fact a learning experience for them to fail in the safe environment provided by the simulation. This was evident in emails like the following:

> After completing day 4, Samuel reached out to me with an IP of a person we can assume to be the creator of a back door in RipTech. I realize this was out of scope and that criminal prosecution may take place, but I take full responsibility.

Design Challenges

While we are pleased with the general direction of these results, they did not come without challenge to our design process. First, was a tension between making the ethical dilemma visible (i.e., discoverable) while also not prompting or priming students to take action. It was difficult adding an unexpected activity into a simulation that had an already structured way of informing students of actions to take. How could we make the situation findable as well as present it as an actual possibility students could take, without listing it explicitly as one of the tasks that they had to complete (e.g., “Day 4: Respond to Sam’s Shady Request”)? Our solution was for students to get an unexpected chat from Sam, but this solution is not without its own difficulties. We soon realized that we were unable to draw a clear connection between the results of the ethical dilemma and our intended outcome. If students do not respond, is that because they knew it was wrong, or because they did not notice it while wrapping up their other tasks? How many of the two-thirds of the students who did not respond did so because our implementation was too subtle? Conversely, if students do breach the scope, is it possible they could feel a social contract had been violated because it was presented in such a nonstandard (perhaps in their view even underhanded) way? One student raised this possibility when he mentioned how it was unfair that the first time he was told that, "accessing a different site was bad [was when] I was getting called out for it."

While we are sensitive to these students' reactions, at the same time the learning outcome toward which we are aiming requires some sense of unexpectedness (e.g., part of the authenticity of the situation is that ethical dilemmas do not typically announce themselves as such). While it can be challenging to design dilemmas that are both authentic and sensitive to students' expectations, if they are avoided completely, students may only learn them through trial and error, on the job when the stakes are high. So we encourage designers to iterate through multiple trials if necessary to find solutions that achieve some measure of balance, for instance, like our current plans to add a debrief session after-the-fact for students to process the dilemma, such as an in-class reflective discussion about the situation (similar to how participants might be debriefed after a psychology experiment). Even though the simulation itself may not be the place to reveal the challenge we were exposing to students, a quick debrief might still preserve their trust in their teachers and the simulation as a learning experience.

It was also difficult to add the dilemma without violating students' expectations for schoolwork. There can be a tension between student expectations about traditional classroom assignments and more open-ended contexts provided by simulations like Cybermatics. In our simulations, we try to immerse students in situations that encourage them to explore richer contexts. This ethical dilemma is a good example; responding to Sam does not help them complete an explicit assignment, and, as we described above, labeling it as an assignment changes the nature of the instructional activity. But students often approach school assignments with a how-fast-can-I-get-this-done mentality. When they bring a get-it-done mentality to the simulation, they are less likely to follow up on the planted cues, possibly seeing them as frustrating "extra work." In our context, it was not clear how many students exhibited an ethical choice to not respond versus how many tried to get their schoolwork done as efficiently as possible. Instructors can promote rich engagement by explaining the unique nature of these experiential learning activities and grading them in ways that encourage exploration more than simply completion. For example, they can introduce the idea that if students are not thoughtful and reflective about their early actions, they may encounter points of failure later on.

Of course, in all of these situations, we recognize the common wisdom of conducting formative evaluation in nondestructive settings before implementing new features, such as a usability test on the dilemma's discoverability, or playtesting the dilemma to calibrate its results. And certainly, we have seen the value of this ourselves as well as being aware of its value in other settings. But this solution brings still additional challenges given the time and resource demands on our team. Given that we do not have the resources to both fully test new ideas and support the existing uses of the simulation at the same time, do we not implement anything new until the all too rare occasions arise that allow us to test them to the point that we can be absolutely sure? Or do we take a risk that, given the results of what small evaluations we could perform along the way, the chances of catastrophic mistakes are small enough that we can recover if we find out in implementation that something did not go as planned?

We saw an innovative opportunity to include an ethical dilemma into our existing cybersecurity simulation and decided to take it. Although we knew the process of adding a feature that hasn't been thoroughly tested would bring on challenges, the results were insightful. Instructional designers have to deal with this need to experiment with new content all the time, and thus we hope that our experience will serve as a form of design knowledge to help them when they find themselves in similar challenges which are not artifacts of us following a haphazard process but rather an intrinsic problem associated with instructional design. The formative evaluation we conducted has helped us identify questions that instructional designers can ask themselves when they find themselves in situations similar to ours. How can spontaneous events (e.g., an ethical dilemma) be introduced into a simulation without priming students that they are coming? How can a balance be struck between authenticity and simplicity in complex learning environments? How can students be motivated to take complex learning activities seriously in an educational environment with expectations for more traditional assignments? While we don't have the ultimate answers to these issues, we hope that our experience working through them will help inform other educational designers grappling to create complex and authentic educational experiences.

References

Balzotti, J., Hansen, D., Ebeling, D., & Fine, L. (2017). *Microcore: A playable case study for improving adolescents' argumentative writing in a workplace context*. In Proceedings of the 50th Hawaii International Conference on System Sciences.

Blanken-Webb, J., Palmer, I., Deshaies, S. E., Burbules, N. C., Campbell, R. H., & Bashir, M. (2018). A case study-based cybersecurity ethics curriculum. In *2018 {USENIX} Workshop on Advances in Security Education ({ASE} 18)*.

Giboney, J., Hansen, D., McDonald, J., Jonathan, B., Tanner, J., Winters, D., & Bonsignore, E. (2019). *Theory of Experiential Career Exploration Technology (TECET): Increasing cybersecurity career interest through playable case studies*. In Proceedings of the 52nd Hawaii International Conference on System Sciences.

Gredler, M. E. (2004). Games and simulations and their relationships to learning. In M. Spector, M. D. Merrill, J. Elen, & M. J. Bishop (Eds.), *Handbook of research on educational communications and technology* (pp. 571–581). New York: Taylor & Francis.

Kwiatkowski, I. (2019). We need to talk–opening a discussion about ethics in infosec. Virus Bulletin.

McDonald, J. K., & Gibbons, A. S. (2009). Technology I, II, and III: Criteria for understanding and improving the practice of instructional technology. *Educational Technology Research and Development, 57*(3), 377–392.

Mcdonald, J., Hansen, D., Balzotti, J., Tanner, J., Winters, D., Giboney, J., & Bonsignore, E. (2019, January). Designing authentic cybersecurity learning experiences: lessons from the cybermatics playable case study. In *Proceedings of the 52nd Hawaii International Conference on System Sciences*.

National Research Council. (2000). How people learn: Brain, mind, experience, and school (Expanded edition). National Academies Press.

Nelson, H. G., & Stolterman, E. (2014). *The design way: Intentional change in an unpredictable world*. Cambridge, MA: MIT Press.

Newmann, F. M., & Wehlage, G. G. (1993). Five standards of authentic instruction. *Educational Leadership, 50*(7), 8.

Shaffer, D. W. (2005). Epistemic games. *Innovate: Journal of Online Education, 1*(6), 2.

Shaffer, D. W. (2006). Epistemic frames for epistemic games. *Computers & Education, 46*(3), 223–234.

Winters, D. M., McDonald, J. K., Hansen, D. L., Johnson, T. W., Balzotti, J., Bonsignore, E., & Giboney, J. S. (2020). The playable case study: An online simulation for skill and attitudinal learning. In B. Hokanson, G. Clinton, A. Tawfik, A. Grincewicz, & M. Schmidt (Eds.), *Educational technology beyond content* (pp. 127–140). Cham: Springer.

White, G. L., Hewitt, B., & Kruck, S. E. (2013). Incorporating global information security and assurance in IS education. *Journal of Information Systems Education*, *24*(1), 11–16.

Yanchar, S. C., & Faulconer, J. E. (2011). Toward a concept of facilitative theorizing: An alternative to prescriptive and descriptive theory in educational technology. *Educational Technology, 51*(3), 26–31.

Two Culturally Situated Instructional Design Cases for Beginner English Language Learning in Haiti

Anuoluwapo Brahim, Adriana Vianna, and Suzanne Ensmann

This chapter reflects on the design and development process of two e-learning modules, the ABC Lesson and Color Crew, by describing the steps we used to develop them. We started with analyzing the target audience who are the underserved elementary pupils in Haiti and later applied learning theories to design relatable modules for the children. Offered as a real-world opportunity in an Instructional Design and Technology (IDT) university class, we (two graduate-level students) participated in this activity to be included in the University of Tampa Research Innovation and Scholarly Excellence (RISE) grant. Having served in Haiti after the 2010 earthquake, the class professor selected Christian Action and Relief for Haiti (CARHA), as they focused on a goal for education.

Some of the strategies that will be elaborated upon will be one such as the use of a culturally situated persona, 9-year-old Roseline (a common Haitian name), and familiar objects to contextualize the module to the Haitian environment and engage the learners. Rather than use mere text, it has been observed that learners can relate better with characters to build emotional connection (Pappas, 2016). According to Gawliu Jr. (2014), the more learners identify with a character, the more they will care about the content, and be self-driven to learn and remember. In other words, learners can be more involved and better motivated to retain information through the use of an e-learning module persona noted children learn best when instruction is built on prior knowledge. Since elementary age learners often struggle with abstract concepts, there is a need for culturally situated persona (familiar name and resemblance) and objects they have seen around them.

A. Brahim (✉) · A. Vianna · S. Ensmann
The University of Tampa, Tampa, FL, USA

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*, Educational Communications and Technology: Issues and Innovations,
https://doi.org/10.1007/978-3-030-85078-4_15

Literature Review

Analyzing the Target Audience

By using the Successive Approximation Model (SAM), we gathered information on the learners' characteristics in order to design effective e-learning modules that will be engaging and motivating. Based on our professor's recent visit and observation in Haiti and issues raised by prior studies highlighted in this section, the target audience for the modules was selected.

The education sector in Haiti lacks the quality and access necessary for sustained social and economic development (USAID, 2016). Less than 60% of first-graders will reach sixth grade, fewer than two-thirds of them sit for the end of sixth-grade examinations, and, among those, only three quarters pass the examination (Échevin, 2017). Possible causes of these results are the lack of teaching materials (Luzincourt & Gulbrandson, 2010). With these existing challenges affecting the education sector, many children struggle to learn another language, including the underserved. Furthermore, the problem with the language of instruction in the early years of education is the outdated learning methodologies, especially for the underserved children who do not have the financial ability to pay for private education (Luzincourt & Gulbrandson, 2010). In the absence of a functioning system of public schools, religious communities and private operators have become the main providers of educational services (Salmi, 2010).

Therefore, the target audience for the e-learning modules were:

- Primarily, the underserved children in Haiti.
- Elementary pupils ranging from ages 5 to 9.
- Children with limited or no literacy skill.
- Pupils with little to no knowledge of basic technology skills.
- Learners with interest in learning English as a second language skill.

Jean Piaget Learning Theory and Successive Approximation Model

Students learning a second language move through five different predictable stages and learners characteristics on second language acquisition: pre-production (minimal comprehension), early production (using key words and familiar phrases), speech emergence (producing simple sentences), intermediate fluency (excellent comprehension), and advanced fluency (near-native level of speech) (Hill and Flynn 2006). With this in mind, we observed the target audience through Zoom meetings, consisted of learners within the pre-production and early production stages in regards to the English language. Hence, we decided to use Jean Piaget's theory (2013), which focuses on understanding how children acquire knowledge and understanding the nature of their intelligence. In addition, the learners range from age 5 to 9 years and Piaget's theory can be applied across respective age groups since it deals with cognitive development across ages.

Piaget's four levels of cognitive development (Cherry, 2019) were used as guides to design the e-learning modules. Generally, cognitive learning theory focuses on different kinds of memories and motivations (Sengupta, 2019), helping students to explore and understand how ideas are connected.

The preoperational stage is the emergence of language. At this stage, children learn through pretend play and still struggle with logic. Children begin to think symbolically and learn to use words and pictures to represent objects (Cherry, 2020). Therefore, this stage was considered in designing the ABC lesson by introducing each alphabet with different images of some common objects in Haiti and a child-voice actor that pronounces to motivate learning.

While at the concrete operational stage, children tend to struggle with abstract and hypothetical concepts. Their thinking becomes more logically inductive and organized. Therefore, the Color Crew module was designed to introduce colors using most objects learners have seen in their environment, such as yellow banana, a green palm tree, red hibiscus, and so on. To further support learners' concrete thinking, there is an evaluation exercise that encourages them to explore the colors of objects around their classroom or outside.

In spite of criticisms, this theory has had a considerable impact on our understanding of child development (Cherry, 2019). Major criticism is related to the nature of a stage theory. For instance, Weinsten (1992) says Piaget may have underestimated young children's development. Bower (1982) and Harris (1983) conducted research that found that some children develop object permanence (e.g., if you place a toy under a blanket, the child who has achieved object permanence knows it is there and can actively seek it) earlier than Piaget thought. Others point out that preoperational children may be less egocentric.

However, Piaget's theory of demarcating developmental stages provided us with guidance on the order children develop, that is, a way to analyze the learners and design relative learning content. Therefore, the preoperational and concrete operational stages informed the application of relevant content at each phase of the project following the Successive Approximation Model (SAM) (see Fig. 1).

SAM is a good design model for small agile projects that do not require a lot of complicated technology (Allen & Sites, 2012; Herrholtz, 2020). Similar to the Analysis Design, Development, Implementation, and Evaluation (ADDIE) model, which begins with the analysis phase, SAM begins with a preparation phase. During this phase, we collected background information on learners, such as prior knowledge. As the project moves into the iterative design phase, the team becomes smaller and is narrowed down to subject matter experts and project designers for project planning and additional designing. Once the team has an agreed-upon design, the project then moves into a constant loop of developing, implementing, and evaluating (Herrholtz, 2020). SAM utilizes a more iterative process that emphasizes prototyping. It guided us to assume that stakeholders will change their minds about the learning content, its structure, and who will be included in the group of learners.

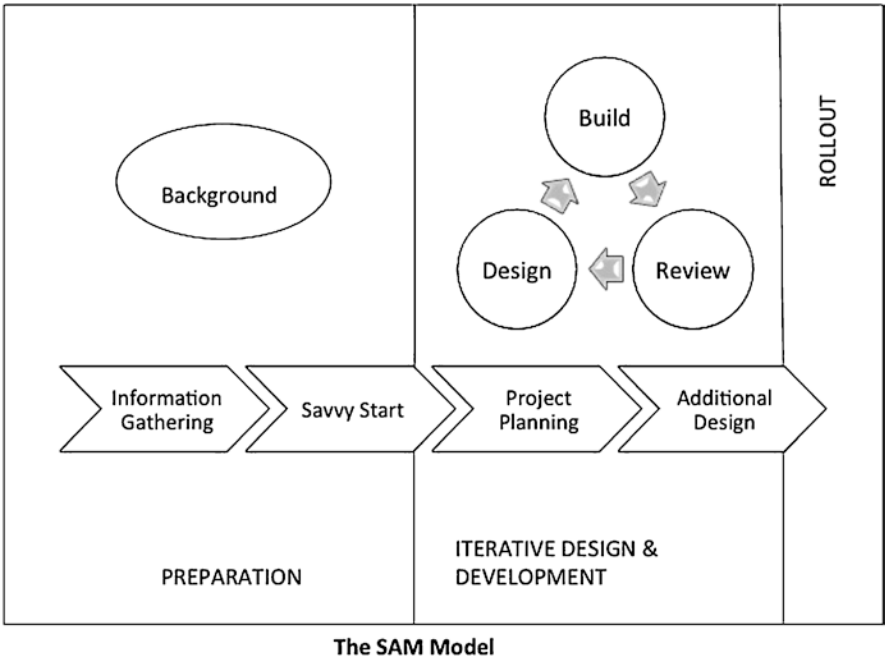


Fig. 1 The Successive Approximation Model (SAM) (Allen, 2012)

Some of these changes were made through an iterative process, for example, ease of navigation, additional images to support visual learning, and more. With this model, collaboration is crucial to prevent potential problems (Allen & Sites, 2012).

We used the basic instructional design SAM to work on the modules with an iterative approach while using design strategies supported by prior studies.

Instructional Design Strategies

Games are generally designed to encourage engagement, and with the growing use of digital devices, it provided an opportunity for us to incorporate some game features. These features were supported by prior studies as highlighted in this section.

Salen and Zimmerman (2003) and Mayer (2014) highlight the importance of engagement in games. Engagement relates to how players experience a game (Ravaja et al., 2005), how they feel connected emotionally and cognitively to a game's features, and how they act within a game to achieve their goals (Csikszentmihalyi, 2008: van Reekum et al., 2004). Therefore, game-based learning can simply be defined as games designed to aid learning.

Game-based learning research suggests that the following strategies improve the effectiveness of instruction (Plass et al., 2020, p. 14).

- Using personas.
- Incorporating instructions directly into gameplay of interactives (vs. being offered as an additional screen).
- Collaborating and reading aloud improves the construct of the language.
- Read-aloud activities.

Prensky (2011) also suggested that game features can provide the entertainment part of the educational design needed to engage learners. Examples of most widely adopted game elements for the gamification of learning are achievement elements (progression), such as badges, certificate of completion; it motivates continued effort, provides a social status element, and signals achievement (Jackson, 2016).

Accessibility features such as closed captions are also critical. Closed captioning adds value to video by enhancing the learner's experience while providing support for hearing impaired students (Taylor, 2019). He further stated that closed captioning or video transcriptions help students comprehend the course content and ensure compliant inclusive design (Taylor, 2019):

> Adding closed caption enhances learning for students with English as a second language. Captions can provide a powerful search capability, allowing users to search the caption text to locate a specific video, or an exact point in a video. They are also useful for people learning to read or learning English as a second language (Mt. SAC Library, 2020).

Another feature is the use of voice acting to promote learners' engagement. A study explored the use of a series of animated videos to teach advanced accounting to 254 undergraduate students at an Australian university over two semesters (Liu & Elms, 2019). It further explored the specific aspects of animation design that were most effective in achieving the pedagogical objective of engaging students. The question asked: What do you find to be the most memorable aspect(s) of the animated videos? The animations included a series of options for multiple selections, including voice acting, character design, dialogues, visual cues, graphics, background or set design, and music and scoring. Based on the survey responses from this study, 39% (n = 144) found the voice acting to be the most memorable aspect of the animated videos.

An additional feature in designing an e-learning module includes navigation. We considered avoiding restriction on the navigational slides as to concentrate mainly on the content, thereby making the interactive user-friendly. The usability of e-learning courseware depends on a number of properties (Koohang, 2015). Koohang summarized and outlined a number of usability properties for e-learning courseware design. These included usability properties, such as simplicity, recognition, comfort, user friendliness, control, and navigability. The study was to assess predictors of success in e-learning courseware usability among subjects who were undergraduate students studying in an online information technology program in a mid-sized higher education institution in the Southeastern United States.

Applied Design

Design

The ABC Lesson design was focused on the late preoperational (ages 5 to 7) theory (Piaget, 2013) to help the learners understand the world through language and mental images. For example, the display of images and the child voice actor repeats its name three (3) times because repetition is fundamental for children on the preoperational stage of development. The Color Crew lesson was designed using objects and persona that are familiar to the late preoperational learners and concrete operational (age 7 to 11) stages of development. This is with a goal to make it logical while also presenting primary and secondary colors in different categories, and a supporting slide for learners to see the colors of objects either peculiar to Haiti or of interest to their age.

Based upon the design strategies, our aim was to design lessons that would effectively, inclusively introduce ESOL to elementary school-age children using closed captions, familiar objects from their cultural context, and a persona with a name that is common in Haiti. All of this was achievable with a focus on the target audience, with an aim to make them comfortable to approach each lesson with enthusiasm while learning. In a condensed summer class, the graduate students had 3 weeks to develop a sample of the modules and to show the stakeholders in Haiti. There was a virtual walkthrough with the stakeholders on the final version of the lessons, and it was received with excitement.

Rather than follow the box-in nature of the ADDIE model, the graduate students engaged the SAM model because it served as a rapid design and development model to create flexible projects. It also enabled us to create a smaller chunk of the project, allowing for end-users to provide feedback through the comment section of each slide on the Articulate Storyline tool and also by email. Captions were integrated into both of the digital interactives as a user-selectable option (closed) and could be toggled on and off by the user via a button on the player interface. Design decisions also included voice acting in the design of the digital interactives.

To work on the e-learning modules, the first step was to interact with the learners via Zoom meeting and review of English as a second language (ESOL) materials provided by a nonprofit serving student in Haiti. The essence of this step was to gather information on the learners, prior learning materials they were exposed to, and deduce the skills and/or opportunities they need to acquire at their level. The booklet used to teach English was from 2008, provided to teachers only, and was copyrighted so that content could not be used. With the support of ESOL subject matter experts at the university, CARHA (stakeholders of the nonprofit organization the modules were being designed for), instructional designers, and the project manager of the grant, it was possible to brainstorm and outline learning objectives to meet the learners' needs. This was a quick and savvy start in order to establish the project foundation otherwise known as the preparation phase.

The next was the iterative design and development phase. At this phase, we developed a prototype, and all the stakeholders involved analyzed each module, provided feedback, and reviews were made. During the development phase, a complete version (alpha) evolved into a beta, i.e., after feedback through a formative evaluation on aspects like design build, grammar, and so on. And finally, the product was rolled out (after another evaluation called beta step) for learner's use. The content of the modules was guided using Piaget's cognitive theory (2013), while the Successive Approximation Model (SAM) guided the steps to the design process (see Table 1).

Development

The ABC Lesson and Color Crew are two important lessons to support learners' navigation through the pre-production stage on second language acquisition. The goal is to use the interactive lessons to promote English language among young Haitian children and increase their interest in learning English as a second language. For instance:

- Using personas: Roseline is a persona used in Color Crew because it is one of the most common names in Haiti, and the intended goal was to provide a potential user with the visual sense of who the target audience is right from the first slide and to appeal to the audience in order to connect upfront. According to Malamed (2019), although there are ongoing debates about the use of persona in user experience circles, it helps while designing to keep the audience characteristics in mind, more like having an imaginary friend.
- Incorporating instructions directly into the gameplay of interactives (vs. being offered as an additional screen): Greene (2014) states that incorporating instructions directly into the interactives is an illustration of explicit instruction, which is aimed at modeling the task directly in order for learners to follow along and succeed easily. For example, each alphabet in ABC Lesson was pronounced

Table 1 Design process of the ABC and Color Crew modules following SAM

Steps	SAM design phase	Design process of the e-learning modules
1.	Preparation	- review of existing ESOL materials - interaction with learners to assess prior knowledge - savvy start
2.	Iterative design and development	- involved stakeholders, e.g., ESOL SMEs, instructional designers, Grant project manager - outlined learning objectives - developed prototypes guided by Jean Piaget's preoperational and concrete operational theories - stakeholders review back and forth - alpha and beta tests

Final e-learning modules of ABC and Color Crew rolled out about three times for clarity and also matched with different images for identification.

- Collaborating and reading aloud improve the construct of the language: Working on a collaborative instructional design team provides a meaningful professional learning and academic development opportunity (Brown, 2013). The use of different voice actors to design the ABC lesson provided learning from different skills.

- Read-aloud activities: Research on the effectiveness of using reading aloud technique toward English as foreign language (EFL) beginners found that students with low proficiency in English developed their understanding gradually in a form of pronunciation, reading new words, encountering unfamiliar sentences, and increasing students' confidence in reading (Ninsuwan, 2015). Both e-learning modules considered this technique to spur learners' confidence to pronounce words as they hear them. More so, practice makes perfect.

In order to keep the target audience engaged following Prensky (2011) argument on using game elements as a motivation, to ensure learners complete the lesson, and possibly retake as much as needed for retention and application, the designers considered incorporating game elements such as a completion certificate at the end of Color Crew lesson (see Fig. 6). Another element of design consideration was the use of voice acting from different characters in both cases to keep the learners engaged.

Formative Evaluation Testing

A survey designed to rate the interactives and its content were used to provide a formative evaluation on both lessons. The scales ranged from 1 (Unsatisfactory) to 2 (Satisfactory) to 3 (Very Satisfactory) on a 3-point scale. Further elaboration of how this instrument was developed is simultaneously under peer review to be published in the *Tech Trends* journal.

Case 1: ABC Lesson The objective of the ABC lesson was to provide a foundation to form words using the correct pronunciation of each alphabet letter. This is fundamental to teach a new language to children. The first step was to select pictures to which the children could relate (see Fig. 2.).

To capture the attention of the learner, voice actors volunteered and were selected based on their relatability with the children. First, a 6-year-old girl was selected as she demonstrated an enthusiastic, child-like voice; she was also fascinated with the possibility of helping Haitian children to speak English. Another voice actor was selected to repeat the alphabet sounds. Each provided the learners with two different consistent roles, one being the adult voice to offer instructions, while the child motivated the learner to repeat pronouncing the alphabet letters. It is speculated that the presence of human agents in interactive e-lessons promotes learners' engagement and helps create a more motivating effect (Baylor & Ryu, 2003).

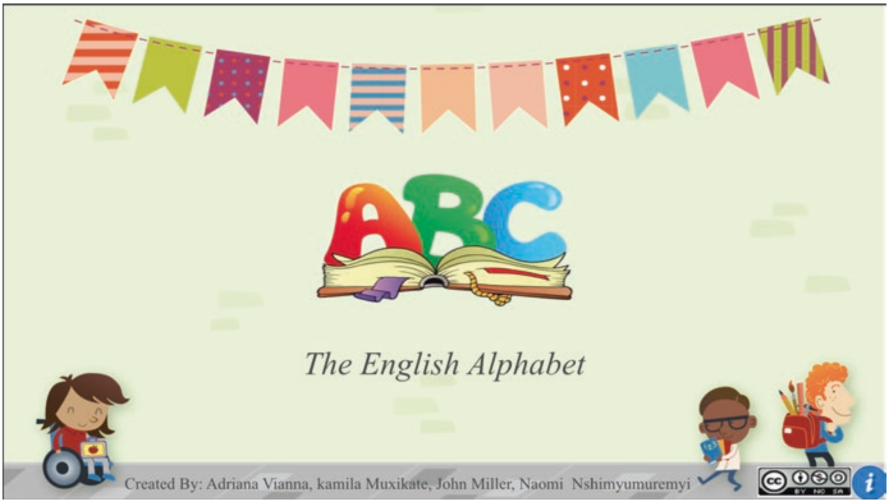


Fig. 2 Home screen of ABC lesson

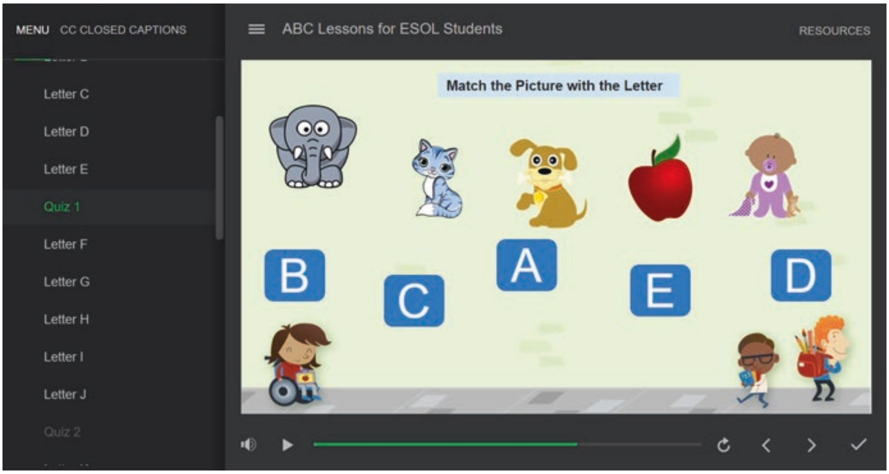


Fig. 3 ABC lesson quiz 1 connecting pictures with the letters

Furthermore, the lesson has five quizzes learners can take to show that they can connect some alphabets to their respective sounds and words (see Fig. 3). This practice gives base to ESL learners to start speaking the language.

Case 2: Color Crew The second e-learning module begins with an illustration of a relatable character for children in Haiti. The character "Roseline" was designed to be a 9-year-old girl who lives with her mother, father, four siblings, and a niece in *Cite Soleil*, one of the poorest neighborhoods in Port au Prince, Haiti. Her house consists of one main room in which they sleep, cook, watch TV, do homework, and pray as a family together.

Roseline wakes up at 8:00 a.m., brushes her teeth, and gets dressed. After that, she walks a half-mile to the nearest fountain from her house to get water so she can take a shower and get ready to go to school. At 11:00 a.m., she leaves home and walks through her neighborhood on her way to school. During her 40-min walk, she sees children playing with their kites, others playing soccer, and vendors selling food on the sidewalks.

Roseline loves school. Her teacher, Mr. Pascal, does the best he can to teach 50 students of different ages and academic levels in the wall-less classroom and dirt floor. After 2 h of lecture, she eats lunch and goes to recess. Her favorite game to play is hide-and-seek. While playing, Roseline asks herself what if she could hide someplace else? What if she could travel or live in a different place, city, or country? Roseline knows that in order to travel to another country, it would be helpful to speak English. However, Roseline's family cannot afford private English lessons. Without the incentive of a few nonprofit local programs that keep children out of the street and teach children dance, arts, sports, and language, it would be impossible for Roseline to learn English and dream about traveling tomorrow.

Color Crew has a cover screen that allows a learner to type in their name for personalized use, with a child actor's voice to motivate the learner during the introduction of the lesson. Design decisions included using the persona with a common Haitian girl's name and resemblance (see Fig. 4). All features are fully functional on both computer and mobile devices.

In the beginning of the lesson, she (Roseline) introduces colors in two main categories of primary and secondary colors. Each category of color takes a specific shape to introduce the concept of shapes. While each color is pronounced through interactivity, the triggered motion path allows each color to fall from a height and drop into a container commonly used in Haitian villages and mountain houses.

An additional slide was added to help the learner relate colors to objects commonly seen in Haiti using interactive markers to images (see Fig. 5). A hover function on each marker reveals the name and sound of each object. The practice section was deliberately designed to provide feedback with no score rating in order to encourage the user to try again after a failed attempt without feeling intimidated. Finally, the user gets a printable personalized child-friendly certificate (Fig. 6).

Formative Evaluation Results

Formative observations were completed by 19 graduate students to test the design aspects of the modules. The major barriers to testing the modules with the target audience were participants' limited access to technology tools (e.g., a computer or tablet), the distance between Haiti and the United States (US) for direct testing, and the need for parental consent, hence, the need to improvise using graduate students.

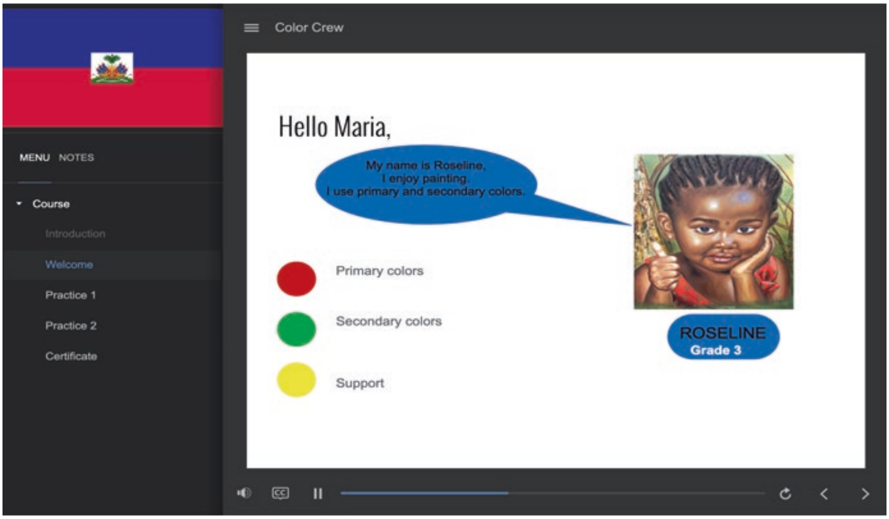


Fig. 4 Color Crew lesson screen reflecting contextualization of child persona

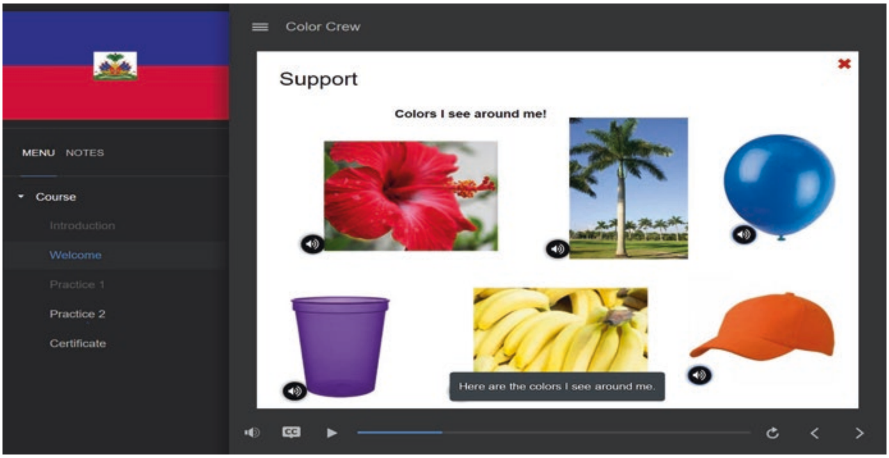


Fig. 5 Color Crew support slide showing objects relatable to the learners

The graduate students observed the functionality of the modules. Their evaluation was fundamental to make sure the relevant elements were working. Observations included a lack of emotional reaction despite the colorful pictures and the importance of more practice. Revisions made included having a child sound out the alphabet letters, and at least two different images were added to each alphabet letter to help learners visualize and recognize an object or an animal's name using their first letter.

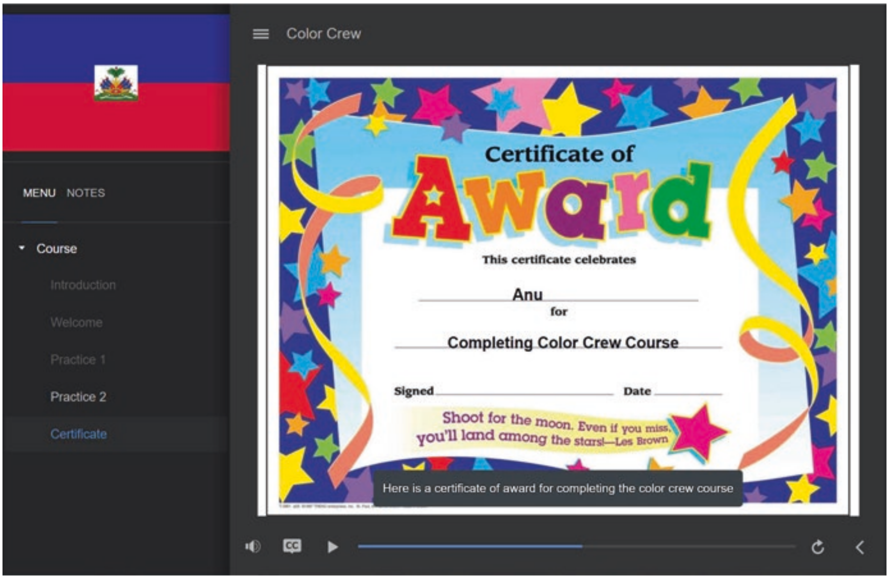


Fig. 6 Color Crew lesson completion certificate for learner motivation

A formative evaluation survey was used to test the module design and content. Subject matter experts, including representatives from the organization the modules were being delivered to, and university educators completed the survey. Table 2 reflects the results on a 3-point scale whereby (1) was unsatisfactory, (2) was satisfactory, and (3) was excellent.

Both lessons (as shown in the tables above) were scored satisfactory to excellent in all the categories. And based on the evaluation result, the lessons were reviewed and simplified for clarity, ease of use, and navigation. For instance, rather than use the "Start" or "Begin" button, it was reworded as "Go." Each slide was allowed to automatically move to the next without restraining the seekbar. That way, a potential user with little to no exposure to technology usage would find the navigation user-friendly.

Discussion

The formative evaluation survey provided critical feedback to improve each e-learning module. Lessons learned included using a child's voice to enable the target audience to easily connect to the instruction. Two pictures for each alphabet letter were also necessary to help the learners visualize, recognize, and apply them to an object or animal's name accordingly.

Other design decisions, such as a virtual character in the Color Crew lesson, were designed to influence the digital interactive setting in the context of emotion and

Table 2 Data result of formative evaluation survey of content (c) and design (d) for ABC lesson and Color Crew

#	Formative evaluation survey of the e-learning modules	The ABC lesson Mean	Standard deviation	Color Crew Mean	Standard deviation
1c	A. Recognition of the symbol: Colors and letters are clearly recognizable	3.00	0.00	3.00	0.00
2c	B. Identification of symbol meaning: Letters or colors are clearly connected to form meaning	3.00	0.00	3.00	0.00
3c	C. Pronunciation of symbol: Audio offers clear pronunciation for letters or colors	2.67	0.47	3.00	0.00
1d	Design build and quality: All interactivity, functions, links, buttons, states, and menus work	2.33	0.47	3.00	0.00
2d	Grammar and writing: All content is grammatically correct and in a legible format	2.67	0.47	3.00	0.00
3d	Engagement: Content includes interactive elements	2.67	0.47	3	0.00
4d	Cultural contextualization: Content is designed with context and images that the audience is familiar with	2.67	0.47	3	0.00
5d	Accessibility: Multimedia available (audio narration, images, text)	3	0.00	3	0.00

motivation since that makes learning effective. Using different motivational strategies such as persona, badge (in ABC lesson), personalized completion certificate (in Color Crew lesson), different voice actors, and contextualized images to the target audience community are some of the techniques that were integrated to provide the user with a relatable experience—and also with the bid to connect theory to practice at learner's pace. Although the Color Crew exposed learners to different colors, the use of shapes for the different colors was a way to introduce basic shapes as a future topic that will be included in future modules. In doing so, learners have some familiarity with shapes.

Presently, 20 tablets were delivered to support learners' use of the entire product, while learners (n = 7) assessed the two modules and selected an average of 4.7 stars on the 1–5 scale (One star is poor. Five stars is great). We observed the learners' excitement as they explored the modules and followed their teacher's guide to use the tablet functions.

Hopefully, the instructional strategies and design decisions we have highlighted will support instructional designers interested in creating engaging and motivating content for the underserved, elementary age or non-native English speakers.

Conclusion

The instructional design strategies that were considered for these design cases to support the underserved elementary age in Haiti to learn ESOL were the use of persona, completion certificates, and closed captioning, incorporating instructions directly into the gameplay of interactives, collaborating and reading aloud to improve the construct of the language, and read-aloud activities and voice acting. The student designers found their efforts from this voluntary work to support the RISE grant project initiative to be valuable for real-world applications.

The COVID-19 pandemic delayed this project, but the University of Tampa RISE grant team eventually delivered the final academic product (including the modules) on 20 tablets to Haiti. With the ongoing restrictions to in-person classes, this made the delivery of the modules timely, supporting continuous learning for the learners. The design decisions and strategies discussed can be explored by other instructional designers to support learning in an informal setting.

The use of objects peculiar to Haiti and persona with the same resemblance are motivations for the target audience. The quiz allows multiple trials in order to encourage the learner to try again. We were also mindful of limited internet access and made provisions for the offline version of the modules to spare learners from the issue of affordability. This is a factor that may need to be considered when designing modules for learners living in rural or underserved populations.

To further strengthen the use of these design decisions, future opportunities include collecting and analyzing the data embedded as star ratings at the end of each module.

References

Allen, M. W., & Sites, R. (2012). Leaving ADDIE for SAM: An agile model for developing the best learning experiences. *American Society for Training and Development.*

Allen (2012). Advanced instructional design for successive eLearning: Based on the successive approximation model (SAM). International journal on eLearning. pp. 193. Reviewed by https://www.researchgate.net/publication/331829482_Advanced_Instructional_Design_for_Successive_ELearning_Based_on_the_Successive_Approximation_Model_SAM

Baylor, M, & Ryu, J. (2003). *The API (agent persona instrument) for assessing pedagogical agent persona*. Department of educational psychology and learning systems. Florida state university. Tech., Inst., Cognition and Learning, Vol. 2, pp. 291–314.

Brown, et al. (2013). Instructional design collaboration: A professional learning and growth experience. *MERLOT Journal of Online Learning and Teaching, 9*(3) *https://jolt.merlot.org/vol9no3/brown_0913.htm*.

Cherry, K. (2019). *Support and criticism of Piaget's stage theory*. Retrieved from https://www.verywellmind.com/support-and-criticism-of-piagets-stage-theory-2795460

Cherry, K. (2020). T*he 4 Stages of cognitive development.* Background and key concepts of Piaget's theory. Very well mind. https://www.verywellmind.com/piagets-stages-of-cognitive-development-2795457

Csikszentmihalyi, M. (2008), van Reekum et. al., (2004). Gameplay engagement and learning in game-based learning: A systematic review. p. 2. https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.947.4260&rep=rep1&type=pdf

Échevin, D. (2017). *Interventions to improve access, retention and learning outcomes in Haitian primary schools*, (p.14). https://www.copenhagenconsensus.com/sites/default/files/haiti_primary_education_-_english.pdf
Gawliu Jr. H. (2014). 6 tips on how to create characters in eLearning. Reviewed by https://elearningindustry.com/6-tips-create-characters-in-elearning
Greene, K. (2014). *Explicit instruction: What you need to know*. Retrieved from https://www.understood.org/en/school-learning/for-educators/universal-design-for-learning/what-is-explicit-instruction
Herrholtz, K. (2020, March 6). *Rapid instructional design with SAM*. E-learning industry. https://elearningindustry.com/sam-successive-approximation-model-for-rapid-instructional-design
Hill, J., & Flynn, K. (2006). *Classroom instruction that works with English language learners: Association for Supervision and Curriculum Development*. https://www.academia.edu/41411904/Classroom_Instruction_That_Works_With_English_Language_Learners
Jackson, M. (2016). *Gamification elements to use for learning*. https://trainingindustry.com/content/uploads/2017/07/enspire_cs_gamification_2016.pdf
Koohang, et al. (2015). Predictors of success in e-learning courseware usability design. *Issues in Information Systems, 16*(2), 116–122. http://www.iacis.org/iis/2015/2_iis_2015_116-122.pdf.
Liu, C., & Elms, P. (2019). Animating student engagement: The impacts of cartoon instructional videos on learning experience. *Research in Learning Technology, 27*, 15–20. https://journal.alt.ac.uk/index.php/rlt/article/view/2124/2511
Luzincourt, K., & Gulbrandson, J. (2010). *Education and conflict in Haiti: Rebuilding the education sector after the 2010 earthquake.* US Institute of Peace, 2010, www.jstor.org/stable/resrep12237
Malamed, C. (2019). *Learner personas for instructional design*. Retrieved from http://theelearningcoach.com/elearning_design/audience/learner-personas-for-elearning/
Mayer, R. (2014). *Computer games for learning: An evidence-based approach*. The MIT Press.
Mt. SAC Library. (2020, December 1). *Universal design for learning (UDL): Closed captioning*. https://mtsac.libguides.com/c.php?g=604857&p=4192181
Ninsuwan, P. (2015). The effectiveness of teaching English by using reading aloud technique towards EFL beginners. *Procedia - Social and Behavioral Sciences, 197*, 1835–1840. https://www.sciencedirect.com/science/article/pii/S1877042815042445.
Pappas, C. (2016). Developing eLearning characters: A quick guide for eLearning professionals. https://elearningindustry.com/developing-elearning-characters-quick-guide-elearning-professionals
Piaget, J. (2013). *The construction of reality in the child* (Vol. 82). Routledge.
Plass, J. L., Mayer, R. E., & Homer, B. D. (Eds.). (2020). *Handbook of game-based learning* (pp. 14–17). Cambridge, Massachusetts: The MIT Press.
Prensky, M. (2011). The effect of gamification on motivation and engagement. International journal of information and learning technology. p. 3. Reviewed by https://www.researchgate.net/publication/321063416_The_Effect_of_Gamification_on_Motivation_and_Engagement
Ravaja et al., (2005). Gameplay engagement and learning in game-based learning: A systematic review. p. 2. https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.947.4260&rep=rep1&type=pdf
Salen, K., & Zimmerman, E. (2003). *Rules of play: Game design fundamentals*. CITY? The MIT press (p. 80).
Salmi, J. (2010). Equity and quality in private education: The Haitian paradox. *Compare: A Journal of Comparative and International Education, 30*(2), 163–178.
Sengupta, D. (2019). How learning theories affect eLearning. https://elearningindustry.com/how-learning-theoriesaffect-elearning
Taylor, R. (2019, October 14). Guide to captioning and subtitling online courses & elearning videos. https://www.rev.com/blog/guide-to-captioning-and-subtitling-online-courses-elearning-videos
Weinten (1992), Criticism of Piaget's theory. A web page. https://www.massey.ac.nz/~wwpapajl/evolution/assign2/AWarren/crit.html

Analyzing Interdisciplinary Program Design Through the Lens of Complexity Theory

Iryna Ashby

Introduction

Practical publications on interdisciplinary program design often suggest that having dedicated faculty, proactive administrators, financial resources, and interested students would be sufficient for the success of an interdisciplinary program (e.g., Kelly, 2008). While these factors are important, cultural, structural, social, policy, pedagogical, curriculum, and visionary differences across structures and players of an education system end up being neglected (Jacobson et al., 2019; Marshall, 2006). In turn, these differences in systems and approaches result in the resilience of professionals and higher education institutions to change and in an intent to maintain the status quo, causing poor "survival" of interdisciplinary programs (Kester as cited in Cambridge University Press, 2020; Marshall, 2006).

To help administrators, program and instructional designers, as well as faculty interested in the design and implementation of interdisciplinary programs, I would like to review the importance of complexity theory in the interdisciplinary program design and how complexity theory is interwoven with an interdisciplinary approach.

Rising Popularity of Interdisciplinary Education

Today's graduates adopt a new career paradigm: frequently moving from job to job and acquiring new skills on-the-go. Even entering college is viewed as a "4-year career" that may or may not impact future job selection (Kamenetz, 2012). Eric

I. Ashby (✉)
Purdue University, West Lafayette, IN, USA
e-mail: iashby@purdue.edu

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*, Educational Communications and Technology: Issues and Innovations,
https://doi.org/10.1007/978-3-030-85078-4_16

Gentry, from the Institute for the Future, shares, “People are learning as they go and considering new avenues for their career in the process. This will have wide-ranging implications – on work and educational establishments” (Institute for the Future, 2018, p. 14). Attempts are made to flip classrooms, introduce technology, and apply problem-based learning, yet the challenge perseveres as the content is still delivered using disciplinary approaches that, in a way, groom students for a predetermined career (Arvanitakis & Hornsby, 2016).

While there is a strong desire to maintain the century-old tradition of disciplinary-based education (Baker & Däumer, 2015; Klein, 2006), universities need to respond to technological advancement, globalization, changes in the economic and societal needs, as well as demands of the labor market in their effort to give their graduates a competitive advantage, and, thus, attract more diverse and engaged students (Arvanitakis & Hornsby, 2016; Denman, 2005; Whitaker, 2018). One such change for higher education is broader implementation of disruptive educational approaches, like interdisciplinarity, as a way to give students an edge in their future careers (Haynes, 2017). Indeed, integration of the arts, humanities, and STEMM (science, technology, engineering, mathematics, and medicine) fields has shown positive results in terms of increased critical thinking and problem-solving abilities, higher-order thinking, deeper learning, content mastery and enjoyment of learning, teamwork, adoption of new tools to address problems, and “soft” skills at both undergraduate and graduate levels. It also allows new graduates to have a wider choice of employment as well as become more active and informed citizens and lead more enriched lives (National Academies of Sciences, Engineering, and Medicine, 2018). As a result, the popularity of interdisciplinary programs has been growing. Since 2003, the increase in enrollment in such majors has grown by 37% across US institutions of higher education (Whitaker, 2018). In 2016, over 96,000 degrees were awarded to students in interdisciplinary majors (DataUSA, n.d.).

Complexity Considerations in Design of Interdisciplinary Programs

Whether we try to alleviate disparities in a community, address organizational issues, or design a new program, it is beneficial to engage people with diverse backgrounds. People coming together, finding a common ground for partnership and collaboration, working through issues, and growing together as they gain experience and feedback from each other and the surroundings introduce aspects of complexity theory, namely, self-organization and emergence (Wolf-Branigin, 2013). Complexity has been part of the discussion on interdisciplinarity for decades. In their paper, Klein and Newell described interdisciplinarity as “…a process of answering a question, solving a problem, or addressing a topic that is too broad or complex to be dealt with c by a single discipline or profession” (1997, p.3). Indeed, Newell (2001) theorized that complexity is an integral part of interdisciplinarity (e.g., nonlinear knowledge that offers variable meanings under changing conditions). While there are different ways to explore interdisciplinarity, for the purpose of this paper, I subscribe to the categorization described in Holley (2017), where interdisciplinarity is viewed as an umbrella term that includes the following typological continuum (see Fig. 1; for more information on interdisciplinarity, typology, challenges, and process models, see Ashby & Exter, 2019):

- Cross-disciplinarity: Borrowing of tools, ideas, or theories mainly from neighboring fields.
- Multidisciplinarity: Integration of multiple disciplines but using a bird-view level of understanding.
- Transdisciplinarity: A synthesis of disciplines that allows creation of new conceptual frameworks and integrate disciplinary perspectives.

The first two types offer only slight discomfort when integrating in a traditional curriculum, mainly connected with the minor changes to the course design and potential co-teaching of some aspects of the course, while the onus is on the students to integrate such knowledge (Holley, 2017; Reynolds, 2012). Transdisciplinarity often requires a significant redesign that involves interprofessional and interdepartmental collaboration and may not fit into the boundaries of a traditional institution of higher education or departmental cultures and limitations (Exter et al., 2017; Holley, 2017).

While we may subscribe that the idea of interdisciplinary knowledge is complex, why would it impact an interdisciplinary program design? To better answer this question, let's start with its basic building blocks of interdisciplinarity – disciplines.

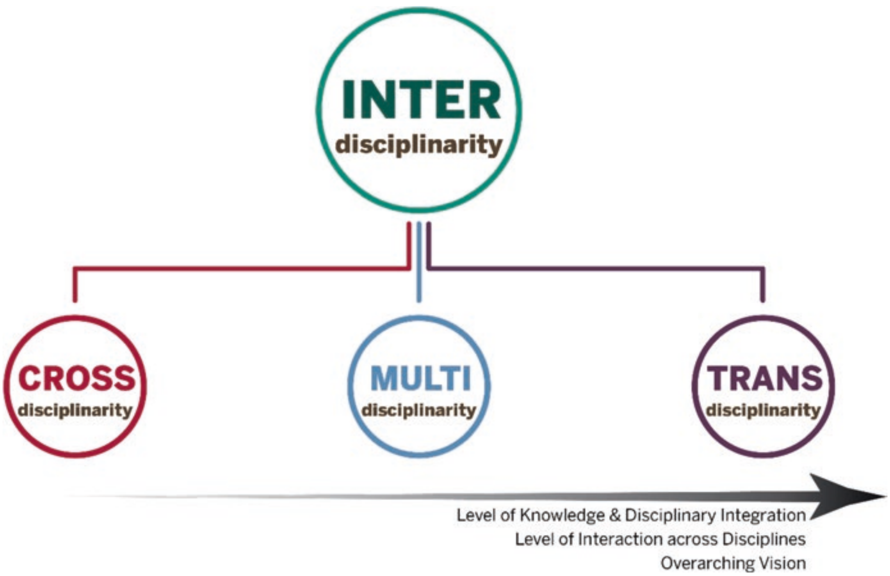


Fig. 1 Interdisciplinary typology

A discipline is a product and is formed on multiple levels: institutional, economic, and societal (Moran, 2010), each representing not only subjects covered but even behaviors or cultures exhibited by its representatives (Becher & Trowler, 2001; Krishnan, 2009; Moran, 2010). For example, the Biglan (1973) classification scheme remains one of the most cited classification systems of academic disciplines across areas of research in higher education and still holds true for the general distribution of disciplines (Becher & Trowler, 2001; Krishnan, 2009; Simpson, 2017). The scheme groups disciplines on a continuum of "hard-soft" and "pure-applied" with a description of epistemic beliefs and know-how. The classification shows discipline demarcations within their own scientific communities setting directions for rigor and units of scientific knowledge through scholarship and peer review of research (Aldrich, 2014). While this classification does not necessarily clearly categorize the complexity of academic disciplines (Becher & Trowler, 2001), it assists in identifying potential dimensions to be observed and thus to better understand epistemic, cultural, and pragmatic differences and challenges faced by representatives of these disciplines when coming together to create an interdisciplinary program (Fig. 2).

To be able to build an interdisciplinary environment that allows interdepartmental collaboration, faculty needs to traverse their own academic "territories" and often go against the culture that they have been part of since the early days of their graduate preparation (Becher & Trowler, 2001). While some educators are eager to work outside of disciplinary silos, others may feel that it means a decrease in the

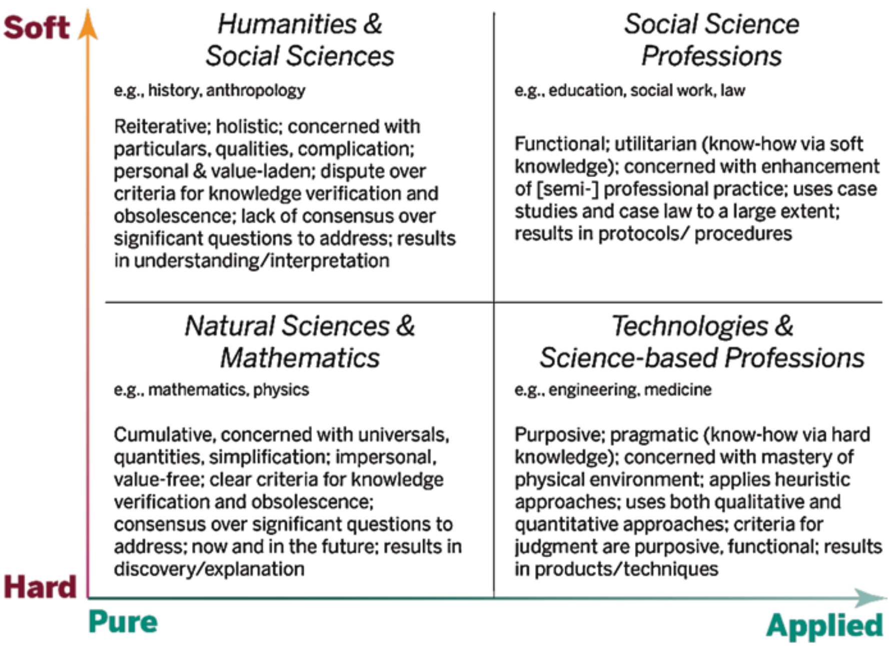


Fig. 2 Discipline classification scheme. (Adapted from Biglan, 1973)

offering of traditional courses that result in interdepartmental rivalries, yet others perceive it as a top-down approach that limits their freedom (Exter et al., 2017; Irani, 2018; Kandiko, 2012; Whitaker, 2018). Challenges exist on the institutional level as well – the traditional disciplinary-based environment is not friendly when it comes to disruptive innovations (Jacob, 2015).

Elements of an Interdisciplinary Program Design Framework: Through the Lens of Complexity

Using the framework described in *Harnessing Complexity: Organizational Implications of a Scientific Career* (Axelrod & Cohen, 1999), let's identify the key elements of an interdisciplinary program design framework.

Agents These are the range of stakeholders involved in program design and implementation, including but not limited to administrators, faculty, curriculum designers, instructional designers, students, as well as a range of officers and clerks from across diverse university systems (e.g., registrar office, bursar office, secretaries). These agents are semi-independent. In other words, while they have free will, and they often act within the boundaries of their own departments, rules, traditions, and external expectations. In addition, agents have their own interests and reasons for the involvement in the design of an interdisciplinary program, views for such a program, and ability to learn and change depending on the external and internal boundaries. For example, in prior research, we observed that humanities faculty felt their field was subservient to STEM when building a transdisciplinary program, which certainly would not result in desired program design outcomes (Exter et al., 2015, 2017). Additionally, the reasons stakeholders may want to join an interdisciplinary program will vary as well – from altruistic desire to improve the outcomes for students to more pragmatic reasons of career development or a new research and funding strand. While no reason is better than another one, it consciously or subconsciously impacts the behaviors of stakeholders.

Populations and Systems Agents can be grouped into populations of similar types (e.g., faculty) with similar strategies or views. In turn, a system is formed of one or more populations of agents. Same agents can belong to different systems (e.g., while a bursar officer may interact with a team designing an interdisciplinary program and provide their input, he/she also belongs to one or more other systems in similar or different capacities). It is expected that there is a variety of agents of different types within a population or system, which is one of the key pillars of a complex system. Agents may go through a selection (or even self-selection) process that may increase or decrease the diversity, which can have a strong impact on the outcomes of the project (i.e., if the majority of faculty members represent the same discipline, we may end up with a cross-disciplinary program). Such processes align with team establishment and the sense of whether stakeholders feel comfortable with the team and diversity of opinions or feel stifled by other team members. Additionally, it is important to note that the bottom-up emergence of such teams is preferable to a top-down administrative decision approach, which results in more positive outcomes (Cilliers, 1998; Wolf-Branigin, 2013).

Physical and Conceptual Space While agents may or may not be at the same location geographically or physically, it is the conceptual space (i.e., ways or strategies for agents to connect and interact) that may play a key role in interactions. The conceptual space is where I have seen most of the action happening: individual beliefs of faculty regarding the idea of interdisciplinarity, the impact of professional disciplinary background on pedagogies that could be used in teaching students, strong impact of signature pedagogies, and a lack of desire to step away and embrace other ways of problem-solving (e.g., Ashby et al., 2018; Exter et al., 2015, 2017).

Internal Diversity This pillar or condition for complexity is probably one of the most self-explanatory in terms of the benefit of which we can observe in any diverse team, like rich plentiful ideas, thinking outside the box, and many others. The diversity of members on an interdisciplinary program design team also makes a difference between a cross-disciplinary and transdisciplinary program. However, as discussed in the conceptual space section, the diversity without communication and co-construction of joint knowledge can be as harmful for program design.

Internal Redundancy This refers to duplications of some aspects and efforts needed for complex actions to allow for better interaction, more efficiency, broader perspectives, coverage of potential gaps, faster work completion (in some cases), and checks and balances. Lack of redundancy may result in poor adaptability and loss of robustness. For example, in one of the interviews with an interdisciplinary program coordinator, she mentioned that she is the driving force behind all the efforts of the program. When asked what will happen if she is not there, her response was sobering as she admitted that the program would probably fall apart as nobody else does what she does. However, it does not mean that a single person cannot design and implement a program (e.g., Lansiquot, 2016). The difference is that should this person no longer be there or have another person (even an administrative assistant) join in; it may have a significant impact (positive or negative) on the program outcome. Just like in a covered or timer-truss bridge, where the weight of a passing truck is distributed across all elements of the bridge, the weight of the program should also be distributed across many members.

Neighboring Interactions This refers to sharing ideas, queries, and approaches that are tightly connected with the notion of internal diversity and conceptual space. It is important to note, though, that it is not important for *all* agents to be in constant communication with each other or have a full picture of what is happening. It is through the neighboring interactions that the system keeps evolving.

There is one more notion – **enabled constraints** – that is key for any system. Such constraints allow for maintaining a balance between coherence (i.e., focus or purpose of a system) and randomness (i.e., heterogeneity of systems that have to constantly adapt to the ever-changing environment). Davis and Sumara (2006) note that complex systems, like education, are bounded by heuristics and rules that may arise from the context, existing structures, settings, or participating agents. Some of these rules are created to maintain boundaries (e.g., mission and vision of an organization), while others are placed externally (e.g., study conduct rules set by the Institutional Review Boards). Such constraints can change an interdisciplinary program significantly. For example, one of our earlier publications explained how the initial program design focused on badges and nonlinear progression of courses to gain transdisciplinary experience. Yet, at the end of the first semester, a significant problem emerged when exploratory students wanted to join a different program and needed to have grades and class standing that are traditional for a higher education system (Exter et al., 2019).

Implications and Recommendations

Why would simple recommendations like dedicated faculty, proactive administrators, sufficient budget, and interested students be insufficient to address complex challenges? To answer this question, I would like to refer to Patton's (2011) scheme for developmental evaluation of programs through complexity theory that includes three levels:

- **Level 1: Simple** – Refers to easy-to-follow instructions that will result in expected outcomes, like a time-tested recipe for a family night dinner.
- **Level 2: Complicated** – Refers to more expanded and interconnected that require knowledge and balance, like an architectural blueprint, which if followed correctly will result in a structure that can withhold the adversaries.
- **Level 3: Complex** – Where a combination of interconnected agents, nonlinear dynamics, added uncertainty may result in quite different outcomes. Look at any team, even if one person is replaced, the dynamics and the outcomes may shift significantly.

Recommendations like the above would fall somewhere between simple and complicated, but they envision a positive outcome each and every time it is applied. In my foray into interdisciplinary education, I have seen a clash of traditions and innovation, structural, cultural, and disciplinary silos, and strong intent of individual faculty to go outside the traditional disciplines, individual differences, preferences, and the need to respond to the market. This dissonance shows the delicate balance between faculty intent, reservations, and university support or lack thereof. There are eager faculty and staff across universities who want the best for their students, but still some programs succeed and prosper, while others terminate their existence.

In the past, we have explored models and best practices for interdisciplinary programs and ensuing collaboration (e.g., Ashby et al., 2018; Ashby & Exter, 2019; Exter et al., 2015, 2017). But the findings felt prescriptive and not necessarily comprehensive as they tend to apply a reductionist approach to boil down aspects of program design to foundational elements (Cilliers, 1998; Davis & Sumara, 2006). After all, even the best-laid plans often crash against the reality of human dynamics, learning and behavioral patterns, individual traits and characteristics, and directives of leadership. Additionally, in my earlier exploration of culture in an online environment (Ashby & Walker, 2015), I have explored how group engagement outcomes may change depending on the combination of people involved, perceived roles, and experiences. This can be true of any group, including faculty involved in designing a program. Thus, to gain a full understanding of why some programs may be more successful, while others may perish, it is important to consider this program from a holistic point of view that allows us to consider the roles played by diverse stakeholders, institutional and departmental cultures, and the environment – namely, complex level.

There are two key takeaways I would like to highlight:

1. When working in a complex system, we cannot expect that the recipe of success to be true for all. Even minor changes in the composition of a system (from stakeholder to strategy used) and external boundaries may result in completely different outcomes. However, we learn from the feedback we receive from each other and the environment and can adapt to the changes. Challenges met are not our mistakes, but rather learning opportunities to allow us to adapt. That is why it is important to accept them, embrace them, and adapt to them in order to develop new solutions.
2. To be successful, agents and the system itself need to be able to adapt. This can be achieved through promoting internal diversity but also internal redundancy. It is hard on a team if only one person has the tacit knowledge about the program, internal and external networks, and other key ingredients of the program design. Yet, it is not effective for everybody to possess the same knowledge as it can lead to information overload. Balance the communication but also support the building of internal "buddy system," where no load is too big for just one person.

References

Aldrich, J. H. (2014). *Interdisciplinarity: Its role in a discipline-based academy*. New York, NY: Oxford University Press.

Arvanitakis, J., & Hornsby, D. J. (2016). Are universities redundant? In J. Arvanitakis, & D. J. Hornsby (Eds.), *Universities, the citizen scholar and the future of higher education* (pp. 7–20). https://doi.org/10.1057/9781137538697_2.

Ashby, I., & Exter, M. (2019). Designing for interdisciplinarity in higher education: Considerations for instructional designers. *TechTrends, 63*(2), 202–208. https://doi.org/10.1007/s11528-018-0352-z.

Ashby, I. V., & Walker, V. L. (2015). Acculturation into a collaborative online learning environment. *AECT 38th Annual Proceedings, 2*, 199–205.

Ashby, I., Caskurlu, S., & Exter, M. (2018). Evolving roles of faculty at an emerging hybrid competency-based transdisciplinary program. *The Journal of Competency-Based Education, 3*(1), e01059.

Axelrod, R., & Cohen, M. (1999). *Harnessing complexity: Organizational implications of a scientific frontier. 9780684867175: Amazon.com: Books*. Retrieved from https://www.amazon.com/Harnessing-Complexity-Organizational-Implications-Scientific/dp/0684867176/ref=tmm_hrd_swatch_0?_encoding=UTF8&qid=&sr=.

Baker, W. D., & Däumer, E. (2015). Designing interdisciplinary instruction: Exploring disciplinary and conceptual differences as a resource. *Pedagogies, 10*(1), 38–53. https://doi.org/10.1080/1554480X.2014.999776.

Becher, T., & Trowler, P. (2001). *Academic tribes and territories : Intellectual enquiry and the culture of disciplines* (2nd ed.). Philadelphia, PA: Open University Press.

Biglan, A. (1973). The characteristics of subject matter in different academic areas. *Journal of Applied Psychology, 57*(3), 195–203.

Cilliers, P. (1998). *Complexity and postmodernism: Understanding complex systems*. New York, NY: Routledge.

DataUSA. (n.d.). Interdisciplinary Studies | Data USA. Retrieved November 28, 2019, from https://datausa.io/profile/cip/interdisciplinary-studies

Davis, B., & Sumara, D. J. (2006). *Complexity and education: Inquiries into learning, teaching, and research*. Lawrence Erlbaum Associates.

Denman, B. D. (2005). What is a university in the 21st century? *Higher Education Management and Polic, 17*(2), 9–28. Retrieved from www.muslimheritage.com/topics/default.cfm?ArticleID=161.

Exter, M., Ashby, I., & Shaurette, M. (2015). Entering the first year of a multi-disciplinary, hands-on, competency-based learning experience: Hopes and concerns of students, parents and faculty. *ASEE Annual Conference and Exposition, Conference Proceedings*, *122nd ASEE*(122nd ASEE Annual Conference and Exposition: Making Value for Society).

Exter, M., Ashby, I., Gray, C. M., Wilder, D. M., & Krause, T. S. (2017). Systematically integrating liberal education in a transdisciplinary design studio environment. *ASEE Annual Conference and Exposition, Conference Proceedings*, *2017-June*.

Exter, M., Ashby, I., & Cascurlu, S. (2019). Elusive expectations for a novel program design: Contrast between program intentions and student recruitment and retention. *Journal of Competency-Based Education*, *e1192*. https://doi.org/10.1002/cbe2.1192.

Haynes, A. (2017). In support of disciplinarity in teaching sociology: Reflections from Ireland. *Teaching Sociology, 45*(1), 54–64. https://doi.org/10.1177/0092055X16664397.

Holley, K. (2017). Interdisciplinary curriculum and learning in higher education. In Oxford research encyclopedia of education.

Institute for the Future. (2018). *The next era of human-machine partnership: Emerging technologies' impact on society and work in 2030*. Retrieved from http://www.iftf.org/fileadmin/user_upload/downloads/th/SR1940_IFTFforDellTechnologies_Human-Machine_070717_readerhigh-res.pdf

Irani, Z. (2018). The university of the future will be interdisciplinary. The Guardian, 24.

Jacob, W. J. (2015). Interdisciplinary trends in higher education. *Palgrave communications, 1*(1), 1–5.

Jacobson, M. J., Levin, J. A., & Kapur, M. (2019). Education as a complex system: Conceptual and methodological implications. *Educational Researcher, 48*(2), 112–119. https://doi.org/10.3102/0013189X19826958

Kamenetz, A. (2012). *The Four-Year Career*. Retrieved February 4, 2020, from Fast Company website: https://www.fastcompany.com/1802731/four-year-career

Kandiko, C. B. (2012, July). Leadership and creativity in higher education: The role of interdisciplinarity. *London Review of Education, 10*, 191–200. https://doi.org/10.1080/14748460.2012.691283.

Kelly, R. (2008). *Creating successful interdisciplinary programs*. Retrieved February 2, 2020, from Faculty Focus website: https://www.facultyfocus.com/articles/course-design-ideas/creating-successful-interdisciplinary-programs/

Klein, J. T. (2006). A platform for a shared discourse of interdisciplinary education 1. *Journal of Social Science Education © JSSE, 5*(2), 10–18. Retrieved from www.jsse.org.

Krishnan, A. (2009). *What are Academic Disciplines?* Retrieved from http://eprints.ncrm.ac.uk/783/

Lansiquot, R. D. (2016). Introduction: Designing and implementing interdisciplinary programs. In *Technology, Theory, and Practice in Interdisciplinary STEM Programs: Connecting STEM and Non-STEM Approaches* (pp. 1–7). https://doi.org/10.1057/978-1-137-56739-0_1.

Moran, J. (2010). *Interdisciplinarity: The new critical idiom* (2nd ed.). New York, NY: Routledge.

Marshall, S. P. (2006). The power to transform: Leadership that brings learning and schooling to life. San Francisco, CA: Jossey-Bass.

National Academies of Sciences, Engineering, and Medicine. (2018). The Integration of the Humanities and Arts with Sciences, Engineering, and Medicine in Higher Education: Branches from the Same Tree. Washington, DC: The National Academies Press. https://doi.org/10.17226/24988.

Patton, M. (2011). *Developmental evaluation: Applying complexity concepts to enhance innovation and use*. New York, NY: Guilford Press.

Reynolds, E. R. (2012). Creating cross-disciplinary courses. *Journal of Undergraduate Neuroscience Education, 11*(1), A72.

Simpson, A. (2017). The surprising persistence of Biglan's classification scheme. *Studies in Higher Education, 42*(8), 1520–1531. https://doi.org/10.1080/03075079.2015.1111323.

Whitaker, M. (2018). The 21st-century academic. *The Chronicle of Higher Education*. Retrieved from https://www.chronicle.com/article/The-21st-Century-Academic/242136

Wolf-Branigin, M. (2013). *Using complexity theory for research and program evaluation*. New York, NY: Oxford University Press.

Supporting Remote Learning Design at Universities: Lessons from China's EdTech Response to COVID-19

Linli Zhou and Na Li

Introduction

The ideas in this article emerged during the serious disruption caused by the COVID-19 outbreak in March when various schools and universities were shut down and forced to quickly adapt to remote learning. The disruption to education happened suddenly and progressed rapidly across the world. This study chose China as the focus of a case study because it has been impacted by the pandemic since December of 2019 and therefore had already experienced coping with educational disruption by the time other countries first encountered it in March 2020. Another important reason for analyzing China's educational technology (EdTech) response is because of the large number of Chinese students and teachers affected by the remote learning solution during COVID-19. For countries with large educational systems alike, China's experiences of their EdTech response might be a necessary reference, both for lessons to learn and problems to avoid. In our study, we focus on teachers and students at the microlevel to help improve learners' engagement in remote learning and to support teachers. In particular, we explored some EdTech design implications about how to build a remote community among learners.

L. Zhou (✉)
University of California, Los Angeles, CA, USA
e-mail: llz1722@g.ucla.edu

N. Li
Pennsylvania State University (University Park), State College, PA, USA

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*, Educational Communications and Technology: Issues and Innovations,
https://doi.org/10.1007/978-3-030-85078-4_17

How Did Schools in China Respond to COVID-19?

During the coronavirus pandemic, a considerable number of schools in China moved from traditional classroom teaching to remote learning and other video conferencing approaches (Huang et al., 2020). This study examined China's EdTech response to COVID-19 based on the Handbook issued by UNESCO and Beijing Normal University in March 2020. This is one of the few sources published so far that described how China maintained "undisrupted flexible learning" during the COVID-19 outbreak.

By analyzing several examples of the EdTech practices in China during the coronavirus outbreak in the Handbook (Huang et al., 2020), we found that China has been reporting itself as effectively supporting students' learning using the following strategies: (1) strong network infrastructure, (2) better learning tools, and (3) more open educational resources (OER). As a result, technology supports at a macro level, including infrastructure and OER, were blooming in China during the COVID-19 period. On the one hand, EdTech has been promoted widely in China to support learning design, which brought new implications to learning experience design for the future. That said, students and teachers still face several challenges, including the emphasis on technology level with an ignorance of issues at person levels.

From a survey of recent posts and news reports about teachers' responsibilities and needs in China, we found that those seemingly successful experiences of China underlie several problems and challenges. The major challenge is that a large volume of OER and robust technologies does not necessarily result in teachers and students making good use of the resources. For most resources, there is a lack of guidance and training for teachers and students. In other words, a large amount of OER will not make a difference to enhance students' remote learning if not offering support to the learners and teachers (e.g., training around OER search and usage and remote learning design) at the same time.

Focusing on the Difficulty of Learning Design

The 2020 coronavirus outbreak changed the traditional way of teaching and learning and challenged the definition of learning design – also known as instructional design or instructional systems design, with the goal of designing, developing, and delivering learning materials and experiences in a consistent and reliable fashion to support and engage learners efficiently and effectively in the process (Merrill et al., 1996). This definition of learning design reveals several important processes to focus on for teachers, including course preparation, learning process management, and delivery of instructional materials. Thus, the following section focuses on these processes, respectively, and reveals how the learning design has been challenged in COVID-19 for Chinese teachers and students.

Hu (2020) showed that compared to traditional face-to-face teaching, synchronous online teaching takes more effort for instructors. Instructors need to spend more time preparing for online teaching because the knowledge delivery is greatly different from how they teach in classrooms.

Besides the time-consuming preparation for online instruction, learning management is a challenge. Although instructors are using different platforms to help them manage the learning processes of their students, the fact that it requires students to switch back and forth frequently has caused confusion to both students and teachers. In the end, the lack of teaching/technology support for instructors has been one of the major problems, especially when, for the majority of teachers, it is the first time a teacher/instructor teaches online (Hu, 2020). Furthermore, technologies and software are not as reliable and effective as depicted in the previous report. In Wei and Liu (2020), teachers and students are reported to have technical problems such as freezing and crashing frequently, and this disrupts their teaching and learning.

A related problem is distraction. Though it seems positive when students are more active in responding to teachers through online chats, the distraction caused by hundreds of messages can lead to lower efficiency in learning (Hu, 2020). Meanwhile, it is hard to build learning communities online since students have more difficulty in staying connected. It has been found that students tend to suffer from a lack of community building with video conferencing classes compared to times with face-to-face interactions. Recent discussions have reflected that remote learning was challenging for teachers to efficiently engage students and to effectively develop a learning community (Hu, 2020).

After all, online teaching is not simply moving teaching materials online; it requires teachers to adjust their instruction methods to make the online teaching quality as good as what they do in the physical classrooms.

Tackling the Challenges

Learning design for remote settings was a major challenge during China's EdTech response during the COVID-19 pandemic. We reviewed literature from learning science and human-computer interaction, including literature published in CSCL (computer support for collaborative learning) and CSCW (computer-supported collaborative work) in recent years. We borrowed a conceptual synthesis of principles from human-computer interaction (HCI) to address the issues that teacher's learning design supports.

Suggestion One: Support Teachers for Better Remote Learning Design

Teachers' responsibilities for building remote communities and designing engaging learning are taken for granted, while it is actually a difficult task that needs professional support. Thus, our first and foremost suggestion is that teachers should not be the only one who take the responsibility of developing a remote community and helping students to engage in remote learning. Professional development around remote learning design has been lacking in China, and literature has not been investigated as to how to support Chinese teachers to teach effectively remotely. Thus, we call for building a teacher service team that consists of professional remote learning designers who understand HCI principles to offer necessary support with pedagogical strategies for remote learning. We believe this professional teacher-support team could (1) investigate the strengths and weaknesses of the learning system and (2) redesign a prototype of a remote learning system for a more connected remote learning community for Chinese students.

After reviewing relevant literature in the CSCL field, we found that several researchers studied how to support teachers to effectively teach remotely. For example, Leeuwen et al. (2013) discussed how to design supporting tools for teachers when they teach synchronously remote classes. Their paper shows teachers reaching students remotely focus mostly on cognitive activities instead of social activities. However, it is important for teachers to pay attention to students' social activities to promote collaboration with groups. Leeuwen et al. gave design suggestions to support teachers' remote teaching: (1) design tools to help teachers monitor the social activities of groups of students (p. 1384) and (2) design tools to support teachers who performed a lot of diagnosing interventions in remote teaching (p. 1385). The following section will expand the idea of social activities and interventions and discuss suggestions for improving learning engagement in remote settings.

Suggestion Two: Information Visualization and Communication Tools for Learning Engagement

In the past 20 years, scholars tended to report the benefits of online learning for learners with low access to educational resources (Finkelstein, 2006; Knox, 1997; Carville & Mitchell, 2000; Fetterman, 1996). However, these scholars only discussed the access to educational materials and learning opportunities, not how to help students stay engaged when learning online. Learning engagement is found to be important in helping increase the online course retention rates (OCRR), which is defined as "…students' persistence in a remote class." Studies also found that OCRR is related to students' feeling of social isolation (Astin, 1984), and the more students feel isolated, the more likely they will not persist in a remote class.

Aiming to improve the quality and the retention rates of remote learning, researchers in the HCI field examined design technology to build a remote community among remote learners. For example, Sun (2016) conducted a mixed methods research about how to use *interactive visualizations* to build a remote learning community. The interactive visualizations were designed to present students' identities and relationships with each other in a remote learning context (Sun, 2016). From the interactive visualizations, "students could identify more social space with multiple interpersonal connections they would otherwise not merely from the virtual avatars or screen names of people" (Sun, 2016, p. 104). Through using interactive visualizations, the learning systems could be integrated with better information visibility among learners to improve their interconnections (Sun, 2016).

To further explore learning design implications for the purpose of engaging students in remote learning, we turned to HCI literature and found that, when learning remotely, students rely heavily on communication tools that could enable them to discuss with other people through text or diagramming (Asterhan & Schwarz, 2010). Remote discussion could help students remain engaged in remote classes. Thus we recommend that, to engage students in remote learning, teachers could make information more visualized and take advantage of communicative tools, especially those embedded in a remote learning system that could promote students' discussion and, thus, their learning experiences. Teachers could give students more opportunities to interact with each other visually, such as developing visual expressions (e.g., diagrams) when presenting their ideas and opening their camera when possible to give a visual presentation of themselves. This would allow others to better understand their ideas with vivid facial expressions and body languages.

Discussion and Conclusion

Focusing on the learning design process of teachers, this chapter reveals several challenges to China's seemingly successful EdTech practices. During the EdTech responses to coronavirus, the technology side (increase the volume of open educational resources) has been emphasized, while the educational side (teachers as learning experiences designers) of remote learning practices has been underdeveloped. As a result, the effectiveness of those EdTech practices and the learning accomplished may be called into question. We recommend ways to support learning design from a perspective of learning engagement. We also suggest that professional remote learning support consisting of HCI designers could be built to enhance students' remote engaging learning experiences. These teams could provide pedagogical support and interface designs for student-centered design before class, interactive and engaging teaching during the class, and performance-based assessment after class, especially at a time of unexpected disruption.

With the findings of this study, school managers could better realize and support teachers' transition to a tech-savvy instructional environment under unexpected teaching disruptions. Teachers could work directly with professional HCI designers to learn strategies about how to design curriculums that fit the psychological and competency development of students and center their remote learning habits and features. Those suggestions may not just be meaningful for challenges reflected in China but also imply widely for other countries for enhancing the effectiveness of remote learning.

References

Asterhan, C. S. C., & Schwarz, B. B. (2010). Remote moderation of synchronous e- argumentation. *International Journal of Computer-Supported Collaborative Learning, 5*(3), 259–282.

Astin, A. (1984). Student involvement: A developmental theory for higher education. *Journal of College Student Personnel, 25*(3), 297–308.

Carville, S., & Mitchell, D. R. (2000). ‘It’s a bit like Star Trek’: The effectiveness of video conferencing. *Innovations in Education and Training International, 37*(1), 42–49.

Fetterman, D. M. (1996). Video conferencing on-line: Enhancing communication over the internet. *Educational Researcher, 25*(4), 23–27.

Finkelstein, J. E. (2006). *Learning in real time: Synchronous teaching and learning remote*. Jossey-Bass.

Hu, X. P. (2020). Analysis of the advantages and challenges of online teaching in colleges and universities during the COVID-19 epidemic. *China Higher Education Research*.

Huang, R. H., Liu, D. J., Tlili, A., Yang, J. F., Wang, H. H., et al. (2020). *Handbook on facilitating flexible learning during educational disruption: The Chinese experience in maintaining undisrupted learning in COVID-19 outbreak*. Smart Learning Institute of Beijing Normal University.

Knox, D. M. (1997). A review of the use of video conferencing for actuarial education—A three-year case study. *Distance Education, 18*(2), 225–235.

Leeuwen, A. V., Janssen, J., Erkens, G., & Brekelmans, M. (2013). Teacher interventions in a synchronous, co-located CSCL setting: Analyzing focus, means, and temporality. *Computers in Human Behavior, 29*(4), 1377–1386.

Merrill, M. D., Drake, L., Lacy, M. J., & Pratt, J. (1996). Reclaiming instructional design (PDF). *Educational Technology, 36*(5), 5–7. Archived from the original (PDF) on 2012-04-26. Retrieved 2011-11-23.

Sun, N. (2016). Enhancing visibility of distance learners to promote sense of community. *Proceedings of the 19th International Conference on Supporting Group Work*.

Wei, L. S., & Liu, J. H. (2020). How middle school teachers can realize the conversion from offline to online teaching under the epidemic situation. *Advances In Education, 10*(3), 297–300.

Mobile Simulation for Effective Classroom Management Skill Training for Preservice Teachers

Sanghoon Park, Jeeheon Ryu, Kukhyeon Kim, and Chaeyeon Kim

Conditions for Effective Training

Just as effective learning is essential for student achievement, effective teacher training is critical for high-quality teaching and classroom management practices. Effective training is particularly important as it results in changes in teacher practices and further improvements in student learning outcomes. Effective classroom management skills are especially necessary components in teacher preparation programs as they ensure that preservice teachers are exposed to classroom management content and evidence-based management practices (Freeman et al., 2014). Freeman et al. (2014) also noted that teacher preparation programs are not preparing preservice teachers to manage student behaviors due to a lack of exposure to classroom management situations. Hence, further study is needed to identify the effective methods for teaching classroom management skills to preservice teachers. In order to understand the conditions for effective training methods, the different natures of "training" and "learning" need to be understood. Attempting to discuss the concepts of training and learning for adult learners, Garavan (1994) introduced Rodgers'

S. Park (✉)
Department of Educational and Psychological Studies, University of South Florida, Tampa, Florida, USA
e-mail: park2@usf.edu

J. Ryu
Institute of Educational Research, Department of Education, Chonnam National University, Gwangju, South Korea
e-mail: jeeheon@jnu.ac.kr

K. Kim · C. Kim
Department of Education, Chonnam National University, Gwangju, South Korea
e-mail: 187106@jnu.ac.kr; 198389@jnu.ac.kr

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*, Educational Communications and Technology: Issues and Innovations,
https://doi.org/10.1007/978-3-030-85078-4_18

(1986) idea of training as having narrow goals and the "right" way to achieve goals while learning as having broad goals and recognizing various ways of thinking and doing. Jones (1994) further defined learning as acquiring what already exists, has been done, or has been said, which results in changes in behaviors, affective, structural, or physical in nature.

To identify key elements for effective teacher training, Darling-Hammond, Hyler, and Gardner (2017) reviewed 35 studies published from 2010 until spring 2017 and reported 7 elements of effective teacher training, which include (1) content-focused, (2) active participation, (3) collaboration, (4) modeling, (5) coaching/expert support, (6) feedback/reflection, and (7) sustained duration. The seven elements need to be considered and included in creating effective classroom management skill training.

Simulations for Classroom Management Training

According to the US Department of Education (2019), teacher turnover is a serious problem for school success. Attention to this issue is particularly important in the case of first-year teachers. A large body of research demonstrates that teachers in their first 3 years of the profession who are satisfied with their preparation and who receive support as they transition into the profession are less likely to exit the profession early (DeAngelis et al., 2013). Classroom management skills, collegial interaction, and collaboration skills have been identified as critical areas of focus to mitigate teacher attrition among new educators (Carver-Thomas & Darling-Hammond, 2017). Competencies in these domains (as well as many other pedagogic approaches) require mastering self-efficacy skills that can only be learned through authentic teaching practices. For this reason, current teacher education programs emphasize the importance of preservice teacher training through structured curriculum plans and having them ready for the unique opportunities and challenges that our schools provide (Cruz & Patterson, 2005).

To offer effective teaching and learning for diverse learners, well-managed classrooms are essential (Jones & Jones, 2013). A teachers' classroom and relationship management skills are key for student achievement (Kane et al., 2014). With rapidly changing instructional practices in the classroom, the demands for classroom management skills have been growing (Korpershoek et al., 2016). Therefore, teacher competencies need to be developed not only in the areas of subject matter and pedagogical knowledge but also in classroom planning and management skills. According to Scrivener (2012), classroom management is defined as "the way teachers manage students' learning by organizing and controlling what happens in their classroom" (p. 1). Effective classroom management improves student behavior through an ongoing interaction between teachers and students (Evertson & Weinstein, 2006), which requires preservice teachers to be more involved in classroom management practices. Current teacher preparation programs provide classroom education through methods courses and clinical application in school field settings, but classroom training lacks the necessary contexts for preservice teachers to practice and master competencies required for classroom management skills. Besides, in a national emergency situation such as the COVID-19 pandemic, preservice teachers face interruptions to their clinical practice experiences with limited on-site visits for clinical training.

One method that is useful in sensitizing preservice teachers to the issues of classroom management is to offer authentic practice opportunities that are almost unlimited within a virtual immersive simulation. Virtual teaching simulations have recently been highlighted as an innovative approach to provide more realistic environments for improving classroom teaching (Kaufman & Ireland, 2016). Virtual teaching simulation systems support preservice teacher training and classroom management skills by allowing users to interact with virtual student avatars using an authentic human-computer interface (Bradley & Kendall, 2014; Kaufman & Ireland, 2016). In addition, the immersive teaching experience can be instructed through various classroom situations with uniquely designed virtual students representing the cultural and linguistic diversity found in our local classrooms (Park & Ryu, 2019). The use of realistic teaching scenarios in a virtual teaching simulation provides a compelling practice of important skills needed for successful management practice in the classroom, including critical thinking, the use of responsive language, and effective decision-making. The virtual teaching simulation also offers opportunities for repeated practice and various simulated scenarios within which a preservice teacher can develop their self-efficacy with content and pedagogic mastery. Furthermore, the virtual simulation does not adversely affect vulnerable students (Carrington et al., 2011; Girod & Girod, 2006; Hixon & So, 2009).

During the past decade, research efforts have been made to examine the affordances and implications of virtual teaching simulations (Kaufman & Ireland, 2016). Widely used examples include *ClassSim*, an online simulation developed to train teachers to work with special needs students (Ferry et al. 2004, 2005); *SimSchool*, a web-based pre-service teacher training environment that offers teaching practice experiences (Badiee & Kaufman 2014; Christensen et al. 2011; Gibson, 2007); *Mursion*, a mixed reality-based learning environment that offers teaching practice experiences (Dalinger et al., 2020); and *Virtual PREX system*, a program that Australia research team created to offer professional training for preservice teachers through various role-play activities in the second life platform (Gregory et al., 2011). Recently, Park and Ryu (2019) introduced a mixed reality-based teaching simulation called *Simulation for Teaching Enhancement of Authentic Classroom beHavior Emulator (SimTEACHER)*. These simulations have been used in teacher preparation programs to offer preservice teachers unlimited opportunities to practice their teaching strategies and/or classroom management strategies by directly interacting with virtual students.

Need for Mobile Simulation

While a simulation program is a useful tool for preservice teacher training, using it on a mobile platform can expedite the integration of teaching simulations in teacher preparation courses. Simulations delivered in the form of mobile apps can uniquely offer easy access to simulation experiences. The growing use of mobile technologies among preservice teachers is evidence of a need for teacher training to be offered in a mobile format (Gibson, 2013). Most preservice teachers already have a mobile device through which they can easily open and close a simulation application without changing to a high functioning computer or moving to a simulation room. Mobile simulation allows anywhere/anytime learning (Gibson, 2013), thus enabling just-in-time integration of simulation into the course activities. For example, preservice teachers can apply their gained knowledge and skills in the classroom to the simulated scenarios using a mobile device and receive immediate feedback on their performance from their peers or the course instructor. Mobile simulations also support each user's own learning pace without having to meet in person in the classroom. Providing individual access to a mobile simulation can ensure that every preservice teacher experiences the same simulation scenarios within their flexible times. For example, when the classroom management courses are offered asynchronously or when preservice teachers are unable to attend their clinical practice experiences through on-site visits, the mobile simulation can still offer comparative clinical training experiences. Using an assessment model, preservice teachers' classroom management performance can be saved and presented with evaluation comments individually. By providing easily accessible teaching simulations in the classroom for each individual teacher candidate, educator preparation programs can lead the way forward to establish sustainable teacher training with innovative technology.

To meet the needs defined here and to improve the easy accessibility of a virtual classroom management simulation, we developed the mobile version of *SimTEACHER* (Park & Ryu, 2019), which was intended to provide preservice teachers with the opportunities to practice their classroom management skills within a mobile simulation environment. It can be easily operated on a mobile device and allows users to experience authentic classroom management scenarios simulated using AR technology. Using *SimTEACHER Mobile*, preservice teachers are expected to learn classroom management skills/knowledge and further practice how to deal with challenging student behavior problems (Christensen et al., 2011; Galarneau, 2005). In this chapter, we introduce the components of *SimTEACHER Mobile* and further present how the *SimTEACHER Mobile* can be utilized to promote preservice teachers' active engagement in classroom management skill training.

SimTEACHER Mobile

Scenario Design

The key to successful simulation design is to create authentic simulation scenarios. We used the scenario-based design method, a development technique to concretely describe an early point of system development, to draft the authentic classroom management scenarios (Rosson & Carroll, 2002). Descriptive episodes were created using the three steps (problem scenarios, activity scenarios, and information/interaction design scenarios) and employed in a variety of ways to guide the development of the system to enable teaching experiences. Each of our classroom management scenarios addresses the three steps. In the first step (problem scenarios), we created scenarios to tell a story of current problem issues. These stories were carefully edited to reveal aspects of the teacher activities that have implications for scenario design. Then, in the second step (activity scenarios), we discussed ideas and stories about the activities of virtual students to present the problem scenarios and how to properly address the behavioral problems in a virtual teaching simulation. In the last step of information and interaction design scenarios, we created active scripts to demonstrate the sequence of actions/dialogues between the user and the virtual student, which will help users perceive, interpret, and make sense of classroom management issues.

Three Main Components

Using these simulation scenarios, we developed *SimTEACHER Mobile*, consisting of three main components. The first component is the AR activation cards that trigger different classroom management scenarios in the simulation. Users can access a virtual student in a selected virtual classroom scenario via mobile devices by using AR triggers on a paper card. Each paper card contains a behavior problem case that a user can read and think about possible classroom management strategies before beginning the simulation scenario. Once the initial response to the behavior problem is formed, the user can scan the AR card to activate the simulation. The triggered simulation scenario includes mainly provocative and challenging behavioral programs that can occur in the classroom. To develop a more authentic and realistic simulation, sociocultural considerations must be reflected in designing virtual classroom scenarios. In *SimTEACHER Mobile*, we developed the scenarios focusing on the cultural characteristics of a typical classroom. The scenario scripts were created through the collaborative design process with an American teacher who has 24 years of teaching experience. Four stages of behavioral problems were included in the scenarios ranging from “trigger,” “agitation,” “acceleration,” and “peak” (Colvin & Scott, 2014). The course instructor can use the information to compare users’ initial responses to the behavioral problems presented in the AR cards with their responses after they experience the simulated scenarios. AR cards are also portable for independent training and can be easily updated with more classroom behavior cases.

The second component of *SimTEACHER Mobile* includes virtual student characters that respond to users' inputs. The virtual students are designed to interact with users based on the Model of Interpersonal Teacher Behavior (MITB), which offers an orthogonal coordinate system (Leary, 1957). The model describes the teacher-student relationships (Wubbels et al., 1985) with two dimensions, the influence dimension (Dominance—Submission) and the affiliation dimension (Hostility-Friendliness) (De Jong et al., 2014; Kiesler, 1983; Tracey, 1994, 2004; Wiggins, 1991). Studies show that when teachers are placed in the dimension of higher influence and higher affiliation, their relationship with students is more positive. Brekelmans (1989) stated that students perceiving the influence dimension from their teacher show positive cognitive outcomes. Studies also show that a teacher's influence dimension has a positive effect on students' performance (Goh & Fraser, 2000), and the affiliation dimension has a positive correlation with students' motivation (Wentzel, 2002). Virtual student avatars were designed to simulate autonomous gestures based on the user's real-time MITB (influence, affiliation). Through predesigned postures and gestures, the virtual student can show their feelings, attitudes, and social relationships. Virtual students in *SimTEACHER Mobile* are particularly designed to change their posture/gestures according to perceived influence and affiliation dimensions determined by the user's selection of classroom management strategies based on Bull's suggestions (2016). For example, the "sideways lean" gesture is decoded as more relaxed and less polite than the "trunk straight" gesture. Also, the "head straight" is decoded as a more polite, superior, and tenser gesture than the "head lean" gesture. Accordingly, we designed virtual students to show "head straight" and "trunk straight" if the user's influence is high or to show the "lean body forward" gesture when the user's affiliation is high.

The last component of *SimTEACHER Mobile* is a performance graph that visualizes users' classroom management evaluation. Once a user's interaction with virtual students is mapped using the MITB model, their performance is analyzed and presented on the evaluation scoring dashboard. The scoring logic of the simulation is based on the analysis method of De Jong et al. (2014), which computes a teacher's performance using both influence and affiliation dimensions. Specifically, a preservice teacher can use one of four classroom management strategies to interact with the virtual student (punishment, recognition, reward, hinting, aggression) (Lewis, 2001; Lewis et al., 2005). Based on De Jong et al.'s (2014) study, we designed the simulation's scoring component to reflect the two dimensions of MITB, which are "influence" and "affiliation" in real-time, depending on users' selected classroom management strategies. The user's MITB score is then evaluated using specified evaluation parameters. Once a user completes the *SimTEACHER Mobile* simulation scenarios, his/her classroom management performance is presented in the form of visualized MITB orthogonal coordinates and feedback.

The three components of *SimTEACHER Mobile* were carefully designed to support the seven elements for effective teacher training (Darling-Hammond et al., 2017). *SimTEACHER* Mobile focuses on classroom management skill training and development within the classroom context (content-focused). It provides preservice teachers an opportunity to actively engage in authentic class management situations using interactive activities within a highly contextualized training setting (active participation). AR provides digitalized scaffolding that can gradually support learning (Bower et al., 2014). By completing the scenarios, preservice teachers can share their experiences, decisions, and ideas with their peers in the classroom or through online discussion boards if enrolled in an online class that promotes collaboration.

For preservice teachers who need guidance, each scenario consists of four stages to make a behavior management decision, and each stage offers a user possible response options. Each option presents a clear vision of what the consequence of the decision would be and what the best practice would look like through modeling. Coaching and expert supports are critical to understanding the behavioral problems and proper management skills to solve the problems. Using the simulation experiences and performance data, the course instructor can provide expertise about effective management skills and best practices to meet individual training needs through coaching and expert support. Completing each simulation scenario, preservice teachers are presented with a performance graph with detailed comments. This helps them reflect on their practices and seek feedback from peers and the course instructor. Lastly, preservice teachers are given time to learn and practice the simulation scenarios at their own pace so that they can reflect on newly gained strategies and further implement them in their classroom management practices, providing the benefits of sustained duration.

Simulation Experience

Whether learning with it in the classroom or using it independently in an informal learning setting, a preservice teacher can access *SimTEACHER Mobile* by following the user interfaces described below.

1. A user (preservice teacher) is given an AR card containing a tracking image that triggers classroom management simulation using a mobile app. Figure 1 shows two AR cards with two classroom management challenges. The directions on the AR card explain the challenging problem behaviors.

2. A user runs the *SimTEACHER Mobile* app to begin the simulation experiences. Figure 2 presents the app icon and the login screen.

3. After logging into the *SimTEACHER Mobile* app, a user finds the main menus and a scenario description. Figure 3 shows the main page of the *SimTEACHER Mobile* app.

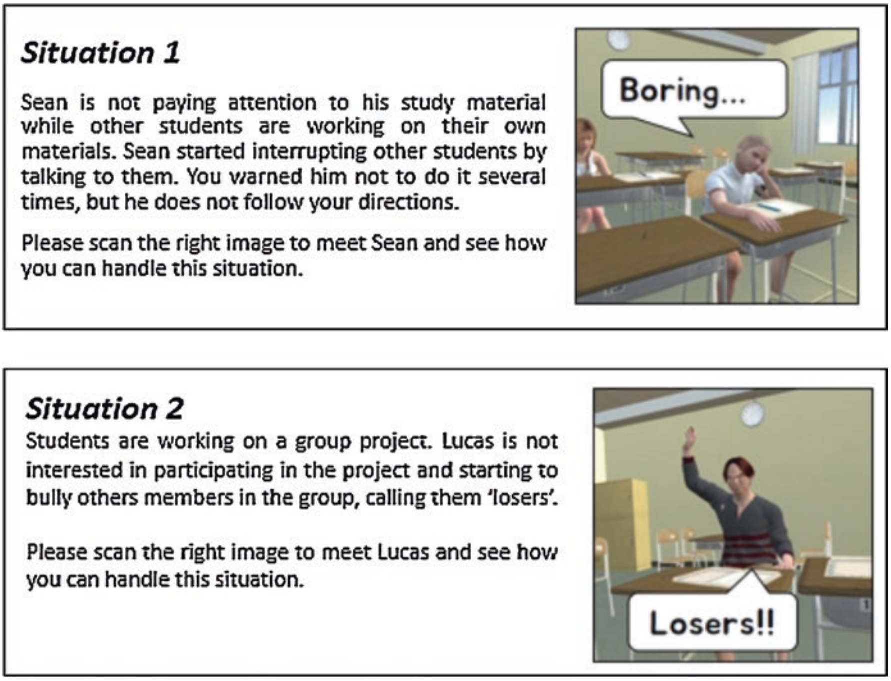


Fig. 1 Two AR cards with tracking images

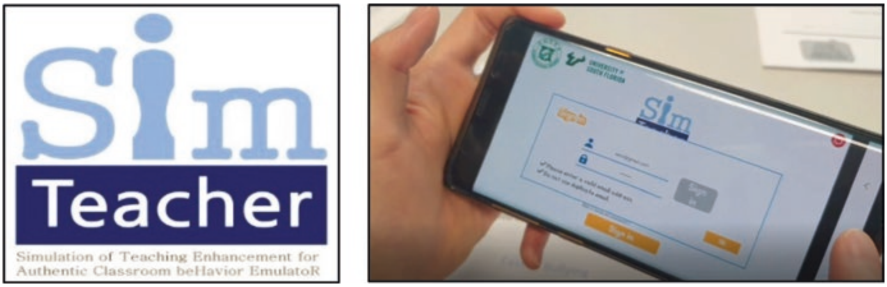


Fig. 2 SimTEACHER Mobile app login

4. A user can then selects a simulation scenario that s/he wants to experience by selecting the name of the scenario on the left menus. Figure 4 indicates the section where the user can find a simulation scenario menu.

5. Once the scenario is selected, an AR tracking window is activated. In this activation mode, the user now can track the AR card image to bring the simulation to the screen. Figures 5 and 6 present an AR tracking mode of the *SimTEACHER Mobile* app. The image on the AR card functions as an AR-based simulation tracker.

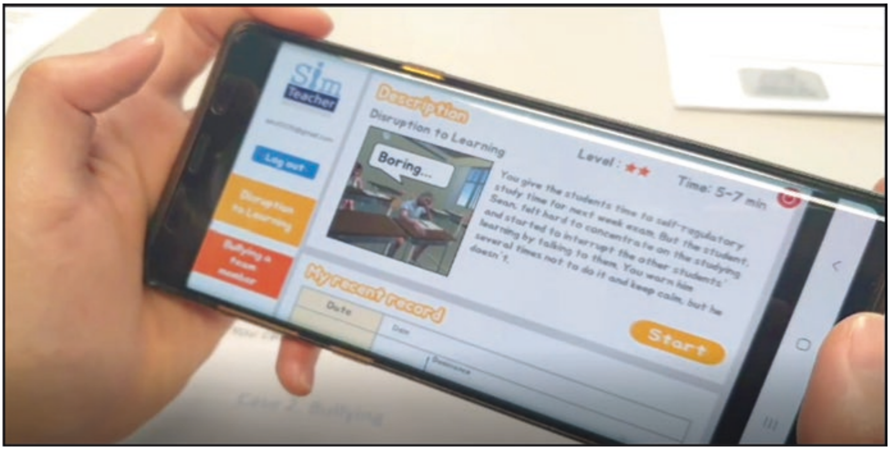


Fig. 3 App interface with menus and matching AR card scenario

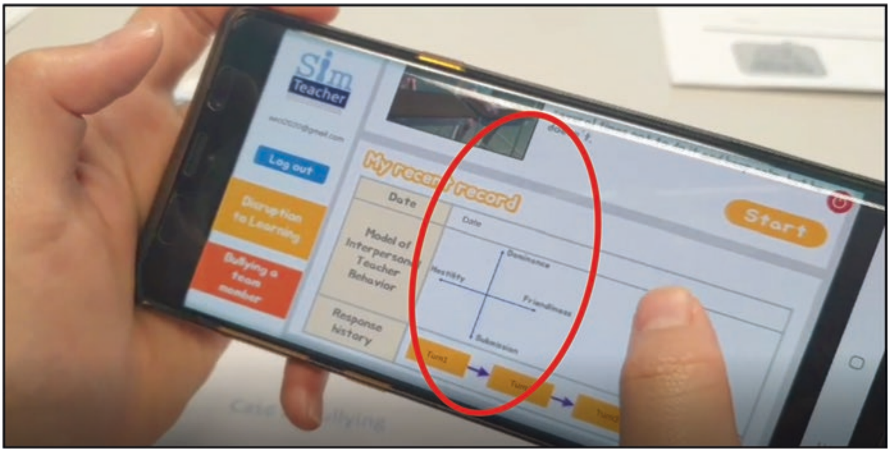


Fig. 4 Simulation scenario selection menus on the left

6. After scanning the AR card image, a matching virtual student character is activated with animated gestures and audio. Figure 7 shows a virtual student character in the form of AR.

7. A user then selects a proper option for behavior management based on what they learned. The virtual student character responds to the selected option (Fig. 8). Every scenario requires four stages to make a behavior management decision. In each stage, a user is given response options, and each option shows the positive consequence and the negative consequence of the selected option. Through the multiple stages and available response options, a user can interact with a virtual student and anticipate the possible outcomes of the decision-making.

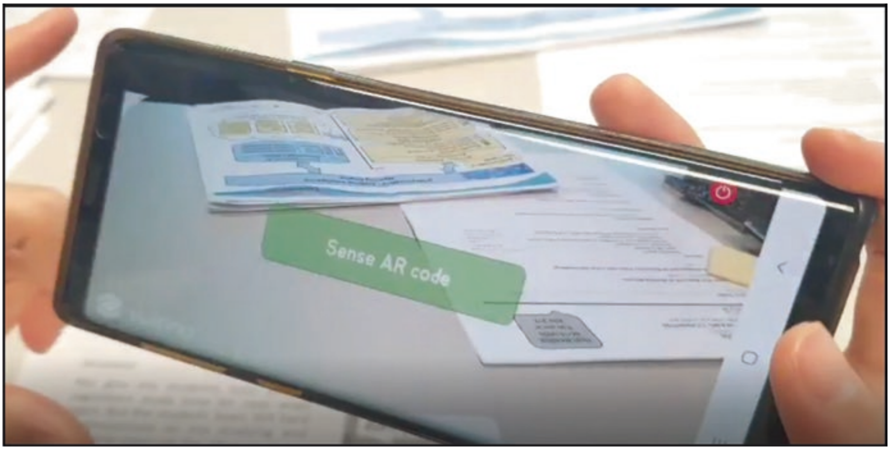


Fig. 5 AR tacking window is activated

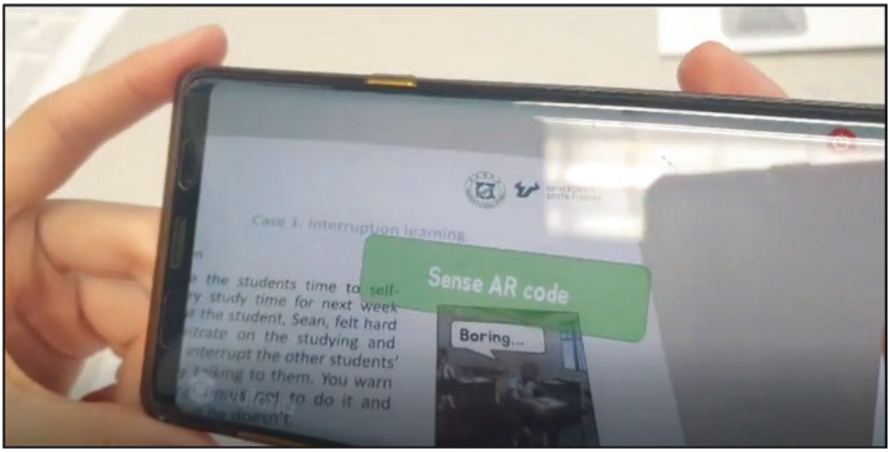


Fig. 6 AR tracking of the image on the AR card

8. Completing the simulation, a user is guided to see the feedback computed based on the options the user has selected (Fig. 9).

9. A user can find his classroom management performance on a graph with detailed comments. The information can be also shared with peers or the course instructor for further reflection (Fig. 10).

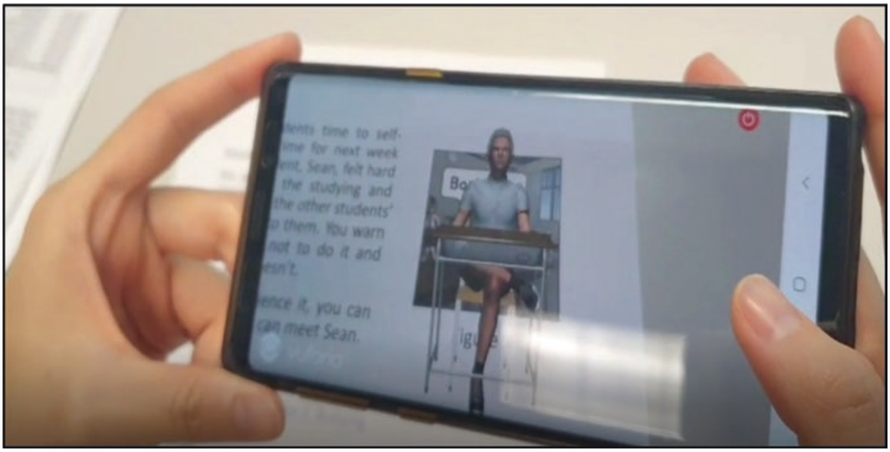


Fig. 7 Virtual student character ready for interaction

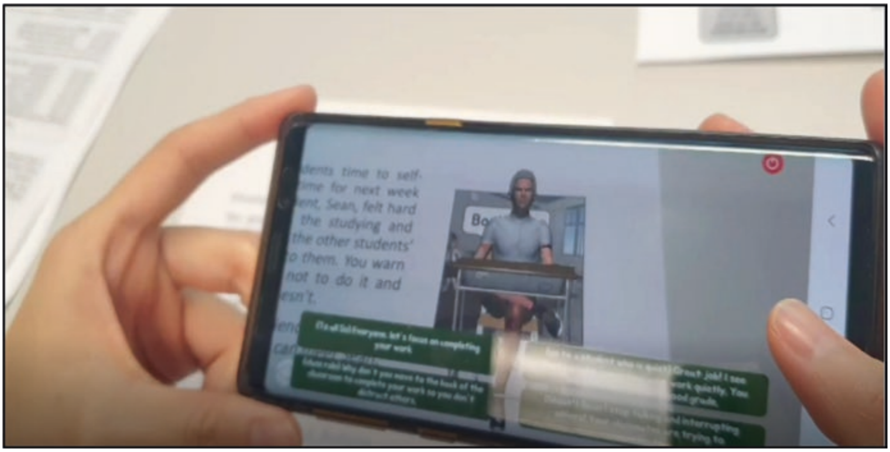


Fig. 8 Virtual student character interaction

User Perception Survey

To examine the usefulness of the simulated scenarios and assess the realistic design of virtual students, a user perception survey was conducted. Since the survey was conducted in South Korea, we created the Korean version of *SimTEACHER Mobile* using the two problem behavior cases (inattentive student case and bullying student case) that were the same as those used in the English version. Participants included 23 Korean preservice teachers with 10 males (43%) and 13 females (57%). The average age was 24.10 and 21.69 for each gender, respectively. Only those who agreed to participate in the survey were included in the data. The scenario

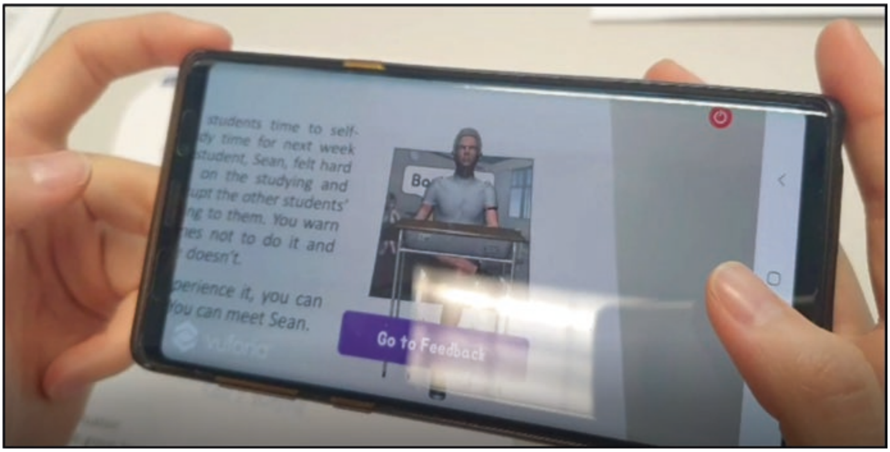


Fig. 9 Simulation ending for feedback

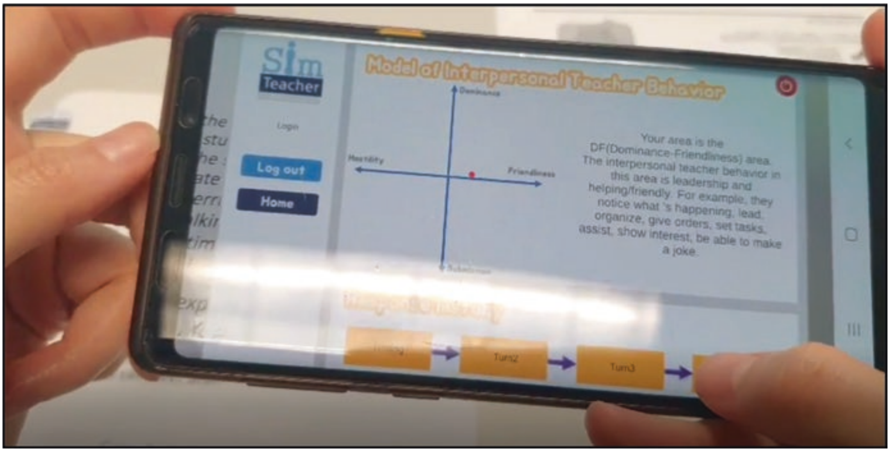


Fig. 10 Performance assessment graph

usefulness survey consisted of six items with high reliability of 0.95, while the virtual student design survey contained three items with high reliability of 0.84. All items used a 1 (strongly disagree) to 7 (strongly agree) Likert scale. The descriptive data from the user perception survey is presented in Table 1.

The survey results showed that overall, participants perceived both simulation scenarios and virtual avatars as highly useful and highly realistic regardless of the gender or the type of simulation scenarios presented.

Table 1 Descriptive data of the user perception survey

Perception survey items	Scenario 1 (n = 23)	Scenario2 (n = 23)
Scenario usefulness		
1. The problem behavior scenarios are useful for improving the class management ability of preservice teachers.	5.57 (1.38)	5.96 (1.07)
2. The problem behavior scenarios will efficiently train preservice teachers.	5.65 (1.15)	6.09 (1.20)
3. Through the problem behavior scenario, I was able to experience authentic situations that could occur in the classroom.	5.87 (1.25)	6.09 (1.04)
4. The problem behavior scenarios provide useful cases of classroom simulation for preservice teachers.	5.65 (1.27)	5.91 (1.16)
5. The problem behavior scenarios are composed of examples that are worth training for preservice teachers.	5.87 (1.22)	6.26 (1.14)
6. The problem behavior scenarios present training content that could actually happen in the classroom.	5.35 (1.56)	6.00 (1.28)
The realistic design of virtual students		
1. The behaviors of the virtual students were realistic.	6.04 (0.83)	6.43 (0.84)
2. The voice of the virtual students was natural.	6.22 (1.09)	6.35 (1.11)
3. The virtual students in the simulation acted as if they are communicating in the classroom.	5.91 (1. 28)	6.30 (1.06)

Conclusion and Future Directions

Creating situational decisions about student's behavior is a crucial function of classroom management simulations. This helps a preservice teacher practice what classroom management decisions need to be made in various classroom situations. *SimTEACHER Mobile* provides competency-based feedback on the preservice teacher's decisions. With various decision trees to cover possible teacher decisions, *SimTEACHER Mobile* offers unlimited practice opportunities to effectively manage the given behavioral problems before entering the clinical teaching setting.

Since the simulations are presented on a mobile platform, *SimTEACHER Mobile* can be used in various training settings. First, it can be used in the classroom as a practice tool to reinforce classroom learning. Preservice teachers can work individually or in a group to test their classroom management skills and share their findings with peers and the course instructor. Through the continuous practice and reflection process, preservice teachers are expected to understand the classroom management strategies and the consequences of different approaches. Second, this platform can be used in an online learning setting where no face-to-face meetings are required. With situations such as COVID-19 where in-person class meetings are discouraged, students can study the classroom management topics online, experience the simulations on their mobile devices, and share their findings and reflections via an online discussion board. Sharing multiple perspectives and ideas can also enrich the pros and cons of different classroom management strategies applied. Lastly, *SimTEACHER Mobile* can also be used in an informal learning setting, where no class or structured learning activities are required. The scenarios offer an interactive interface with a virtual student; thus, a user can experience the simulation independently without intended training goals.

The advancement in simulation capability combined with mobile technology is expected to provide significant benefits for preservice teacher training. The success of such simulations relies on various simulation scenarios that are validated by teacher preparation programs and in-service teachers. To further develop *SimTEACHER Mobile*, future studies will create and validate simulation scenarios and develop a scenario repository for different grade levels, subject areas, and types of behavioral problems.

Acknowledgments This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2021S1A5B8096558)

References

Badiee, F., & Kaufman, D. (2014). The effectiveness of an online simulation for teacher education. *Journal of Technology and Teacher Education, 22*(2), 167–186.

Bower, M., Howe, C., McCredie, N., Robinson, A., & Grover, D. (2014). Augmented reality in education: Cases, places and potentials. *Educational Media International, 51*(1), 1–15.

Bradley, E. G., & Kendall, B. (2014). A review of computer simulations in teacher education. *Journal of Educational Technology Systems, 43*(1), 3–12. https://doi.org/10.2190/ET.43.1.b

Brekelmans, M. (1989). *Interpersonal teacher behaviour in the classroom*. W.C.C.

Bull, P. E. (2016). *Posture & gesture* (Vol. 16). Elsevier.

Carrington, L., Kervin, L. K., & Ferry, B. (2011). Enhancing the development of pre-service teacher professional identity via an online classroom simulation. *Journal of Technology and Teacher Education, 19*(3), 351–368.

Carver-Thomas, D., & Darling-Hammond, L. (2017). *Teacher turnover: Why it matters and what we can do about it*. Learning Policy Institute.

Christensen, R., Knezek, G., Tyler-Wood, T., & Gibson, D. (2011). SimSchool: An online dynamic simulator for enhancing teacher preparation. *International Journal of Learning Technology, 6*(1), 201–220.

Colvin, G., & Scott, T. M. (2014). A seven-phase model for describing acting-out behavior. In G. Colvin & T. M. Scott (Eds.), *Managing the cycle of acting-out behavior in the classroom*. Corwin Press.

Cruz, B. C., & Patterson, J. (2005). Cross-cultural simulations in teacher education: Developing empathy and understanding. *Multicultural Perspectives, 7*(2), 40–47. https://doi.org/10.1207/s15327892mcp0702_7

Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). *Effective teacher professional development*. Learning Policy Institute.

Dalinger, T., Thomas, K. B., Stansberry, S., & Xiu, Y. (2020). A mixed reality simulation offers strategic practice for pre-service teachers. *Computers in Education, 144*, 103696. https://doi.org/10.1016/j.compedu.2019.103696

DeAngelis, K. J., Wall, A. F., & Che, J. (2013). The impact of preservice preparation and early career support on novice teachers' career intentions and decisions. *Journal of Teacher Education, 64*(4), 338–355.

De Jong, R., Mainhard, T., Van Tartwijk, J., Veldman, I., Verloop, N., & Wubbels, T. (2014). How pre-service teachers' personality traits, self-efficacy, and discipline strategies contribute to the teacher–student relationship. *British Journal of Educational Psychology, 84*(2), 294–310.

Evertson, C. M., & Weinstein, C. S. (Eds.). (2006). *Handbook of classroom management: Research, practice, and contemporary issues*. Lawrence Erlbaum.

Ferry, B., Kervin, L., Cambourne, B., Turbill, J., Puglisi, S., Jonassen, D., & Hedberg, J. (2004). Online classroom simulation: The "next wave" for pre-service teacher education? In R. Atkinson, C. McBeath, D. Jonas-Dwyer, & R. Phillips (Eds.), *Beyond the comfort zone: Proceedings of the 21st ASCILITE conference* (pp. 294–302). Australian Society for Computers in Learning in Tertiary Education.

Ferry, B., Kervin, L., Hedberg, J. G., Turbill, J., Cambourne, B., & Jonassen, D. (2005). In P. Kommers & G. Richards (Eds.), *Proceedings, world conference on educational multimedia, hypermedia and communication (EdMedia)* (pp. 3096–3103). Association for the Advancement of Computing in Education (AACE).

Freeman, J., Simonsen, B., Briere, D. E., & MacSuga-Gage, A. S. (2014). Pre-service teacher training in classroom management: A review of state accreditation policy and teacher preparation programs. *Teacher Education and Special Education, 37*(2), 106–120.

Galarneau, L. (2005). *Authentic learning experiences through play: Games, simulations and the construction of knowledge. Simulations and the Construction of Knowledge*, Paper presented at the 2005 International DiGRA conference, Vancouver, British Columbia, Canada.

Garavanm, T. N. (1994). Training, development, education and learning: Different or the same? *Journal of European Industrial Training, 21*(2), 39–50.

Gibson, D. (2007). SimSchool and the conceptual assessment framework. In D. Gibson, C. Aldrich, & M. Prensky (Eds.), *Games and simulations in online learning: Research & development frameworks* (pp. 308–322). Idea Group.

Gibson, D. (2013). Assessing teaching skills with a mobile simulation. *Journal of Digital Learning in Teacher Education, 30*(1), 4–10. https://doi.org/10.1080/21532974.2013.10784720

Girod, M., & Girod, G. R. (2006). Exploring the efficacy of the cook school district simulation. *Journal of Teacher Education, 57*(5), 481–497. https://doi.org/10.1177/0022487106293742

Goh, S., & Fraser, B. J. (2000). Teacher interpersonal teacher behaviour and elementary students' outcomes. *Journal of Research in Childhood Education, 14*, 216–231.

Gregory, S., Dalgarno, B., Campbell, M., Reiners, T., Knox, V., & Masters, Y. (2011). Changing directions through VirtualPREX: Engaging pre-service teachers in virtual professional experience. In G. Williams, P. Statham, N. Brown, & B. Cleland (Eds.), *Changing demands, changing directions* (pp. 491–501). Proceedings Ascilite Hobart 2011.

Hixon, E., & So, H.-J. (2009). Technology's role in field experiences for preservice teacher training. *Educational Technology & Society, 12*, 294–304.

Jones, A. (1994). A learning in organizations mode. In D. C. A. Bradshaw (Ed.), *Bringing learning to life: The learning revolution, the economy and the individual*. Falmer.

Jones, V. F., & Jones, L. S. (2013). *Comprehensive classroom management, creating communities of support and solving problems* (10th ed.). Pearson.

Kane, T. J., Kerr, K. A., & Pianta, R. C. (Eds.). (2014). *Designing teacher evaluation systems: New guidance from the measures of effective teaching project*. Jossey-Bass.

Kaufman, D., & Ireland, A. (2016). Enhancing teacher education with simulations. *Tech Trends, 60*(3), 260–267.

Kiesler, D. J. (1983). The 1982 interpersonal circle: A taxonomy for complementarity in human transactions. *Psychological Review, 90*, 185–214.

Korpershoek, H., Harms, T., de Boer, H., van Kuijk, M., & Doolaard, S. (2016). A meta-analysis of the effects of classroom management strategies and classroom management programs on students' academic, behavioral, emotional, and motivational outcomes. *Review of Educational Research, 86*(3), 643–680. https://doi.org/10.3102/0034654315626799

Leary, T. (1957). *An interpersonal diagnosis of personality*. Ronald Press Company.

Lewis, R. (2001). Classroom discipline and student responsibility: The student's view. *Teaching and Teacher Education, 17*, 307–319.

Lewis, R., Romi, S., Qui, X., & Katz, Y. J. (2005). Teachers' classroom discipline and student misbehavior in Australia, China, and Israel. *Teaching and Teacher Education, 21*, 729–741.

National Center for Education Statistics (NCES), U.S. Department of Education. (2019). *National Teacher and Principal Survey (NTPS) Overview.* https://nces.ed.gov/surveys/ntps/overview.asp

Park, S., & Ryu, J. H. (2019). Exploring pre-service teachers' emotional experiences in an immersive virtual teaching simulation through facial expression recognition. *International Journal of Human Computer Interaction, 35*(6), 521–533.

Rodgers, A. (1986). *Teaching adults.* CITY?Open University Press: Milton Keynes.

Rosson, M. B., & Carroll, J. M. (2002). Scenario-based design. In J. Jacko & A. Sears (Eds.), *The human-computer interaction handbook: Fundamentals, evolving technologies and emerging applications*. Lawrence Erlbaum.

Scrivener, J. (2012). *Classroom management techniques*. Cambridge University Press.

Tracey, T. J. (1994). An examination of the complementarity of interpersonal behavior. *Journal of Personality and Social Psychology, 67*, 864–878.

Tracey, T. J. G. (2004). Levels of interpersonal complementarity: A simplex representation. *Personality and Social Psychology Bulletin, 30*, 1211–1225.

Wentzel, K. R. (2002). Are effective teachers like good parents? Teaching styles and student adjustment in early adolescence. *Child Development, 73*, 287–301.

Wiggins, J. S. (1991). Agency and communion as conceptual coordinates for understanding and measurement of interpersonal behavior. In W. M. Grove & D. Cicchetti (Eds.), *Thinking clearly about psychology* (pp. 89–113). University of Minnesota Press.

Wubbels, T., Cre'ton, H. A., & Hooymayers, H. P. (1985). Discipline problems of beginning teachers, interactional teacher behavior mapped out. *Abstracted in Resources in Education, 20*(12), 153.

Sanghoon Park is an associate professor in the Instructional Technology program at the University of South Florida. His research focuses on motivational and emotional experiences in online learning, online learning experience analysis, and the design and development of augmented reality-based mobile learning. Address for correspondence: Dr. Sanghoon Park, Instructional Technology program, EDU302K, College of Education, University of South Florida, Tampa, FL, 33620, USA.

When a Pen Is More than a Pen: Object-Based Learning and the Value of Objects as Concrete Referents

Caren S. Oberg

Introduction: What Is an Object?

"Object" has distinct meanings depending on the disciplinary view. David Wiley introduced the concept of learning objects, saying that

> …learning objects are elements of a new type of computer-based instruction grounded in the object-oriented paradigm of computer science…The fundamental idea behind learning objects is that instructional designers can build small (relative to the size of the entire course) instructional components that can be reused a number of times in different learning contexts. (Wiley, 2002, p. 4)

In anthropology and archaeology, objects are physical, three-dimensional entities that are created by humans (Berger, 2014). Such objects are also called "material culture," a two-word phrase introduced by art historians interested in the historical importance of decorative arts (as opposed to paintings and sculptures) (Prown, 1982; Prown & Haltman, 2000) and archaeologists, for whom such things are at the core of their discipline. In recent decades, material culture has been expanded to include any physical result of human action, including nonphysical entities such as the internet (Berger, 2014; Miller, 2010). The objects to be discussed in this chapter are not those types of objects, however. The objects to be discussed here are physical, three-dimensional entities. It is these types of objects that provide new and often overlooked avenues for students to make sense of the real world and its abstract ideas.

C. S. Oberg (✉)
College of Design, University of Minnesota, Minneapolis, MN, USA
e-mail: oberg168@umn.edu

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*, Educational Communications and Technology: Issues and Innovations,
https://doi.org/10.1007/978-3-030-85078-4_19

Object-Based Learning

Both museum professionals and academics explain object-based learning as a student-centered approach to using objects to facilitate learning (Chatterjee, 2007; Paris, 2002).[1] Museum professionals have also studied object-based learning and have found that direct interaction with objects allows for visual and kinesthetic learning that can be far richer and more complex than text alone (Borun et al., 1997). For objects which are in museums, four features make them “unique modes for ideas and their elaboration: (1) resolution and density of information; (2) objects are their natural scale, rather than limited to a size of a page or needing comparative scaling; (3) authenticity in that it is a sense of historical connection or connection to nature; and (4) value – the object’s uniqueness” (Leinhardt & Crowley, 2002, pp. 304–305).

Within the university classroom, objects are “useful tools for inspiring cross-disciplinary study, providing a novel research area for a new body of students using the collections” (Chatterjee, 2010, p. 5). In terms of “novel” research areas, anthropologists, archaeologists, and museum curators would likely disagree on the word “novel.” Early university anthropologists used objects in classroom learning, although this changed during the twentieth century as anthropology – the field to which objects were a central feature – moved from object-based orientation to idea-based orientation (Adams, 2015). However, in the late twentieth century and early twenty-first, there was a material turn in anthropology, with academics embracing the idea that objects are, in and of themselves, concepts to be studied, which resulted in a push to bring objects back to the higher education classroom (Adams, 2015; Chatterjee, 2010). Helen Chatterjee, a scholar at the forefront of object-based learning in higher education, explains that “Objects can be employed in a variety of ways to enhance and disseminate subject-specific knowledge to facilitate the acquisition of communication, team working, practical, observational and drawing skills and for inspiration” (Chatterjee, 2007, p. 180).

The Role of Slow or Close Looking in Object-Based Learning

There is a common misperception that looking at an object is a passive experience. Looking at an object includes the process of thinking and responding (intellectually, emotionally, etc.) and is very much an active experience (Tishman, 2017; Williams, 1982). In addition to Chatterjee’s list of potential knowledge acquisitions above, object-based learning includes an area called slow looking. Slow looking has emerged at the same time as other slow movements, starting with the slow food movements, and social media Sabbaths. These are all attempts to slow down in what

[1] Some scholars use the term object-centered learning (Paris, 2002). The terms are interchangeable.

is perceived to be an ever-increasingly rapid pace of the world around us (Tishman, 2017; Roberts, 2013).

Slow looking asks the viewer to spend actual time with an object to look at it for so long that new attributes appear. Such a reaction is seeing, not just looking. Jennifer L. Roberts, a professor of American Art at Harvard University, extends the concept of slow looking into a 3-hour assignment for her students (Roberts, 2013). In this assignment, she directs students to find a painting of their choice at the Museum of Fine Arts, Boston. The students are instructed to spend 3 hours looking at a painting. During the 3 hours, the students note each detail they see and the time of observation. For example, a student may choose to view John Singleton Copley's 1768 *Paul Revere*. The student may notice the teapot in the first 3 minutes, but they may not notice Revere's engraving tools in the foreground until the 27th minute. It may be 92 minutes before the student notices the dirt on Revere's fingernails. Such slow or close looking "creates opportunities for students to engage in deceleration, patience, and immersive attention. Slow looking foregrounds the capacity to observe details, to defer interpretation, to make careful discernments, and to shift between different perspectives" (Tishman, 2017, p. 6).

It is helpful to try slow looking for oneself before applying it to instructional design. Find a pen and look at it for 2 minutes. What do you see? In the first half a minute I notice that my pen is a black ballpoint Pilot G-2 gel pen with a 0.38 tip. The body of the pen is colorless plastic, while the end cap and clip are made of black plastic. The bottom third of the pen body is covered by black rubber, while the cone is colorless plastic. The transparent body allows me to see a yellow-tinged ink cartridge, which is about half full of black ink. The end cap plunger drops smoothly, pushing the back and front springs, which can be seen through the clear plastic barrel. If I keep my focus on the pen for another minute, I realize it weighs no more than a few grams and has a circumference of 1–2 centimeters. The pen balances comfortably in my hand. I notice the black rubber on the bottom third of the body curves in ever so slightly, and eight incisions encircle the rubber. This texture provides a grip for my fingers and mimics the look of the front springs. In the last 30 seconds, I notice that there are markings which can be seen through the transparent body of the pen. I see eight engraved circles and a set of numbers. Despite having used this specific type of pen for years, I had not noticed most of these details.

Slow Looking and the Development of Context

It is not enough to engage in the act of slow looking. In order to make sense of an object, the viewer must be able to determine the object's context. Context makes the object less ambiguous and more certain to the viewer. This process is sometimes referred to as having the viewer "disambiguate" the object (Rose, 2017). In a museum setting, labels help to disambiguate an object by providing at least the essential art historical information such as the artist's name, media, and year of the work. Slow looking allows the viewer to build their context based on what they perceive in the artwork. Rose suggests that this close looking “emerges in practice as yielding not exactly a closer relation to the ‘object,’ but a kind of allegory structured by whatever context is, however implicitly, is brought to bear” (pp. 158). In other words, slow looking builds meaning. Such meaning is, however, determined by the knowledge of the viewer. The students who look closely at the paintings at the Museum of Fine Arts, Boston, or you who look at the pen in your hand individually build a symbolic structure of meaning. The symbolic structure allows the object to become less ambiguous and more certain.

Taking the example from above, what meaning do I derive from looking closely at my pen? As mentioned earlier, the weight and circumference of the pen balance comfortably in my hand. My thumb and fingers fit perfectly at the bottom edge of the incised rubber. The circumference and rubber supports the odd way in which I learned to write (I hold pens extremely close to the tip and with two fingers and thumb). The gel ink reveals my preference for smooth flow of ink, while the tiny 0.38 diameter cartridge barrel allows for my comically tiny and angular handwriting. Handwriting which my high school teachers thought both beautiful to look at and infuriating to read. I am also known to press and depress the end cap plunger, which gives off a satisfying clicking sound reminding me of a throwaway joke from *The Simpsons*. In the end, the pen has been disambiguated, and there is a great deal of meaning to explore.

Objects as Concrete Referents

Additionally, the pen becomes a concrete referent for meaning. A referent is a linguistic term. It is the concrete – rather than abstract – notion which is designated by a word or expression and can be “an object, action, state, relationship, or attribute in the referential realm” (“SIL Glossary of Linguistic Terms,” n.d.). For example, the animal with four legs, fur, a snout, barks, and is usually a pet is the concrete referent for the linguistic term “dog.” It is suggested that abstract concepts are difficult for small children, specifically, to learn without assistance from another’s linguistic understanding of social structures (Fini & Borghi, 2019). University students have trouble with advanced abstract concepts such as theoretical ideas, philosophical ideas, or other abstractions. Object-based learning uses objects as concrete referents, and in this way, students are able to build meaning around abstract concepts. Object-based learning as a student-centered pedagogy expands how students are able to learn as it “conveys ideas that are not necessarily mediated by written language” (Riello, 2018, p. 29).

Examples of Objects as Concrete Referents

Example 1 *Museum object in the classroom – Successful use of historic objects as concrete referents*

The more common object-based learning method in university classrooms is the use of museum objects. University museum staff, often also faculty themselves, come to the classroom with a variety of historic and often one-of-a-kind objects and facilitate discussion about the object and its context. In one example, as a collections assistant for the Goldstein Museum of Design at the University of Minnesota, I brought a range of women's coats to a classroom. This class was studying abstract notions of fashion, trends, fads, and defining "classic". The historic coats were to be concrete referents for these abstract ideas. I arrived in the classroom with six different women's coats, ranging in time from the 1950s to the 1970s. The coats were all appropriate to late fall or winter, all wool, and all fashionable to their time. The coats were hung in different parts of the classroom, and students were asked to view each coat slowly, touch if they chose to (while wearing gloves) and critically consider whether the item is classic, trend, or fad depending on a list of attributes provided (Casto, 2015).[2] Attributes included cut of the garment, silhouette, the texture and textiles, and its weight. More specifically, these are concepts that cannot be explored as easily through images.

The students had 15 minutes to view the coats. The class then came back together, and I facilitated a discussion in which the students discussed their concepts of classic, trend, and fad while referring to the coats as evidence. Abstract ideas such as color were discussed, such as students who considered that the gray coat from 1950 and gray coat from 1970 were both considered "classic" because gray is a neutral color. The 1960s orange coat was considered "trend" because of its color. But the students discussed that the same orange was used for coats in the present day. Therefore, what made this coat a trend? As it could be worn in 2019, because of its age and silhouette, it was also considered a "classic." Rose's discussion on context is acutely useful here to explain why a coat could be a classic and a trend at the same time. Such discussions as these showed that students successfully used the objects to discuss abstract ideas such as aesthetics, trends, fads, and other notions.

Example 2 *Museum object in the classroom – An unsuccessful use of historic objects as concrete referents*

In the same semester, Fall 2019, I stood in front of a class of undergraduate students while holding a single historic object. The object was a single shoe dated to the late eighteenth century. Although its shape signals that it is a shoe, this shoe looks different than today's shoes. It is quite small, about a size 5 women's shoe today. The closure across the shoe is folded leather rather than laces, and there is no

[2] This exercise is a methodology developed by Dr. Mary Alice Casto for her 2015 doctoral dissertation *Categories of Design for Sustainability: A Wearer's Perspective of Classic Design*.

tongue. The heel is a Louis XIV heel – a distinct curved shape but not one which is popular today – and the entire shoe is covered in a yellowish embroidered looking fabric called silk brocade. Unlike the coats in the example above, this shoe was strange and unfamiliar.

My intention was to use the shoe as a concrete referent to discuss how biases, stereotypes, and other "knowledge" interfere with our study of historic objects – specifically that we could make an argument for this being a men's shoe, as men wore heeled shoes, silk brocade, and brighter colors, in the eighteenth century. I walked around the classroom so that the students could view the shoe. I tried a few different types of questions to engage the students in observation of this shoe. Trying to stay away from closed questions or questions which would rely on context I knew they did not yet have, I used open-ended questions such as "What do you notice?" and "What makes you say that?" or "What more do you see?" As it would happen, this line of questioning did not lead very far.

The students could sense it was historic, but when asked why they knew it was historical, they could only say it doesn't look like what we wear today. Someone who vaguely remembered high school history said its shape looks like the heeled shoes George Washington wore in paintings. Another student suggested that the shoe belonged to a woman because of the heel. Despite further prodding, the students could not offer any more observations.

Compared to the fruitful conversation in the example above, this use of an object as a concrete referent was a flop. The students in the first example had 15 minutes to see the objects up close. The students in this example saw the shoe for a split second as I walked by. The students in the other example could compare one coat and another, making it easier to talk about differences between the coats. These students had one shoe to look at and nothing to compare it to. Lastly, the coats in the first example were completely familiar as coats. This historic shoe looked very little like the shoes the undergraduates had seen in their lives. In summary, the students in this example were simply not physically close enough to the shoe (the object) to form observations, did not have the knowledge or vocabulary to disambiguate the shoe, and, therefore, could not develop meaning from the shoe. For a moment, I tried to explain how our ideas about the clothing we wear today bias us in understanding fashion in the past. I tried to disambiguate the shoe for them. In doing so, however, I gave the students the meaning of the shoe. The students were not able to connect the abstract ideas to the shoe to form meaning for themselves.

Example 3 *Ordinary pen in the classroom – Using everyday objects as concrete referents*

Using objects to support student learning in universities need not only be the purview of the museum curator or museum educator. Object-based learning with ordinary objects, in which the everyday object is a concrete referent, is valuable. I do not refer to the use of studios or labs. To be sure, studio classes that support hands-on training in illustration, graphic design, apparel design, and wearable technologies are extremely valuable resources. These classes are closer in definition, however, to learning by doing (echoing Dewey, Piaget, and others), rather than object-based learning.

How can ordinary objects become concrete referents for university students? Take, for example, a discussion I had with students in an introductory course on design thinking. A central part of the first assignment was to describe any ordinary object that they happen to have in their dorm room or at home. One purpose of the assignment was for students to be introduced to slow looking, although we did not call it that. I had 23 students, and I wrote, "Look closer, needs more detail" on 23 assignments.

I then considered what did *I* mean by "Look closer, needs more detail"? "Look closer" is an abstract idea, and textual language was likely not going to be of any help. I needed a concrete referent to make this abstract idea – "Look closer, needs more detail" – more understandable. As such, I developed a 10-minute object-based learning exercise for the next class period. I asked everyone to take out a pen. Whatever pen the student had available, but could not be a pencil. The students, as a whole group, had to give me ten characteristics about pens, using the pen in their hand as an example. The conversation started with something like this:

Me: Tell me something about your pen.
Student: My pen is blue.
Me: The whole pen is blue? Even the inside?
Student: No. The outside…the body… of the pen is blue.

Another student raised their hand.
Student: It uses ink.
Me: What uses ink?
Student: The pen.
Me: The pen, on its own volition, uses ink?
Student: No…I write with the ink.
Me: So the entire pen is ink? Must be messy.
Student: No, the pen has a container of ink in it. And a body around the container of ink. And I grip the body.
Me: Ok, what is the body made of?

And in this way, we quickly reached ten characteristics. In this conversation, students were asked to be more detailed, more articulate, and more specific in their explanation of their pen. Object-based learning helped them to learn what I meant by "Be more specific." This exercise intended to have students understand what I meant when I say "Be more specific" in their writing and thinking about designed objects. Their next set of papers, in which they described the object from the first assignment, but this time with design changes, proved much more robust.

Characteristics of Successful Use of Objects as Concrete Referents in Instruction

Successful use of objects as concrete referents can be extrapolated from these three examples:

- The student has to be able to *see* the object as closely as possible and even be able to have the object in their possession for a length of time. If you compare the two museum object experiences, the coat experience was far more successful because the students could *see* the coats. The eighteenth-century shoe was far too small for any student to view from their seats. If I were to use the shoe in an object-based learning activity in the future, I would need to start with their shoes. Then I would ask the students to come up in small groups and look at the eighteenth-century shoe for 10 minutes, writing their thoughts and observations. *Then* we would compare their findings, thereby using both modern and historical shoes to discuss abstract ideas of history, the study of dress history, culture, and internal biases relating to dress.
- The student needs a structure for looking at the object. Slow looking is not a normal activity. Students need structure to keep their attention focused. Such structure may include length of time, number of characteristics, or developing comparisons among two or more objects.
- The student needs some familiarity with the object. Some background knowledge or experience. The students who worked with the coats and the pens were familiar with both types of objects. Coats may have changed silhouette and popular color, but their basic shape and use have not changed. The eighteenth-century shoe was a shoe. But its form was just unfamiliar enough (as was its material – silk) that students had a difficult time disambiguating the shoe. Students then could not build context, which made both the concrete referent (shoe) and the abstract notion it was representing (bias in history) meaningful.

Conclusion

In object-based learning, students recognize objects as concrete referents that are useful for critically considering and understanding the abstract nature of the world. While museum objects are useful for such learning, such objects may be difficult to obtain on a regular basis. Rather, instructional designers may consider including everyday physical objects to enhance student connections between the concrete and abstract worlds.

Acknowledgments The examples in this article were conducted, while the author was the Dora Wallace Collections Assistant at the Goldstein Museum of Design (GMD) at the University of Minnesota and as a teaching assistant in the College of Design at the University of Minnesota. The author wishes to thank GMD for their support of these experiences, especially Lin Nelson-Mayson, Jean McElvain, and Eunice Haugen, and the support of University of Minnesota lecturer Pat Hemmis.

References

Adams, K. M. (2015). Back to the future?: Emergent visions for Object-Based Teaching in and beyond the classroom. *Museum Anthropology, 38*(2), 88–95.

Berger, A. A. (2014). *What objects mean: An introduction to material culture*. Routledge.

Casto, M. A. (2015). *Categories of design for sustainability: A wearer's perspective of classic design*. University of Minnesota Press.

Chatterjee, H. J. (2010). Object-based learning in higher education: The pedagogical power of museums. In *Proceedings of the 9th conference of the International Committee of ICOM for University Museums and Collections (UMAC), Berkeley, USA, 10th–13th September 2009* (pp. 179–182). International Committee for University Museums and Collections. Retrieved from https://edoc.hu-berlin.de/handle/18452/9349?show=full

Chatterjee, H. J. (2007). Staying essential: Articulating the value of object-based learning. *University Museums and Collections Journal*.

Fini, C., & Borghi, A. M. (2019). Sociality to reach objects and to catch meaning. *Frontiers in Psychology, 10*, Article 838. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6491622/pdf/fpsyg-10-00838.pdf

Miller, D. (2010). *Stuff*. Polity Press.

Paris, S. G. (2002). *Perspectives on object-centered learning in museums*. : Routledge.

Prown, J. D. (1982). Mind in matter: An introduction to material culture theory and method. *Winterthur Portfolio, 17*(1), 1–19.

Prown, J. D., & Haltman, K. E. (2000). *American artifacts: Essays in material culture*. Michigan State University.

Riello, G. (2018). Things that shape history: Material culture and historical narratives. In K. Harvey (Ed.), *History and material culture: A student's guide to approaching alternative sources* (2nd ed., pp. 27–50). Routledge.

Roberts, J. (2013). The power of patience: Teaching students the value of deceleration and immersive attention. In *The Harvard initiative for learning and teaching*. Harvard Magazine. Retrieved from https://harvardmagazine.com/2013/11/the-power-of-patience

Rose, S. (2017). Close looking and conviction. *Art History2, 40*(1), 156–177.

SIL Glossary of Linguistic Terms. (n.d.). Retrieved September 8, 2020, from https://glossary.sil.org/

Tishman, S. (2017). *Slow looking: The art and practice of learning through observation*. Routledge.

Wiley, D. A. (2002). Connecting learning objects to instructional design theory: A definition, a metaphor, and a taxonomy. In D. A. Wiley (Ed.), *The instructional use of learning objects* (pp. 1–24). Agency for Instructional Technology; Association for Educational Communications & Technology. Retrieved from https://members.aect.org/publications/InstructionalUseofLearningObjects.pdf

Williams, P. (1982). *Object-oriented learning in art museums*. Retrieved from https://sjmusart.org/sites/default/files/files/object-oriented-learning-in-art-museums.pdf

A Conceptual Model for Transforming Universities into Learning Organizations

Martha Lorena Obermeier

Introduction

The main objective of education is to change the way a person thinks and widen his vision. Policymakers recognize higher education as an element to make countries knowledge-based and make them economically competitive as it forms people capabilities and gives advantages to graduates (Walker & Boni, 2013). These authors also state that: "Knowledge is the currency of the powerful" (p. 19). The inclusion of technology has increased the opportunities for training, communication, and promotion. This inclusion will also demand that universities restructure their areas and change their ways of working. The more prepared the person, the easiest it will be to adapt to changes and obtain jobs that demand creativity, expertise, and critical thinking.

Education and lifelong learning skills will be the key to survive in the labor market and improve personal wealth. An educated university graduate participates in the construction of his own life and transforms individuals and society, as knowledge taught in universities bestows confidence to transform society (McLean et al., 2013). Universities have traditionally been seen as places to transfer knowledge; however, in some Latin American contexts, universities do not have the characteristics of a learning organization. Knowledge is power and free access to knowledge fights inequalities (McLean et al., 2013).

M. L. Obermeier (✉)
Nova Southeastern University, Fort Lauderdale, FL, USA

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*, Educational Communications and Technology: Issues and Innovations,
https://doi.org/10.1007/978-3-030-85078-4_20

Problem and Context

In my experience, I have continually observed that students in Mexican universities drop out or do not finish their academic programs. At the same time, many of those students who finish their programs do not have many opportunities in the labor market or they do not possess certain skills demanded in certain positions. Universities have several challenges to fulfill the needs of society. One of them is that their structures are not flexible and do not allow changes to foster new ways of learning. In most cases, infrastructure and technical equipment are not adequate. Regarding the faculty, tenure track faculty commonly refuses to train or update. Several opportunities to study abroad are refused and considered unnecessary. When they decide to train or upgrade, local universities are chosen, even if they do not reach the minimum quality standards. The lack of growth and innovation is evident and a result of the lack of research activities. As a consequence of all that has been mentioned, students and graduates do not develop lifelong learning skills.

Some educational institutions redesign the curricula and the educational model when they notice that students' permanence or graduation requirements are not met. Some institutions' policies and academic procedures are not clear, and efforts to solve these problems are not encouraged. Even if these efforts are made, the problems remain as the administrative structure, the teaching staff, and the learning context remain the same. Every change proposed is rejected and considered irrelevant even if pieces of evidences show that something needs to be done.

After many years of teaching in a higher education institution in Mexico, I have wondered many times about the reasons for the lack of growth, the reasons the staff was fine in this comfort zone, and what could be done to change this situation. The book *The Fifth Discipline* by Senge (2006) answered many of these questions and presented new concepts to be considered. This book presents disciplines that foster growth in an organization, as well as learning disabilities or ideas that hinder growth. As a result of this reading, a literature review was conducted on topics including organizational culture, leadership, change, and system thinking. A conceptual model was proposed based on the literature to design an intervention to promote change within people. Most of the materials consulted emphasized that the most important element in organizations is people that conform to it. As Azeem and Mataruna (2019) state: "The success of schools is determined by the human resource in the organization" (p. 1318). The model is centered on people, as their changes will reflect on the other elements of the model.

A systematic literature review was conducted to compare findings and look for constructs across individual studies and find recommendations for best practices. Twenty-nine articles, 7 books, a dissertation, and a lecture were selected in the review with topics as learning organizations, system thinking and change, organizational change, resistance to change, leadership, coaching, mentoring, lifelong learning, knowledge workers, and knowledge development. Most of the articles consulted were qualitative studies, such as documental researches, a conceptual framework, a phenomenology, and a grounded theory. Quantitative studies were also found, six surveys, and an experimental study were selected. As the concept of an organization can be applied to universities and enterprises, the studies were conducted in several contexts and countries, in health and educational organizations. The population of the studies was educators in higher education, faculty, language instructors, and soft or hard skills trainers.

Learning Organization

The term *learning organization* has been used to describe organizations that constantly learn and adapt to changes, which demands a new mindset on the part of the organization (Marquardt, 2011). Transforming a university into a learning and future-ready institution can be accomplished through encouragement to accept change, not only in the curricula but also in the administrative structure and the staff. Traditionally, universities have been considered places where learning happens; nevertheless, they are not necessarily learning organizations.

A learning organization recognizes the value of knowledge, talent, and motivation of its employees, as its success depends on the efficient use of their talent. These organizations promote knowledge sharing between employees, offer lifelong learning opportunities, and encourage critical thinking and risk-taking. For a traditional organization to transform into a learning organization, a learning environment should be created: Employees' behavior should be modified, leadership skills should be developed, and control should be decentralized (Halmaghi, 2018).

For Bandura (2000), the leading theorist of observational learning, learning takes place at observing. This is based on the idea that learning is the product of social interactions. The socio-cognitive theory focuses on behavioral change that results from exposure to a social group. Social constructive theories encourage the creation of knowledge through interaction and collaboration. If an institution is considering a major change, a community of practice may provide the opportunity to use systems thinking to explore the planned change and its effects (Bond & Blevins, 2020).

Conceptual Model

The elements proposed in this conceptual model are aimed at fostering a context for learning (see Fig. 1). Learning has traditionally been considered as mainly enhanced in a classroom, when in fact external elements can enhanced it. Universities that foster lifelong learning skills train their graduates to be open to changes and learn continuously. Lifelong learning is a process that allows individuals to improve knowledge, skills, and profit from every learning opportunity (Tezer & Aynas, 2018). As has been previously stated, the model proposed to transform universities into learning organizations focuses on people. Improving people with the elements proposed will affect the other aspects of the model, as Fig. 1 shows.

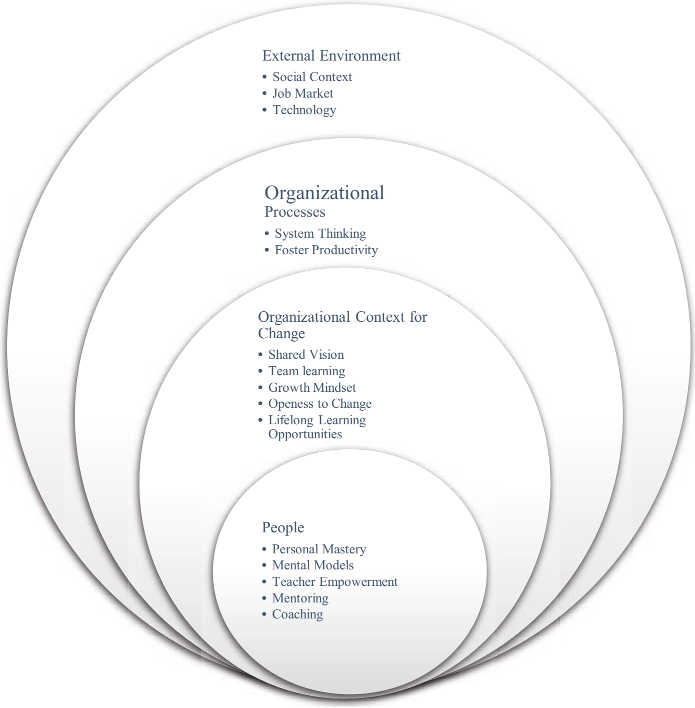


Fig. 1 Conceptualization of a learning organization

Elements of the Conceptual Model Proposed

Organizational resilience is the capacity of an organization to cope with changes and adjust over time to challenging situations. The higher the levels of organizational resilience, the better able to cope with changes. Gover and Duxbury (2018) propose a conceptualization of organizational resilience, which include the main elements considered in the conceptual model proposed. These elements were related to other variables found in the literature review conducted.

1. People: Persons in leadership positions; staff (unhappy, committed, or flexible people) and the organizational culture (how the organization treats people).
2. The organizational context for change: Change management, the pace of change processes, and specific changes.
3. Organizational processes: Communication and work processes.
4. External environment: Financial constraints.

The first element of this model is people, which should be the origin of the change. The organizational culture is mainly influenced by the attitude of the staff. According to Wilson and Holligan (2013), the influence of emotions in the lives of professionals has recently gained more attention. Emotions are linked to personal and professional well-being in times of change. Dasborough et al. (2015) state that during the implementation of a change, many emotions can be aroused. For a change effort to be successful, it should create positive feelings in employees toward the proposed changes. Emotions are associated with commitment, resistance, and support during the change. Negative emotions create resistance, and the lack of information regarding changes can generate anxiety. Fear is a result of feeling in danger and anger that reflects the loss of something valuable.

Emotions toward change will be considered as they are normal when a change is proposed. The four elements of the model by Gover and Duxbury (2018) considered in this proposal are focused on people and how their change can improve an organization. The other element of the model is the five disciplines proposed by Senge (2006), which also focus on people. These five disciplines should be present in an organization that continuously learns and grows. Personal mastery is the continuous improvement of skills needed to accomplish important tasks. Mental models or ideas can both empower or constrain a person, as they condition perceptions and thoughts. A shared vision is a picture of the goal to achieve that creates a personal compromise as it is aligned to the individual's vision. When encouraged, teamwork allows a respectful discussion of opinions and ensures that everybody's contribution will be respected and recognized. Lastly, system thinking is the type of thinking that allows seeing the whole, the interrelationship, and the patterns of change rather than individual things.

Personal mastery and mental models are elements that consider people, the first element of the model (see Fig. 1). Shared vision and teamwork impact on organizational context and organizational process, the second and third element. Finally, system thinking allows us to see the external environment, the fourth element.

As it was stated in the Gover and Duxbury model (2018), people can enhance or hinder an organization's ability to change. Unhappy people are diminished in their ability to cope with change. New staff, committed people, and flexible people can enhance the ability of an organization to cope with change. A supportive culture is also a key element to foster change. People and their mental models are the key elements in an organization. As Owen and Dietz (2012) state, the mental models of the people in an organization determine the way the system evolves and shapes the communication in the organization.

The absence of Senge's (2006) five disciplines and the presence of learning disabilities have been observed in many universities. In this context, learning disabilities are considered a belief system or barriers to learning that can have severe consequences. They are also known as "self-limiting behaviors that inhibit organizational learning" (Retna, 2005, p. 428). Some of the examples provided by Senge (2006) are considering a position as a part of your personality, considering the enemy is outside and not inside, inability to offer suitable solutions, fixation on events, lack of ability to detect danger, the delusion of learning from experience, and the myth of the management team.

As Kotter (2012) explained, in this context, educational leadership, academic productivity, and lifelong learning skills are almost nonexistent. Leadership skills should be developed to implement organizational change. Staff should be highly trained faculty focused on improving teaching and learning through research. This can be achieved by encouraging empowerment and a growth mindset, which would ensure the success of a transformation, as faculty interact with students and act as role models. Empowerment means expansion of capabilities, which are what make a person's life valuable (Boni & Walker, 2013). The development of human values and capabilities is key concepts that should be considered in a university's vision, apart from the goal of preparing people for the workforce.

Universities need to teach hard skills, which are the technical skills traditionally developed through academic courses. Skill is the ability or capability to perform a task, and the teaching and transfer of knowledge, skills, and attitudes are the responsibility of the academic community, the students, and the educational organization (Patacsil & Tablatin, 2017). Hard skills are the basis of the educational curriculum, the knowledge needed to perform a job (Patacsil & Tablatin, 2017; Wisshak & Hochholdinger, 2020). Many employers have noticed that graduates may have the hard skills to perform a job, but they lack soft skills. The development of soft skills reduces work-related stress and improves performance, productivity, and lifelong learning. They help to control negative emotions and to maintain a positive attitude toward problem-solving. Communication skills, intellectual curiosity, personal self-encouragement, mental openness, teamwork, ethics, empathy, and openness to embracing change are soft skills. They are all highly demanded by employers but seldom developed by universities.

According to Kamin (2013), soft skills are known as a person's ability to communicate, to build relationships, to promote problem-solving, to negotiate, to resolve conflict, and to team build. Patacsil and Tablatin (2017) also recognize critical and decision-making, self-confidence, self-management, teamwork, and work ethics as soft skills. Wisshak and Hochholdinger (2020) would add leadership, organization, and analysis skills to the list of soft skills. Most respected people in an organization are those with soft skills, who communicate with encouragement and bring people together to work in teams. These authors also mention that soft skills are more difficult to transfer as their development depends on individual characteristics and on the workplace culture.

Transformational leaders exhibit the characteristics of role models and, at the same time, are motivated to act as mentors. Leaders who create trust and confidence increase followers' performance, as they set high-performance standards and increase professional respect (Jyoti & Bhau, 2015). Members of an organization usually resist any need for change, while leadership is all about change, about urgency, vision, empowering people, and seizing the opportunity to act, and obtain results (Issah, 2018). Organizational effectiveness is improved when leaders support followers, as they understand their emotions and help them to manage emotional and intellectual growth. Emotional intelligence influences leadership abilities directly; as a result, emotionally intelligent leaders are more effective in facilitating change, increasing morale, motivation, and teamwork, as well as fostering a positive work environment (Issah, 2018). These leaders are also the most effective in encouraging change and avoiding resistance from collaborators.

Teacher Empowerment

As Friedman (2006) states, in a world where the intellectual coefficient is the most valuable asset, the most effective is to hire the brightest people for your organization. It is not possible to improve a country's economy if its people are not highly trained. Giving good quality education to a person is to provide the necessary tools to create a good lifestyle, generate income, and improve the country's economy.

The brightest people can only continue to grow and promote growth in an organizational atmosphere that makes faculty and students feel valued, respected, and motivated to contribute. Motivated faculty is a result of a good organizational atmosphere, which is mostly determined by the leader's attitude. It is recommended to encourage training, updating, skills development, and achievement of objectives. A person who considers that his contribution is important and meaningful has a strong feeling of self-efficacy (Anderson, 1994). Self-efficacy makes people feel empowered and willing to contribute to the success of the organization.

Mindset

Dweck (2017) mentions that people can have two types of mindsets. People with a fixed mindset believe that things can be accomplished without effort. They do not seek help to improve and tend to exaggerate the self-evaluation of their abilities. They worry that they can be judged if they recognize their weaknesses and continuously try to show superiority by doing the same things to show themselves as successful or perfect. Failure affects their self-esteem, and, as a result, they look for external reasons to avoid assuming their responsibility. People with a fixed mindset tend to judge, criticize, and classify people as superior or inferior. They tend to be abusive, to generate segregation, and foster a toxic environment. They also tend to attack those who do not obey them or think differently; they judge constantly and think that the rest should change instead of them.

On the other hand, according to Dweck (2017), people with a growth mindset think that abilities can be improved if you work on them. As they think that anybody can change and improve with effort, they take risks and work on mastering skills and abilities. They objectively evaluate their strengths and weaknesses and persevere even in adverse situations to grow and succeed. Their focus is on self-growth, self-motivation, and making themselves responsible for their development. Leaders with this mindset motivate their followers to grow, as they listen to their ideas and consider their feedback as a means to target their areas of growth and learning. Challenges are taken and pursued to success; failure is easily overcome. Another characteristic of these leaders is that they help others to grow instead of labeling or limiting them.

As the mindset conforms to ideas, limiting ideas can be recognized and transformed into growing or positive ones. In educational institutions, it is necessary to teach that failure does not mean a lack of intelligence, but a lack of experience and evidence of undeveloped skills. Mindset can be more important than intelligence, as there are more probabilities to succeed if a person has the discipline to keep developing skills. Successful people can be recognized as those who, besides having a growth mindset, develop different types of thinking that allow them to recognize opportunities and solve problems (Dweck, 2017).

As the social constructive theories state, a behavioral change can be produced through exposure to a social group (Bandura, 2000). People with a fixed mindset could benefit from contact with people with a growth mindset. A mentoring and coaching program could also enhance behavioral change. Mentoring programs can make new members feel included as professional relationships are improved. It has been observed that mentors are not always the senior ones, but those who are more up to date with technological developments.

Mentoring

People are more productive in organizational environments that promote trust and respect (Piggot-Irvine, 2015). A toxic organizational ambiance can be avoided with a mentoring program that improves productivity, motivates people, improves communication, and as a result strengthens the organizational culture. As Hersman (2018) states: "Mentoring is a leadership position" (pg. 148). To have a leadership role, it is necessary to be able to communicate effectively, align expectations, be knowledgeable, foster independence, accept diversity, and promote professional development.

Coaching

Coaching is another tool for contributing to personal and professional development (Gómez Palacio et al., 2019; Lemisiou, 2018). This process develops awareness of what the person wants to achieve and the strategies needed to achieve it. As a model of external leadership to motivate, it functions as a consulting resource to develop certain skills. Its main purpose is to make the person aware of what he wants to do and to take responsibility for his actions. Coaching sessions establish the objectives related to the change that the person wants to make, and then the real and the ideal situations are described. These descriptions make clear if the change is possible as the strategies to implement it are defined.

A coaching process changes the mindset from one focused on problems to one focused on looking for solutions. Besides self-esteem and self-efficacy, self-consciousness is also developed, and it is one of the main elements to develop socio-emotional skills. The person that follows a coaching process develops the ability to transform situations and face them efficiently both in their personal and professional life (Eret et al., 2018). To restructure universities, coaching and mentoring processes would also be helpful to encourage team building and develop lifelong learning skills. Universities need to adapt their administrative structures to become an intelligent organization that trains lifelong learners with both hard and soft skills.

The constructs considered in the conceptual model are presented in Table 1, as well as the definitions found in the literature review conducted.

Table 1 Elements of the learning organization

Construct	Definition
Learning organization	An organization that creates, acquires, and transfers knowledge, modifies its behavior, and reflects on new concepts Garvin (as cited in Nicolae & Nicolae, 2016)
Personal mastery	Continuous clarification and deepening of an individual's abilities (Choi et al., 2016)
Mental models	Psychological images of how the world works (Choi et al., 2016).
Teacher empowerment	Actions performed by faculty focused on the improvement and efficiency of the organization (Román-Calderón et al., 2016)
Mentoring	A formal role of teacher leadership to support colleagues and help less experienced teachers transform their practices (Gul et al., 2019)
Coaching	A method focused on goal setting and on the future that uses content-oriented techniques (Lemisiou, 2018)
Leadership skills	Abilities to manage human resources efficiently (Jyoti & Bhau, 2015)
Shared vision	A picture of the future goal and creates a consensus among organizational members about how to achieve it (Choi et al., 2016)
Team learning	The capacity of members of a team to suspend assumptions and enter into a genuine "thinking together" (Senge, 2006)
Growth mindset	View or beliefs a person holds regarding the acquisition and development of qualities (Dweck, 2017)
Openness to change	Ability to use strategies, curiosity, and imagination to new experiences (Bath & Smith, 2009)
Lifelong learning	Educational models are based on the continuous improvement of knowledge (Blaszczak, 2013)
System thinking	An approach that can help to solve managerial challenges, as it helps to consider separately and together with the parts of a whole (Ruiz-Amurrio et al., 2018)
Knowledge productivity	Work that requires continuous learning and innovation to produce high-quality outcomes (Drucker, 1999)
	Feeling of effectiveness, efficiency, and capability to perform tasks in the workforce (Hatam et al., 2014)
Social context	Components that encompass the individual's living conditions as the physical environment, socioeconomic level, level of education, work, and income (Lozano-Hernández et al., 2020)

Conclusions

Lifelong learning transforms the way knowledge is acquired and transferred. It demands a shift from education to learning throughout life (Roche, 2015). As information is produced continuously, people have to increase their education throughout their lives, even after completing their formal education. University teachers should preserve their curiosity as they are aiming to train lifelong learners and transfer these skills to them.

Interventions to implement the elements presented in this conceptual model might transform universities into learning organizations. These organizations encourage academic and personal growth, accept change, develop leadership skills, empower people, and develop lifelong learning skills. A learning organization also encourages its members to constantly grow, learn, and transform others, causing a positive effect on their lives. Lifelong learning should be present in an intelligent organization as a way to continuously adapt to changes (Pereira et al., 2016). Universities should be transformative places where relations of equality and respect of difference should be promoted. They should also be places where original, creative, and transformative knowledge is produced (Walker & Boni, 2013).

References

Anderson, M. (1994). *Self-efficacy of teacher education students: A study based on Bandura's social cognitive theory* (doctoral dissertation). Retrieved from ProQuest.

Azeem, M., & Mataruna, L. (2019). Identifying factor measuring collective leadership at academic workplaces. *International Journal of Educational Management, 33*(6), 1316–1335.

Bandura, A. (2000). Self-efficacy. In A. E. Kadzin (Ed.), *Social-cognitive theory*. American Psychological Association, American Psychological Association Oxford University Press. https://doi.org/10.1037/10522-140

Bath, D. M., & Smith, C. D. (2009). The relationship between epistemological beliefs and the propensity for lifelong learning. *Studies in Continuing Education, 31*(2), 173–189.

Blaszczak, I. (2013, May). *Contemporary perspectives in adult education and lifelong learning-andragogical model of learning.* Paper presented at the annual meeting of the Bulgarian comparative education society, Plovdiv, Bulgaria.

Bond, M. A., & Blevins, S. J. (2020). Using faculty professional development to foster organizational change: A social learning framework. *TechTrends, 64*, 229–237.

Boni, A., & Walker, M. (2013). Human development, capabilities and universities of the twenty-first century. In A. Boni & M. Walker (Eds.), *Re-imagining the university of the twenty-first century* (pp. 1–11). Taylor & Francis Group.

Choi, Y., Kim, J. K., & Yoo, T. (2016). A study on the learning organization readiness on employees' quality commitment: The moderating effect of leader-member exchange. *Total Quality Management, 27*(3), 325–338.

Dasborough, M., Lamb, P., & Suseno, Y. (2015). Understanding emotions in higher education change management. *Journal of Organizational Change Management, 28*(4), 579–590.

Drucker, P. (1999). Knowledge-worker productivity: The biggest challenge. *California Management Review, 41*(2), 79–94.

Dweck, C. (2017). *Mindset: Changing the way you think to fulfil your potential*. RandomHouse Digital.

Eret, E., Yerin Güneri, O., & Capa Aydin, Y. (2018). Evaluation of peer mentoring program in higher education: Does it support smooth transition of new faculty to the academia? *Journal of Higher Education and Science/Yüksekögretim ve Bilim Dergisi, 8*(3), 532–541.

Friedman, T. L. (2006). *La tierra es plana: breve historia del mundo globalizado en el siglo XXI*. Ediciones Martínez Roca.

Gómez Palacio, C., Gómez Vargas, E., & Pulgarín Taborda, H. (2019). Coaching as a professional development strategy for adjunct instructors in a Colombian university. *Profile: Issues in Teachers' Professional Development, 21*(1), 121–135. https://doi.org/10.15446/profile.v21n1.71362

Gover, L., & Duxbury, L. (2018). Inside the onion: Understanding what enhances and inhibits organizational resilience. *The Journal of Applied Behavioral Science, 54*(4), 477–501.

Gul, T., Demir, K., & Criswell, B. (2019). Constructing teacher leadership through mentoring: Functionality of mentoring practices in evolving teacher leadership. *Journal of Science Teacher Education, 30*(3), 209–228.

Halmaghi, E. (2018). From the traditional organization to the learning organization. *Journal of Defense Resources Management, 1*, 98–103.

Hatam, N., Kavosi, Z., Lotfi, M., Zarifi, M., Tavakoli, A., & Rahimi, M. K. (2014). Localization of the knowledge workers' productivity questionnaire and evaluation of the productivity of knowledge workers of the central field of Shiraz University of Medical Sciences. *International Journal of Travel Medicine and Global Health, 2*(2), 51–60.

Hersman, B. (2018). Mentoring: A convenience or convergence? *Quest, 70*(2), 139–152.

Issah, M. (2018). Change leadership: The role of emotional intelligence. *SAGE Open*, 1–6. https://doi.org/10.1177/2158244018800910

Jyoti, J., & Bhau, S. (2015). Impact of transformational leadership on job performance: Mediating the role of leader-member exchange and relational identification. *SAGE Open*, 1–13. https://doi.org/10.1177/2158244015612518

Kamin, M. (2013). *Soft skills revolution. A guide for connecting with compassion for trainers, teams and leaders*. Wiley.

Kotter, J. (2012). *Leading change*. Harvard Business Review Press.

Lemisiou, M. (2018). The effectiveness of person-centered coaching intervention in raising emotional and social intelligence competencies in the workplace. *International Coaching Psychology Review, 13*(2), 6–25.

Lozano-Hernández, C. M., López-Rodríguez, J. A., Leiva-Fernández, F., Calderón-Larrañaga, A., Barrio-Cortés, J., Gimeno-Feliu, L. A., et al. (2020). Social support, social context and nonadherence to treatment in young senior patients with multimorbidity and polypharmacy followed-up in primary care. MULTIPAP study. *PLoS ONE, 15*(6), e0235148. https://doi.org/10.1371/journal.pone.0235148

Marquardt, M. (2011). *Building the learning organization. Achieving strategic advantage through a commitment to learning* (3rd ed.). Nicholas Brealey Publishing.

McLean, M., Abbas, A., & Ashwin, P. (2013). University knowledge, human development and pedagogic rights. In A. Boni & M. Walker (Eds.), *Re-imagining the university of the twenty-first century* (pp. 30–43). Taylor & Francis Group.

Nicolae, E. E., & Nicolae, M. (2016). Universities as learning organizations managing people and processes. *Euromentor Journal, 1*, 7–13.

Owen, K. O., & Dietz, A. S. (2012). Understanding organizational reality: Concepts for the change leader. *SAGE Open*. https://doi.org/10.1177/2158244012461922

Patacsil, F., & Tablatin, C. L. (2017). Exploring the importance of soft and hard skills as perceived by IT internship students and industry: A gap analysis. *Journal of Technology and Science Education, 7*(3), 347–368.

Pereira, M., Gomez, C., Pinto, M., Ruiz-Ochoa, M., & Meneses-Jacome, A. (2016). Transformation and innovation of organizational culture in higher education institutions: State of the art and conceptual bases. *Revista Docencia Universitaria, 17*, 43–54.

Piggot-Irvine, E. (2015). Leader bullying through a different lens. *SAGE Open*, 1–10. https://doi.org/10.1177/2158244015589786

Retna, K. (2005). *Universities as learning organisations: Putting tutors in the picture, in higher education in a changing world*. Proceedings of the 28th HERDSA annual conference, Sydney. Retrieved from: https://www.herdsa.org.au/publications/conference-proceedings/research-and-development-higher-education-higher-education-97

Roche, S. (2015). We don't need no education: The radical implications of lifelong learning. *International Review of Education, 61*, 1–6.

Román-Calderón, J. P., Krikorian, A., Franco, C., & Betancur, A. (2016). Apoyo organizacional y empoderamiento como antecedentes de comportamientos empoderados y participación de empleados. *Estudios Gerenciales, 32*, 154–161.

Ruiz-Amurrio, M., Elorza-Iñurritegi, U., Linnéusson-Iñurritegi, G., & Zabaleta-Etxebarria, N. (2018). Identificación de factores que influyen en el compromiso de los empleados utilizando pensamiento sistémico. *Psicología Industrial, 93*(5), 504–511.

Senge, P. (2006). *The fifth discipline. The art and practice of the learning organization*. Doubleday Currency.

Tezer, M., & Aynas, N. (2018). The effect of university education on lifelong learning tendency. *Cypriot Journal of Educational Science, 8*(1), 66–80.

Walker, M., & Boni, A. (2013). Higher education and human development: Towards the public and social good. In A. Boni & M. Walker (Eds.), *Re-imagining the university of the twenty-first century* (pp. 15–29). Taylor & Francis Group.

Wilson, M., & Holligan, C. (2013). Performativity, work-related emotions and collective research identities in UK university education departments: An exploratory study. *Cambridge Journal of Education, 43*(2), 223–241.

Wisshak, S., & Hochholdinger, S. (2020). Perceived instructional requirements of soft-skills trainers and hard-skills trainers. *Journal of Workplace Learning, 32*(6), 405–416.

Strategies for Creating Engaging Learning Communities to Inspire and Motivate Adult Learners

Dwan V. Robinson, Tracy Robinson, and Adesola Ogundimu

Introduction

Teaching and learning environments are continually changing, and thus pedagogy must adapt to meet the contextual needs of the learner. Learners hail from diverse backgrounds and come to learning communities in higher education with varied needs and skills and expectations. The creation of engaging educational contexts is key for the successful advancement of all students. For decades, scholars have presented varied strategies for good teaching and effective approaches for motivating and inspiring students in both virtual and face-to-face higher education learning environments (Chickering & Gamson, 1987; Dixon, 2010; Pontius & Harper, 2006; Kuh, 2016; Kuh et al., 2011). These approaches often embrace the integration of new technologies and include high expectations, academic support, active learning, and respect for diverse learning styles and skills. As such, faculty members must consider the use of varied innovative strategies to develop and sustain robust courses. This inquiry highlights strategies used in the instructional design of a dissertation preparation course, the pedagogical practices used to engage students, and the practical lessons learned. This research details an intervention that provides recommended strategies for inspiring and motivating adult learners in hybrid or online courses.

D. V. Robinson (✉) · T. Robinson
Ohio University, Athens, OH, USA

A. Ogundimu
Johns Hopkins University, Baltimore, MD, USA

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*,
Educational Communications and Technology: Issues and Innovations,
https://doi.org/10.1007/978-3-030-85078-4_21

Literature Review

Adult Learning Theory

There is a substantial amount of research focused on how adults learn best (Allen et al., 2016, Merriam, 2008). The adult learner is situated in a unique learner demographic for whom age is not the only distinguishing characteristic. Consistent with Knowles' (1980) work on andragogy, Merriam indicates that adult learners have "an independent self-concept," are capable of directing their learning, and possess a collection of past experiences valuable as a foundation for learning (p. 5). Additionally, for adults, learning is often necessary to fulfill socially defined roles dictated by the learner's professional and personal obligations. Their approach to learning is therefore problem-centered, goal-focused, and application-oriented in nature. Finally, the adult learner's motivation for learning is internally driven. This latter trait of self-knowledge and self-regulation applied by adults toward learning-related endeavors also forms a crucial part of other theories that are central to adult learning such as self-directed learning, heutagogy, and transformative learning (Mezirow & Taylor, 2011).

Engagement Strategies: Impact on Motivation

Theorists from both online and face-to-face learning environments suggest that engagement enhances student learning in various ways (Kuh, 2016; Martin & Bolliger, 2018). Martin and Bolliger (2018) posit that when students are engaged, they have better performance outcomes; they experience greater motivation and satisfaction in learning and thus feel less isolated as learners.

Scholars posit that students are engaged when they are involved "in educationally effective practices" (Quaye & Harper, 2014) and when higher education allocates "resources and organizes the curriculum and other learning opportunities" to help students advance (Kuh et al., 2011). Thus, it is incumbent upon educators to consider strategies for maximizing educational spaces for students from varied backgrounds.

Based on perspectives of these theorists, ideas from other scholars, and the teaching profession, there appears to be a need to transform teaching to create engaging learning experiences for students. Powell, Cleveland, Thompson, and Forde emphasize the use of varied and creative technology-supported instructional strategies for enhancing course delivery and stimulating active student learning. As such, we suggest that an infusion of technology-enhanced content and activities to illuminate concepts and to support student learning will provide an innovative way to enhance curricular experiences and help to reinforce course content.

The Course: The Dissertation Preparation and Research Seminar

The Dissertation Preparation and Research Seminar is a course designed to guide doctoral students in the development of their dissertations. Course experiences include guidance regarding the varied sections of the dissertation and direction to help students understand the dissertation experience. In addition, course components are structured to provide blended and online support and resources that can extend learning. The course also encourages collaborative learning that facilitates knowledge building (Scardamalia & Bereiter, 2006).

Learners in the course hail from numerous backgrounds and are at different junctures of their dissertation journey including those who are developing parts of their proposals (introduction, literature review, and methodology sections), some who are working on analyzing their findings and those who are in the discussion and/or conclusion phase. Students have been in their doctoral programs from 2 to 10 years and the majority of students are in their fourth or fifth year.

Some of the students have even petitioned for extensions on their dissertation completion time or have left the University for a period and have returned.

The course is a venue for not only instruction but also support and mentoring. Students have commented that the course helps to "motivate" them and "lets them know that they are not alone." Kim et al. suggest, as students feel comfortable in their learning communities, they are more likely to be active participants in that community. The dissertation preparation experience is geared toward providing an opportunity for students to engage with other similarly situated scholars and offers a chance for peer-to-peer learning. In addition to preparing them to work through various components of their research, students in the course are engaged in various learning activities designed to help them develop relational and communication skills. These skills developed through multiple in-class opportunities (i.e., one-on-one and group discussions) are necessary for students to effectively collaborate with faculty on their dissertation committees and to clearly articulate their research.

Our Approach

Engagement Strategies in the Dissertation Preparation and Research Seminar

In order to design effective learning spaces, conducting a learner analysis can inform the design and development of courses and curricular offerings. Students in the class are at different levels of the dissertation process. Students are either at the beginning, middle, or end. Many students acknowledge that they are in the class because they are “stuck” and “do not know where to turn to complete the dissertation” (student comments).

Student profile data was gathered from a total of 42 students enrolled in the course over 2 semesters. Profiles were distributed to students for completion prior to the start of the class. Each profile had ten questions to discern details about where students were in the dissertation process, their past academic and professional experiences, and student research plans and ideas. Insights from the student profiles informed the course design. Students were asked what new learning they expected from the class. Information from the profiles was used to inform the choice and design of the various instructional elements addressed in this research.

An additional important consideration was how these traits helped to inform the design and delivery of relevant course content and activities as well as media to support adult learning experiences in the course. All data collected from students were categorized based on student needs and how the needs would be integrated into lesson plans to help develop the course content.

In considering engagement strategies for the course, the instructor used a learner analysis approach that involved using data on student characteristics to determine the various attributes of the targeted audience. This information also influenced the design of the course and materials. The profiles revealed the nature of the student groups, the students’ preparation, the degree of motivation, and other traits that contributed to their interest and success in learning. The learner characteristics provided insights into either opportunities or constraints on the course design. Early in course design, learner characteristics were used to determine learner abilities, motivations, experiences, needs, and interests. This information helped in further designing course elements such as entry points for the selection of topics, the depth of a topic discussion, the choice and sequencing of learning objectives, and the variety of learning experiences.

Learner Analysis

To understand the learning traits of adult learners in the course, the team analyzed data from the student profiles. It is important to understand that regardless of their age or unique career and life situations, adult learners possess other unique learning traits that may provide clues for how best to support their learning using online content (Cercone, 2008).

Once the data was analyzed for trends in the learning community, the data was shared with the class. Displaying the learner analysis data to the class helped to build community and helped to engage students prior to the first-class meeting. Students also became intrigued by who their classmates would be. The data enabled the instructor to extract salient information for tailoring the course content for students.

When teaching online or in person, it is often good to know whether students have begun to engage with the course material or not at all. The learner analysis informed and guided course development on where to place emphasis, how to design course assignments and develop learning activities. This analysis also helped the instructor identify entry points into the course content.

Further, the learner analysis served as a motivator for students to become engaged. As students recognized that the data would be used to help build the learning community and connect them with classmates, some students (who were embarrassed by not completing the profile) would hurry to finish their student profile during class so that their data could be included in the discussion of learning community characteristics. This information was used to expand the students' knowledge about each other and the entire class.

Student Community and Collaboration

Each cohort of students taking the dissertation seminar was formed into a community of learners within the first few weeks of interaction. Their unique characteristics as doctoral-level scholars and professionals along with their common learning goals (for research and dissertation writing) served as the basis for group/community formation. Activities early on in the course such as shared themes from the student profile data, as well as the Kings' Table activity, stimulated connections between similarly situated students by highlighting commonalities, a process Aitchison and Lee (2006) describe as "identification." Articulating research topics, ideas, and goals one-on-one over multiple rounds not only helped students refine their research through peer feedback but also created more personal interactions and appreciation of one another's research. Students further had opportunities to collaborate during scheduled class sessions as well as informally outside class time.

Since students at the dissertation stage typically have already completed all other coursework, this collaborative learning environment afforded a sense of community that significantly alleviated feelings of isolation often present during dissertation research. These peer-to-peer interactions therefore provided motivation for progress, improved persistence, and moved members of the learning community toward timely completion as supported by Pauley (2004) as well as Holmes, Seay, and Wilson (2009).

Peer-to-Peer Learning Strategies

Peer-to-peer learning strategies and the development of learning communities and communities of practice have been heralded as key to facilitating robust learning experiences for students. In addition, group interaction and collaboration have been found to stimulate the creation of and stimulation of knowledge (Holzweiss et al., 2014). During this course, a collaborative learning activity known as the King's Table was used to help students co-create knowledge. The King's Table activity is a learning activity that simulates a speed dating exercise. The King's Table is given that name because it is considered a venue where high-level conversations occur between members of the King's court like one would expect at a King's table. Everyone in the class is welcome at the King's Table, but they are required to contribute to the conversation by discussing various aspects of their dissertation journey. At the beginning of the class, students sit on either side of a long table across from a fellow classmate and have a discussion. Each partner is required to provide an overview of their research study, describe their research idea, and articulate ideas regarding what they want to research, their perspective on their topic, and visioning about how the research will be conducted. A timer is set, and every 3 minutes, students are asked to rotate to a new partner.

During this exercise, participants get ideas for their research, collaboration occurs between students, and students engage in peer-to-peer learning and reflection regarding suggestions and affirmations from their classmates. In addition, study groups and mini-learning communities develop as a result of the interaction. From this exercise, students are motivated to participate. In addition, student profile data informs this activity to help students better prepare for, articulate and frame research goals to peers, and to eventually transform that into their writing.

Blended Learning: Instructor Videos and Blackboard

With the growth in the use of digital learning technologies seen in higher education in recent years, adult learners have an increasing number of tools and resources at their disposal to support their learning goals. Regardless of age, digital media particularly video, has been known to support the acquisition of knowledge. Therefore, adult learners, just like traditional learners, stand to benefit from the interactivity and engagement that instructional video content provides.

The analysis of learner characteristics results drove the pedagogical decisions. All students were adult learners in doctoral programs with unique academic, personal, and professional characteristics that affected their approach to education. For example, approximately 90% were employed either full-time or part-time. Additionally, half of the students were international students with diverse cultural and contextual approaches to the course. Further, many students travelled significant distances to class and as a result had to rely on technology to keep them connected to the course and the learning community when they were not on campus. Finally, many students had family commitments that required flexibility regarding when and how they could approach learning.

Based on many of these factors, instructional videos were used to support student learning in the class. Video served as a tool to reinforce learning and to engage students who many times were feeling isolated, who were busy or working. These videos were used to strengthen learning in the course. Videos also provided access to course content 24 hours per day. This was important because adult learners learn at different times of the day because of work and family commitments. The learners needed access to the course content when they were available to study. The videos also provided access for distance learners, commuters, and absent class members.

Additionally, research shows that many graduate students enter courses with fear and apprehension. This fear can be amplified for international students because of different cultural expectations about faculty and student interactions. The ability to see the professor, hear the professor's tone, and approach created an approachable and welcoming class. The welcome video helped build trust between faculty and students.

Enhancing Self-Directed Learning: Productivity and Time Management Using Digital Learning Tools

A key theme that emerged from the learner analysis data was the need for the doctoral students to make progress toward timely completion. As adult learners, conflicting work schedules and other obligations often impose constraints on time and motivation toward productive dissertation research and writing. Goal setting, planning, and tracking progress toward milestones are therefore crucial. Two of the foundational course activities—timeline development and daily journaling—were designed to help students advance toward their goals.

Early on in the course, each student created a timeline of all activities, meetings, and events involved in the dissertation process from start to finish with key dates, milestones, and realistic deadlines identified. Implementing this project management approach was useful for helping students define and visualize the learning path while exercising self-direction and autonomy in setting and meeting realistic targets. Students were encouraged to use any time management or project management software of their choice. In addition to timeline development and tracking, the daily practice of research journaling was incorporated in order to encourage students to maintain a continuous and consistent writing schedule. Both of these approaches have been identified by Lindsay (2015) as effective practices for improved research writing organization and productivity.

Conclusion

In considering the experiences of students from the course, we gleaned an understanding regarding how course experiences motivated learners and served to reinforce approaches for students to complete their dissertations. The learner analysis provided direction for the development of robust curricula and learning activities that helped to design instruction to motivate and engage students. The strategies developed in the course also served as a vehicle to enhance teaching practices.

References

Aitchison, C., & Lee, A. (2006). Research writing: Problems and pedagogies. *Teaching in Higher Education, 11*(3), 265–278.

Allen, P., Withey, P., Lawton, D., & Aquino, C. T. (2016). Andragogical teaching methods to enhance non-traditional student classroom engagement. *Journal of Educational Technology, 13*(2), 47–59.

Cercone, K. (2008). Characteristics of adult learners with implications for online learning design. *AACE Journal, 16*(2), 137–159.

Chickering, A. W., & Gamson, Z. F. (1987). Seven principles for good practice in undergraduate education. *AAHE Bulletin, 3*, 7.

Dixon, M. D. (2010). Creating effective student engagement in online courses: What do students find engaging? *Journal of the Scholarship of Teaching and Learning, 10*(2), 1–13.

Holmes, B. D., Seay, A. D., & Wilson, K. N. (2009). Re-envisioning the dissertation stage of doctoral study: Traditional mistakes with non-traditional learners. *Journal of College Teaching & Learning (TLC), 6*(8).

Holzweiss, P. C., Joyner, S. A., Fuller, M. B., Henderson, S., & Young, R. (2014). Online graduate students' perceptions of best learning experiences. *Distance Education, 35*(3), 311–323.

Knowles, M. S. (1980). *The modern practice of adult education*. Prentice Hall.

Kuh, G. D. (2016). Making learning meaningful: Engaging students in ways that matter to them. *New Directions for Teaching and Learning, 2016*(145), 49–56.

Kuh, G. D., Kinzie, J., Buckley, J. A., Bridges, B. K., & Hayek, J. C. (2011). Piecing together the student success puzzle: Research, propositions, and recommendations. In *ASHE higher education report* (Vol. 116). Wiley.

Lindsay, S. (2015). What works for doctoral students in completing their thesis? *Teaching in Higher Education, 20*(2), 183–196.

Martin, F., & Bolliger, D. U. (2018). Engagement matters: Student perceptions on the importance of engagement strategies in the online learning environment. *Online Learning, 22*(1), 205–222.

Merriam, S. B. (2008). Adult learning theory for the twenty-first century. *New Directions for Adult and Continuing Education, 2008*(119), 93–98.

Mezirow, J., & Taylor, E. W. (Eds.). (2011). *Transformative learning in practice: Insights from community, workplace, and higher education*. Wiley.

Pauley, D. (2004). Group therapy for dissertation-writers: The right modality for a struggling population. *Journal of College Student Psychotherapy, 18*(4), 25–43.

Pontius, J. L., & Harper, S. R. (2006). Principles for good practice in graduate and professional student engagement. *New Directions for Student Services, 2006*(115), 47–58.

Quaye, S. J., & Harper, S. R. (2014). *Student engagement in higher education: Theoretical perspectives and practical approaches for diverse populations*. Routledge.

Scardamalia, M., & Bereiter, C. (2006). *Knowledge building: Theory, pedagogy, and technology*, (pp. 97–118).

The Invisible Message

Andrew S. Gibbons and Elizabeth Boling

The movie *Wall-E* tempts us to empathize with a trash compactor and a detector bot who dance in space with fire extinguishers and relive for us the innocence and exuberance of a first love. How is this done? Certainly, it is a work of its own kind of art, but to an instructional designer, it presents an inspectable object, full of lessons on the design of disciplined, coherent, intellectually and affectively powerful communication. *Wall-E* and many other animated features show the mastery by their designers of a disciplined message design process that underlies and supplies structure for the colorful, moving surface representation. Their secret is that *they know what they intend to say before they say it*. They are adept at shaping their messages first and then their representations as if they were separate layers of the design. By observing the techniques of the movie makers at incorporating message into products, instructional designers can learn to appropriate more focused and disciplined methods of message capture and expression.

What is a message? It is not surface show, physical arrangement, appearance, or exterior features: those things are representations. Messages are invisible and abstract: they are the hand inside the puppet, as it were, and not the puppet itself. Most designers have been taught to design puppets; our purpose in this chapter is to describe how instructional designers can design the hands and only then design the puppets.

Our definition of message is set in the context of a theory of design outlined in *The Architecture of Instructional Design* (Gibbons, 2014, see also Gibbons & Rogers, 2009). In this architectural theory, designs of instructional artifacts actually consist of multiple sub-designs of specific functions carried out by instructional

A. S. Gibbons (✉)
Brigham Young University, Provo, UT, USA

E. Boling
Indiana University, Bloomington, IN, USA

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*, Educational Communications and Technology: Issues and Innovations,
https://doi.org/10.1007/978-3-030-85078-4_22

artifacts. One function common to all instruction is to execute strategic moves; another function is to supply elements of subject matter, or content.

In this chapter, our focus is on the function of messaging and the design of conversational exchanges between learners and instructional sources. During instruction, communications are sent to learners in the form of media representations hoped to convey the intellectual and affective intentions of the designer. Learners respond by sending communications back that can be analyzed to determine the learner's intellectual and affective intentions—messages from the learner. Instructional conversation in any medium, live or technology-based, consists of a constant processing of representation surfaces in order to get to intentions (messages). While representation design is well-documented in the literature of instructional technology, theories and techniques for message design and the manner of conveying intentions and values are largely unexplored.

The literature of instructional technology is full of concern for message design. It can be readily seen in the work of Markle (1964, 1969) and her specificity in describing the content of a programmed instruction frame. A typical Markle frame contained information and a challenge to respond. After a response, a correct answer was revealed, setting up a conversational rhythm between the learner and the program. Conversationality was built in to the system.

Markle's attention was on the frame. In her book *Good Frames and Bad*, Markle described in painstaking detail the *composition* of frames in terms of their message constituents—the elements of intended message they contained. Different types of frame were characterized in terms of different message elements that were combined within a frame. One frame could state a rule; another could give an example; and another could ask for a particular type of response.

The important lesson of programmed instruction was that whatever the style of the program (and there were many), programming was an exercise in the disciplined arrangement of conversational messages formed in the designer's mind before they were expressed in text or diagrams—the hand within the puppet. The function of each invisible message was to perform a conversational action to which the other conversant could reciprocate with their conversational action. The core of the communication process in a program was for each conversant to understand the actions intended by the other. This was assured for programs through constant testing of individual frames and sequences and the elimination of frames that did not yield readily to interpretation.

The subtitle of Markle's book, *A Grammar of Frame Writing*, made it clear that she was describing a discipline for arranging elements of message within frames, prior to representation:

> This book is called a grammar because it tries to do what a grammar of language would do. It contains a classification scheme of the basic elements (or structures) and operations (or procedures) and a survey of the possible ways of combining these operations and elements into "good" forms. As with many grammars, you could also expect considerable practice aimed at eliminating from your repertoire certain inelegant or unpermitted ways of combining the elements and operations. (Markle, 1969, p. 56)

Merrill too explored the disciplined formation of messages into structures approximating program frames in his Component Display Theory (Merrill et al., 1980; Merrill, 1983). Whereas in programmed instruction, the challenge was to create a sequence of frames set by the designer, Merrill's challenge in the design of the TICCIT computer-assisted instruction system was to allow the learner to determine the course of the conversation—the order of message exchange. To accomplish this, Merrill devised a system of standard display types, each type characterized in terms of its message composition. Merrill drew inspiration from the RULEG system (Evans et al., 1960, 1962), which categorized message elements in functional terms of rules and examples. To this basic message set Merrill added a rich family of related messages (practice, easier, harder, objective, etc.) accessible to the learner through a specially designed keyboard that gave the learner's full control of the instructional conversation. So oriented toward the learner was this system that literally nothing would happen unless learner asked (see Gibbons & O'Neal, 2014). Merrill's focus was on the structure of a message set for a specific project, so there was little time to generalize the idea of the message as a design construct, and the message construct remained unexplored at the time.

Markle and Merrill both represented an instructional style heavily influenced by the behaviorist foundations that represented the theoretical environment of the times. The message construct was important to the work done in that environment, but it did not emerge as a named research topic.

Somewhat in in parallel with the work of Markle and Merrill, advances in computer technology and the growth of the cognitive science movement stimulated research into the development of intelligent tutoring systems. Within this new theoretical environment, there was a practical need for a theory of message structure, but the message as a design construct was again assigned a place in the background, and the design of mechanisms for intelligent adaptation was given priority. This included emphasis on (a) program mechanisms and programming languages that permitted intelligent adaptation and (b) high-level patterns of instructional style, mainly direct versus Socratic styles of instruction. The message in these explorations was simply a vehicle for enabling experiments that were related to higher-level, theory-driven conversational styles and program mechanisms.

Pioneering research by Carbonell (1970) used templated sentence forms into which specific subject matter elements could be substituted to generate representations, conflating message, and representation concerns. The same form that produced "The average yearly rainfall in <Argentina> is <28> inches" could also produce "The average yearly rainfall in <Peru> is <39> inches." These structures could convey intellectual content, but they were unidimensional and limited to only the information-bearing function. They could be formed into interactional sequences, but it would be hard to characterize these austere forms as turns in a normal conversation, because many of the human elements of message were missing that acknowledged an understanding of and adaptation to the learner as a distinct individual.

Incorporating the human quality into conversational exchanges and adapting to the individual became over time a main pursuit of the intelligent tutoring movement. It resulted in the end in the use of avatars capable of showing expression changes intended to create in the learner the sense of a caring, responsive conversational partner. However, what was and is still missing is a robust theory of conversation by which theories of strategy could be implemented. There is a convergence point where instructional goals at their finest level of granularity and conversational goals must meet for the management of goal-oriented communications.

The organization of an instructional design that involves the convergence of strategy, message, and representation has to be multifunctional and multilayered because the theoretical base for designing each—strategy, message, and representation—is different. A strategy function operates according to rules and theories of strategy that have roots in the psychology of learning. A message formation function requires theory that decomposes higher-order strategic goals to smaller, more conversational goals to guide expression. These take the form of messages to be conveyed. Then a representation function must draw upon representation theory to convey as faithfully as possible the intent of the message. Wenger (1987) might consider this a chain of transformations for ensuring "epistemic fidelity":

> For the purposes of this discussion, let us define a *representation* of knowledge very broadly as a *mapping* of knowledge onto a physical medium. It is useful to be able to speak about knowledge that is the source of this mapping, and we will use the adjective *epistemic* to refer to this "disembodied" level. Whether such an epistemic level really exists in some Platonic sense is not the point here. The claim is, rather, that the distinction between the epistemic and representation levels is *useful* in designing and evaluating models of communicable knowledge. (Wenger, 1987, p. 312, emphasis in the original)

Wenger points here to a gulf between the formation of an intention to communicate and the formation of a representation capable of communicating. This gulf is spanned using principles and theories of message design as we have defined it.

A notable example of spanning this gulf can be found in the Steve intelligent tutoring demonstration developed by Lewis Johnson and Jeff Rickel at the University of Southern California (Rickel & Johnson, 1997; Johnson & Rickel, 2000). Steve's design depends heavily on the driving of representations by messaging rules, which are in turn driven by strategic rules. Steve's artifacts—strategy, messaging, and representations—are generated or constructed in real time during instruction. Steve operates in the virtual world of a ship's boiler room. "Steve" is a graphical avatar/instructor capable of either guiding instruction or responding to learner questions, including, to a certain extent, "Why?".

What is remarkable about the Steve simulation is the broad spectrum of messaging devices employed and made manifest in representations that preserve the values of the message. Steve uses gestures, direction of gaze, body position, motions, and pauses in close coordination with strategic purposes. When demonstrating a procedural step, Steve looks at the student while speaking, pauses, and looks at the location of the action to be performed, makes the action, and then lifts gaze back to the student before proceeding. The effect is the closest approximation to a live tutor's behavior in terms of what could be called presence. Steve is a rule-driven simulation in which the message-driven avatar actions not only execute an intellectual, content-related strategy but also mimic to the senses a caring, aware person.

Social learning theory provides a final illustration of the value of the message layer as an independent functional area of designs. It capitalizes on the use of learners to create message content and the ordering of messaging simply by controlling the categories of the messages learners can use. CSILE (Computer-Supported Intentional Learning Environment, Scardamalia et al., 1987; Bereiter & Scardamalia, 1989; Scardamalia, 2004) provides instructors with a controlled discussion and problem-solving environment in which contributions of students to the solution of problems are constrained by category. Categories may vary depending on the type of problems students are challenging and may either be supplied from a standard set or tailored by the instructor.

The typing of messages in CSILE raises the question of how many types of message there might be, which in turn suggests the possibility that the number might be very great. This is the conclusion supported by conversation analysis, a content-agnostic, synthetic theory of conversation analysis and structure (Sidnell & Stivers, 2013). Schegloff, a major proponent of conversation analysis, proposes that each turn in a conversation (including, of course, instructional conversations) performs one or more actions. Levinson (2013) notes that a single conversational turn may perform multiple actions and that the number of possible actions is, indeed, very large and grows through experience. A young person may be aware of many actions, but a mature person, having more experience, understands the action performed by the nuanced utterance at a dinner table, “Has anyone seen the salt?”. This question may not draw a response from a youngster, but from an adult, the response will bring a salt-shaker to hand.

Room permitting, a much more detailed argument for the message layer and its design as a semi-independent element of an instructional design, could be made. Gibbons and Boling (in press) make this argument in a monograph that explains in much more detail the concept of message design, its place within an architectural theory of design, and the practical theory of conversation analysis and its structural facilitation of instructional conversation design.

Numerous implications arise from the concept of message layer design: the possibility of a more explicit and detailed description of the use of message in successful instructional products; the possibility of providing guidance to instructional designers for the design of more interactive and conversational artifacts; a new view of possible alternative orders of design decision-making; new design team disciplines and the increased use of team specialty skills in message explication; the possibility for everyday designers to consider innovative design patterns that are more adaptive and generative; increased incorporation of nonverbal message representations to reduce cognitive demands; increased ability and incentive to incorporate more human-like value and presence in designs; increased ability to embed more nuanced messages expressing the value of the learner to the learner; increased emphasis on short passages of direct messaging interspersed with application analysis and feedback; and an increased likelihood of faithfully communicating knowledge and skill structures.

We feel these are goals worth pursuing.

References

Bereiter, C., & Scardamalia, M. (1989). Intentional learning as a goal of instruction. In L. Resnick (Ed.), *Knowing, learning and instruction: Essays in honor of Robert Glaser* (pp. 361–392). Lawrence Erlbaum Associates.

Carbonell, J. R. (1970). AI in CAI: An artificial intelligence approach to computer-assisted instruction. *IEEE Transactions in Man-Machine Systems, 11*(4), 190–202.

Evans, J. L., Glaser, R., & Homme, L. E. (1960). *The RULEG system for the construction of programmed verbal learning sequences*. United States Department of Health, Education, and Welfare. Report CRF-691-3. ED 014894.

Evans, J. L., Homme, L. E., & Glaser, R. (1962). The RULEG system for the construction of programmed verbal learning sequences. *Journal of Educational Research, 55*(9), 513–518.

Gibbons, A. S. & Boling, E. (in press). Conversational forms of instruction and message layer design. Bloomington, IN: AECT/Springer.

Gibbons, A. S. (2014). *An architectural approach to instructional design*. Routledge.

Gibbons, A. S., & O'Neal, A. F. (2014). TICCIT: Building theory for practical purposes. *International Journal of Designs for Learning, 5*(2).

Gibbons, A. S., & Rogers, P. C. (2009). The architecture of instructional theory. In C. M. Reigeluth & A. Carr-Chellman (Eds.), *Instructional-design theories and models, Volume III*. Lawrence Erlbaum Associates.

Johnson, L. W., & Rickel, J. (2000). Animated pedagogical agents: Face-to-face interaction in interactive learning environments. *International Journal of Artificial Intelligence in Education, 11*, 47–78. https://d1wqtxts1xzle7.cloudfront.net/30727066/AIED00-animated_pedagogical.pdf?1361994073=&response-content-disposition=inline%3B+filename%3DAnimated_pedagogical_agents_Face-to-face.pdf&Expires=1594175156&Signature=hRxBjNvcC0uFkslKd0F5n5c~JK-TwPEMqHhVY-oD-U7k-6AUOiyU-AAzkglTACn29cAAXRhSkQHHKNVkIrBes42emyA4FsNxT7J7O3IpShVJAKLC6T~-SCYGkiGDUYDM0G~tvxJQOC6NyrVuJX7aXgy5fFx1n4mXrtkXRqZyLDSNxgcryrlaHwesZqMdSDD9O8rZCrH~n~K3iT7EPjtir7WrCerlOejRNw0PxYY5u4miAgGd5-ii68cRDdgXMfWgZPRseOF-fnEbyVeihUVDMcU~TNsXc-S4BUiuFLOuxnnMZjrHS2qZtaf85KbCjewdOVZF66BoKBPeQ3jx32vyiw__&Key-Pair-Id=APKAJLOHF5GGSLRBV4ZA

Levinson, S. C. (2013). Action formation and ascription. In J. Sidnell & T. Stivers (Eds.), *The handbook of conversation analysis* (pp. 103–130). Wiley-Blackwell.

Markle, S. M. (1964). *Good frames and bad: A grammar of frame writing*. Wiley.

Markle, S. M. (1969). *Good frames and bad: A grammar of frame writing* (2nd ed.). Wiley.

Merrill, M. D. (1983). Component display theory. In C. Reigeluth (Ed.), *Instructional-design theories and models: An overview of their status* (pp. 397–424). Erlbaum Associates.

Merrill, M. D., Schneider, E. W., & Fletcher, K. A. (1980). *TICCIT* (Instructional design library, vol. 40). Educational Technology Publications.

Rickel, J., & Johnson, L. W. (1997). Intelligent tutoring and virtual reality: A preliminary report. *Proceedings of the eighth world conference on AI in education.* August 1997. http://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=721C11DEC2E41AECB30E992C74C82B3C?doi=10.1.1.87.6291&rep=rep1&type=pdf

Scardamalia, M. (2004). CSILE/Knowledge Forum®. In *Education and technology: An encyclopedia* (pp. 183–192). ABC-CLIO.

Scardamalia, M., Bereiter, C., McLean, R. S., Swallow, J., & Woodruff, E. (1987). Computer supported intentional learning environments. In A. Collins (Chair), *Strategies for teaching thinking skills with interactive technologies*. Symposium conducted at the meeting of the American Educational Research Association, Washington, DC. (ED 288913) Downloaded from: https://files.eric.ed.gov/fulltext/ED288913.pdf

Sidnell, J., & Stivers, T. (Eds.). (2013). *Handbook of conversation analysis*. Wiley-Blackwell.

Wenger, E. (1987). Artificial intelligence and tutoring systems: Computational and cognitive approaches to the communication of knowledge. Los Altos, CA: Morgan Kaufmann.

Block, Access, Success, Engagement: Design Considerations for Learning Environments

Sudip Kumar Ghosh, Simon Richard Hooper, Liao Jian, Susan Rose, and Rayne Audrey Sperling

Block, Access, Success, Engagement: Design Considerations for Learning Environments

Design deals with ill-structured problems—goals are not clear, constraints are not well-defined, and information about ill-structured problems is incomplete (Simon, 1988). Designers continuously use new information to clarify goals, to understand constraints, and to create alternatives as possible solutions (Simon, 1973). Designers use different types of information to inform their design processes: theory, empirical evidence, expertise, inspiration, etc. (McKenney & McKenney, 2018). Any information that designers use to inform their design processes is a termed a *design consderation*. While design considerations differ based on context or goals, a deliberate, purpose-driven set of design considerations can guide design teams design alternatives as possible solutions.

While designing for learning, the challenge is to design learning environments that are learner-centered, expertise-centered, community-centered, and assessment-centered (Bransford et al., 2000). In this chapter, we propose a design framework that attempts to address the above challenge by focusing on four types of design considerations for learning: blocks, access, success, and engagement (BASE). In

S. K. Ghosh (✉) · S. R. Hooper · L. Jian · R. A. Sperling
Pennsylvania State University, State College, PA, USA
e-mail: skg91@psu.edu

S. Rose
University of Minnesota, Minneapolis, MN, USA

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*, Educational Communications and Technology: Issues and Innovations,
https://doi.org/10.1007/978-3-030-85078-4_23

line with the theme of this book, the chapter explores design considerations with a focus on learners' prior experiences, learning goals, participation in communities, and feedback. We first present the theories that guide the framework—distributed cognition and design of learning environments. Subsequently, we give an example of the design of a progress monitoring software, where we apply BASE design considerations to findings from a task analysis exercise.

Theoretical Framework

The BASE framework is used to guide the design of learning environments. Frameworks help to organize how we experience or make sense of our environments, set expectations, create new alternatives, and even transform entire environments or societies (Benford & Snow, 2000; Goffman, 1974). Frameworks can also help design teams in creating new alternatives -new technology, new curricula, or new learning environments. We assume that the learning environment is a sociotechnical system where individuals interact with different people, and objects within the environment (Sannino et al., 2016; Schot & Steinmueller, 2018). We adopt a systems approach where the learning environment is modeled as a sociotechnical system and interactions are modeled as tasks. We use tasks as the unit of analysis, where a task comprises of *people*, *activity*, and *context* - how *people* perform some *activity* under some *context* (Bailey, 1996; Flavell, 1979). Here, people are individuals under consideration, activities are steps involved in an interaction, and contexts are goals or relevant system settings. Overall, we use theories of distributed cognition to design learning environments (Brown et al., 1993; Pea, 1993).

In the following section, we briefly explain how distributed cognition is used to model learning in sociotechnical systems. We then give some relevant examples of how researchers use distributed cognition in learning environments. Finally, we discuss how using distributed cognition in the design of learning environments leads to the BASE design considerations.

Distributed Cognition

Cognition is about how information is processed. Many of the earlier studies in cognition focused on how information is processed in an individual's brain (Card et al., 1986) or assumed that cognition happens only in an individual's brain (Simon, 1998). As sociocultural researchers emphasized how individuals collaborate with people or use tools for cognitive processes (Leont'ev, 1974; Vygotsky, 1978), studies started focusing on how people interact with the environment (Cole & Engeström, 1993). For example, a child interacts with a teacher to learn (Vygotsky, 1978), students use calculators to perform calculations (Leont'ev, 1974), or teams may collaborate for problem-solving and learning (Caldwell, 2008; Ghosh & Caldwell, 2006; Hutchins & Klausen, 1995). Building on information theory (Ackoff, 1989; Shannon & Weaver, 1948), distributed cognition views an environment as a sociotechnical system where information flows between people or objects via interactions. In the theory of distributed cognition, cognition can happen within an individual, or cognition can be distributed across different people, objects, and interactions in an environment (Salomon, 1993).

Distributed cognition also acknowledges the interdependence between the individual and the environment by exploring four aspects of a sociotechnical system: signals (different types of information), objects (tools or artifacts), interactions (activities or steps), and people. There is a broad range of research in distributed cognition such as the use of language as signals (Ellis, 2019), mobile tools (Land & Zimmerman, 2015), interactions (Jordan & Henderson, 1995), and people (Brown et al., 1993; Perkins, 1993; Salomon, 1993), or researchers may analyze the sociotechnical system in a cultural context (Hutchins & Klausen, 1995), design interventions (Anderson & Shattuck, 2012; Pea, 1993; Sannino et al., 2016), develop computational models (Ellis, 2019; Ghosh & Caldwell, 2006), etc. We model the learning environment as a distributed sociotechnical system which consists of different elements: signals, objects, interactions, and people. The next section discusses how we use distributed cognition in learning environments.

Distributed Cognition in Learning Environments: BASE Design Considerations

There are different ways of using distributed cognition in learning environments. A classroom can be viewed as a community of learners (Lave & Wenger, 1991) where expertise is distributed across students, teachers, curricula, technology, and assessments (Brown et al., 1993). In technology-enabled classrooms, cognition can be viewed as distributed across technology and different elements of the learning environment (Angeli, 2008). Students and teachers can use technology to perform cognitive tasks more efficiently (Perkins, 1993; Salomon, 1993), or technology can support people with independent cognitive processing that creates expertise (Pea, 1993). For example, a student may use a calculator to perform calculations more quickly, or a class may use a computer to analyze complex scenarios. Distributed cognition has been used to improve schools by analyzing policies, cultures, and contexts that affect how teachers and principals are assessed (Halverson & Clifford, 2006; Kelley & Dikkers, 2016). Usage-based approaches for language acquisition use distributed cognition to understand and model how we learn languages—a form of signals (Ellis, 2019). Coordinated pedagogy uses distributed cognition to identify practices where multilingual teachers collaborate dynamically, use different languages, and coordinate instructional practices to attend to the needs of a diverse groups of multilingual students in shared classes (Pontier & Gort, 2016).

There are complex considerations about how the interdependent and dynamic nature of distributed cognition in learning environments leads to learning. As designers, we can focus on creating different types of supports for students who are learning. For example, distributed scaffolding is a concept that explores how support is distributed in learning environments via instructional tools, routines, and activities (Puntambekar & Kolodner, 2005). Though we intend to be learner-centered, in many cases, students do not have enough metacognitive awareness to find and access the appropriate support at the appropriate time (Nickerson, 1993). Here, teachers can play an important role by monitoring students' progress and adapting supports on behalf of students (Brown et al., 1993; Pea, 2004). By understanding how support can be distributed across the learning environment, designers can be more effective in supporting students, teachers, and others.

Distributed Cognition and Design of Learning Environments

Distributed cognition can help in designing tools or representations that make it easy for individuals to use tools, access information, process information, or gain expertise that align with learning goals (Kirsch, 2014; Perkins, 1993). Some researchers note the difficulty of applying distributed cognition to the design of learning environments (Angeli, 2008; Rogers, 2005) though distributed cognition is used as a theoretical base for user-centered design of educational tools (Schmidt et al., 2015; Ursu et al., 2020) that range from visual design to augmented reality (Dunleavy & Dede, 2014; Kirsch, 2014). Design considerations may be simple, limited to a single element, or they can be complex design considerations that are distributed and dynamic in nature. In this section, we identify four types of design considerations for learning environments: blocks, access, success, and engagement.

When we design learning environments, we create design alternatives that enhance or constrain learning (Pea, 1993). We often assume that designed alternatives are better or can be accessed by everyone, but designed alternatives often block users from completing tasks effectively (Norman, 2013). *Block* design considerations are any information about how learning tasks are hindered or blocked. Note that *Block* considerations may also arise because of the absence of a tool or affordance. For example, lack of internet may result in technology failure, or a teacher may not be able to access student data because the tool may lack class management tools that organize data effectively (Nickerson, 1993; Wong & Looi, 2011). The design process relies on failure and feedback to identify design opportunities and improve alternatives through iterations (Nelson & Stolterman, 2012; Simon, 1988). *Block* design considerations are important for identifying design opportunities throughout the design process. To further guide the design of learning environments, we focus on four important perspectives for designing learning environments (Bransford et al., 2000): being learner-centered, knowledge-centered, community-centered, and assessment-centered.

Learner-Centered Environments: Access

Learner-centered environments are cognizant of the background and prior experiences of students. The goal is to push the boundaries of student achievement and continually find better means to increase the expertise of students (Leont'ev, 1974; Vygotsky, 1978). Instead of designing what is convenient for designers or researchers, we should strive for the highest levels of learning by creating environments where students and teachers can collaborate productively (Brown, 1992). Designers must consider the backgrounds and prior experiences of students and teachers so that they can account for equality issues—variations in how different people access learning resources or how learning outcomes may differ (Bailey, 1996; Gillborn & Youdell, 2000; International Organization for Standardization, 2018; Pea, 1993; Shah & Lewis, 2019). We track *Access* considerations as design considerations that allow learners to effectively access learning resources and account for the different abilities, backgrounds, or prior experiences of individuals. Examples include ensuring all the students of a class can access shared online notes, and ensuring that different teachers can easily use data tools for progress monitoring.

Knowledge-Centered Environments: Success

Knowledge-centered environments focus on how learners acquire knowledge and expertise—learning goals (Bransford et al., 2000). Knowledge is information that is processed and referenced for retrieval as necessary, while expertise develops when learners learn to use knowledge repositories for strategic, goal-related performances (Ackoff, 1989; Shannon & Weaver, 1949). Access is necessary but not sufficient for learning (Vossoughi, 2017); design should also ensure that learners and teachers learn to use affordances strategically based on the learning goals (Nickerson, 1993). *Success* considerations are design considerations that lead to successful achievement of learning goals. Examples of *Success* considerations may include ensuring students can take notes for referencing, organizing data for instruction-related decision making, and problem solving. Success considerations may deal with cognitive, behavioral, affective, motivational, or metacognition aspects of learning (Clariana et al., 2013; Panadero, 2017; Puustinen & Pulkkinen, 2001), or how teaching improves expertise (Hokanson & Hooper, 2004). For example, gaming elements may be used to shift student perceptions about assessments (Hooper et al., 2013), or affordances such as interactivity and feedback may be used to promote learning at deeper levels (National Academies of Sciences, Engineering, and Medicine, 2018).

Community-Centered Environments: Engagement

Community-centered environments are places that encourage participation, how people collaborate with other people and objects in an environment (Bransford et al., 2000; Brown et al., 1993). Participation in communities is one of the main activities of learning (Lave & Wenger, 1991). A student interacts with a teacher in a classroom located in a school that is part of a larger community. Performance improves when learners feel they are a part of a community that shares common values, norms, and high standards of learning (Bransford et al., 2000; Halverson & Clifford, 2006; Kelley & Dikkers, 2016). Inclusive schools promote a sense of belonging, provide an inclusionary environment, and provide support systems such as behavior support systems, co-teaching, instructional practice, and feedback to provide guidance (Demie, 2019; OECD, 2018; Shogren et al., 2015). *Engagement* design considerations are about participation in groups or communities that lead to learning. Engagement considerations may be related to learning processes such as classroom orchestration, monitoring, metacognition, or self-regulation (Follmer & Sperling, 2016; National Academies of Sciences, Engineering, and Medicine, 2018; Schraw & Dennison, 1994). For example, engagement design considerations may be about classroom activities, communication of concepts, getting feedback, or constructing potential solutions.

Assessment-Centered Environments

Assessments are an important mechanism for providing feedback about learning, but opportunities for feedback in learning environments are scarce (Bransford et al., 2000). Assessments can be used formatively to improve learning processes or to assess student achievement, programs and institutions, individuals, classrooms, schools, or other aspects that affect learning. Learners, teachers, and other individuals can benefit when assessments are based on empirical evidence and aligned with learning goals (Pellegrino, 2019). However, students often do not have metacognitive awareness to use feedback effectively for learning; students may need support from teachers to use feedback and supports (Martin et al., 2019; Puntambekar & Kolodner, 2005). Designers have the opportunity to help teachers and students by using assessments to monitor student progress and adapting supports distributed in a learning environment (Brown et al., 1993; Pea, 2004). Assessments can also create extra tasks for teachers like grading or data management, so we should design tools that help teachers to monitor progress and make decisions without increasing their cognitive load (Dillenbourg et al., 2019; Martin et al., 2019).

Summary of Base Design

Together, *block, access, success, and engagement* design considerations cover different aspects of designing learning environments (see Fig. 1). *Block* considerations track instances that hinder learning but may lead to design opportunities; *Access* considerations are about ensuring that the learning environment can be used easily by people with different background and prior experiences; *Success* considerations are about achieving learning goals; *Engagement* considerations are about participation activities that lead to learning. In the next section, we will apply the BASE design considerations to progress monitoring software, AvenuePM.

Applying BASE Design Considerations to Progress Monitoring Software

The authors are designing a progress monitoring tool, AvenuePM, that aims to help teachers in monitoring the progress of students who are learning American Sign Language (ASL) or English. The following sections discuss a design iteration where the objective was to make design changes so teachers find it easy to use and easy to learn in different classroom settings (Nickerson, 1993). Below, we give an overview of the background and methods used to design different progress monitoring tasks. We then discuss BASE design considerations with some examples based on task analysis of the software.

Background

Progress monitoring is a type of formative assessment where assessments are administered periodically to evaluate student progress, and assessment data is used as feedback to improve learning (Pellegrino, 2019). AvenuePM is a progress-monitoring software that consists of eight assessments designed using principles of curriculum-based measures (CBM; Deno, 1985, 2003): CBM are easy to

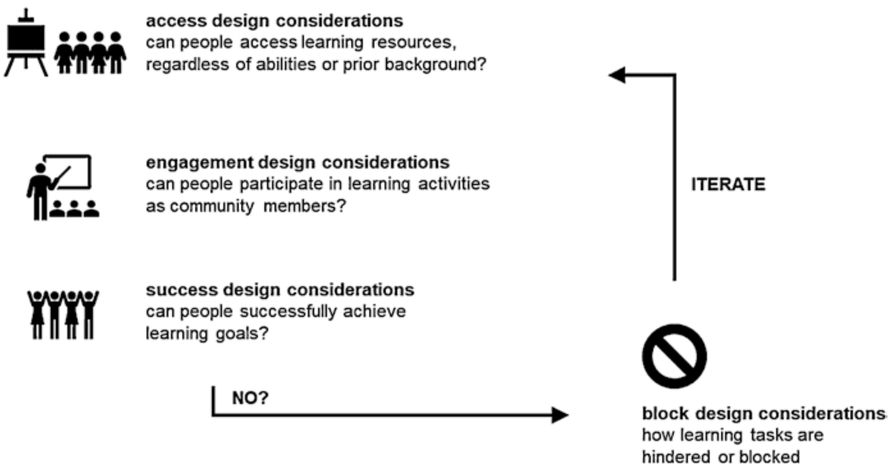


Fig. 1 Block, access, success, and engagement—BASE design considerations for learning environments

administer, brief (1–5 min), reliable, and valid. Teachers are advised to administer CBM assessments to students on a weekly or monthly basis (Fuchs & Fuchs, 2002) so that teachers can monitor student progress and make decisions about the goals, instructions, or other strategies available to the student (Rose, 2007). Assessment data in AvenuePM are represented as graphs, so we rely on three aspects of graph comprehension to understand how teachers interpret data— how teachers identify data, recognize patterns, and make decisions (Coburn & Turner, 2011; Friel et al., 2001). The software also supports multiple dimensions of mobile seamless learning (Wong & Looi, 2011). For example, the software can be used in classrooms, homes, or other remote locations in synchronous or asynchronous settings. Principles of universal design for learning (UDL) guide the design process to support students with different abilities (Burgstahler, 2009; CAST, 2018). For example, the design supports students of different abilities who may communicate using American Sign Language or English.

Originally, the software was developed as a digital tool for teachers who were monitoring the progress of students who were deaf or hard of hearing (DHH). Over the years, the software has gone through many design iterations (Hooper et al., 2013; Miller et al., 2008) to make it more useful for teachers, students, parents, and others. Today, the software is used in elementary schools across the United States. However, when educational technology is implemented in schools, challenges may arise depending on technology considerations, people's background, or prior expertise (Blumenfeld et al., 2000); further design changes are continuously needed to ensure that technology improves in school settings. Below we discuss the task analysis methods and findings from an ongoing design iteration where tasks were used as a unit of analysis.

Methods: Task Analysis and Design

The authors conducted a task analysis focused on design functionality (Kieras, 2004). Seventeen tasks were shortlisted. Hierarchical task modeling was used to break down tasks into smaller steps. Tasks were categorized into four types: assessment tasks, data interpretation tasks, class management tasks, and common (miscellaneous) tasks.

Assessment tasks are tasks related to CBM assessments—teachers administer assessments while students perform assessment tasks. Three assessments were shortlisted for the task analysis exercise: Picture Naming, Word Sign/Say, and Slash. In Picture Naming (see Fig. 2), pictures of common objects are shown randomly, and the student is prompted to say or sign the name of the picture. Similarly, in Word Sign/Say, common words are shown randomly, and the student has to say or sign the word. Slash (see Fig. 3) is a comprehension measure where students are presented with a block of text without any spaces; the student marks spaces to create meaningful words and sentences.

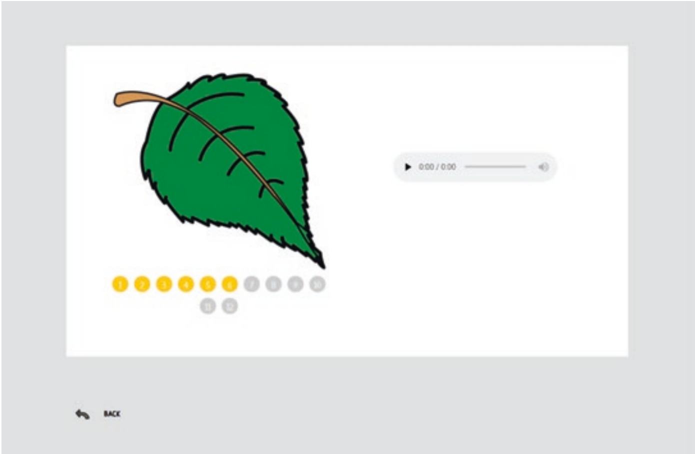


Fig. 2 Interface for Picture Naming. Students are presented with a picture, and the student has to say or sign the name of the picture

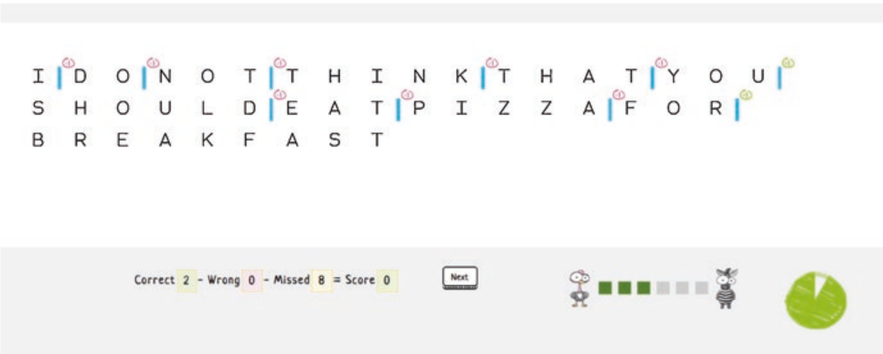


Fig. 3 Interface for Slash. Students are presented with a block of text without any spaces; student then marks the spaces with slashes to create meaningful words and sentences

Data interpretation tasks are related to graph comprehension (Friel et al., 2001). For CBM graphs, identifying data refers to using data to understand student progress within and between levels; identifying trends in CBM graphs is about evaluating student progress against references such as expected progress rates; making decisions refers to making effective adjustments (in instructional strategies, time, effort, or other accommodations) for achieving learning goals, or adjusting learning goals.

Class management tasks are those that allow teachers to enroll students, manage classes, track scores, and perform other typical school tasks. These tasks are important for managing information and using assessment data effectively (Perkins, 1993).

Lastly, *common tasks* are those that affect how different users access and use AvenuePM. Common tasks include how teachers navigate the AvenuePM website and maintain security logins or other tasks that may be needed to use the system.

After the initial task analysis, a simple walkthrough exercise (Hackos & Redish, 1998) was conducted to evaluate the different tasks further. Several criteria were used to evaluate and prioritize tasks under consideration. Two CBM principles (Deno, 1985, 2003), whether AvenuePM is quick and easy to use, formed the first set of evaluation criteria. A randomly generated set of CBM data (not actual student performance data) was used for graph comprehension. Graph comprehension is dependent on background, relevance, and other contextual factors, but random data can be agnostic to such factors. So, graph comprehension tasks were limited to tasks of identifying data and trends. Additional revisions to the task analysis considerations were made using dimensions of mobile seamless learning (MSL; Wong & Looi, 2011) as a checklist. Finally, principles of Universal Design for Learning (CAST, 2018; Rappolt-Schlichtmann & Daley, 2013) provided further guidance in technology design considerations such as accessibility, usability, and other human factors.

Based on the above analysis, assessment tasks, data interpretation tasks, and class management tasks were determined to be important for progress monitoring goals. As cognition is involved in the above tasks, further analysis was conducted by using cognitive walkthrough (Wharton et al., 1994) and natural GOMS language (NGOMSL; Kieras, 1994, 2004) models for analyzing interfaces. Findings were collated, and important design considerations were categorized.

Findings: BASE Design Considerations

Table 1 lists progress monitoring tasks and the corresponding design considerations based on the task analysis above. Teacher tasks are listed first, and student tasks are listed later. All tasks have *access* design considerations related to completion rate, efficiency, or ease of use. Most tasks have some *block* considerations. Tasks related to CBM assessments and CBM data have *success* considerations since CBM tasks are related to progress monitoring. CBM assessment tasks, data interpretation tasks, and class management tasks also have *engagement* considerations as they are ongoing tasks for progress monitoring.

Discussion

In the initial design iterations, many *block* considerations may emerge when a different type of analysis and user feedback is incorporated. In AvenuePM, many of the block considerations were because of ambiguous labels. For example, a label of "Request an Account" (Fig. 1) was ambiguous to users (teachers and students) who

Table 1 Tasks and BASE Design Considerations

Tasks	Design Considerations			
	Block	Access	Success	Engagement
Teacher tasks				
Create a teacher account	Not using commonly used term, create an account (for teacher/ student)	Completion rate, efficiency, easy to use		
Log in as a teacher	Forgot username or password	Completion rate, efficiency, easy to use		
Create a class	No label; icon ambiguous	Completion rate, efficiency, easy to use		Class management consideration
Add a student to a class		Completion rate, efficiency, easy to use		Class management consideration
Change/edit student details	Icon ambiguous; may be tedious for many students	Completion rate, efficiency, easy to use		Class management consideration
Find student (CBM) data, charts, or scores		Completion rate, efficiency		
Use data charts (identify data, student progress levels, or make decisions)	Cannot navigate to appropriate week	Completion rate, efficiency, easy to use	Data monitored on a weekly/ monthly basis, trend identification, and decision-making	To be done regularly as appropriate
Find notifications (to-do list)	Change label to 'to-do list'	Completion rate, efficiency		
Share a student with another teacher	Unclear if this task shares or transfers the student	Completion rate, efficiency, easy to use		Class management consideration
Log out (teacher)		Completion rate, efficiency, easy to use		
Student tasks				
Log in as a student	Cannot find student log in and password credentials	Completion rate, efficiency, easy to use		

(continued)

Table 1 (continued)

Tasks	Design Considerations			
	Block	Access	Success	Engagement
Find PictureNaming and slash	No labels; icon ambiguous	Completion rate, efficiency		
Complete a PictureNaming (CBM) task	Overview and instructions needed; practice sections not noticed by all.	Completion rate, efficiency, easy to use	Easy to use, easy to learn, CBM task completed on a weekly/ monthly basis	To be done regularly as appropriate
Complete a slash (CBM) task	Overview and instructions needed; practice sections not noticed by all.	Completion rate, efficiency, easy to use	CBM task completed on a weekly/ monthly basis	To be done regularly as appropriate
Find Progress (CBM) data	Levels and animal critters not interpreted as progression	Completion rate, efficiency		
Complete word sign/say (CBM) task	Overview and instructions needed; practice sections not noticed by all.	Completion rate, efficiency, easy to use	CBM task completed on a weekly/ monthly basis	To be done regularly as appropriate
Log out (student)		Completion rate, efficiency, easy to use		
OVERALL				
	Form fields not loading			
	Internet, device and browser requirements			
	Cannot find or forgot login credentials			
	Relevance of CBM tasks is unclear			

expected the more prevalent label, "Create an Account." While such considerations may seem trivial, we later found that teachers have difficulty with ambiguous labels even when teachers had several minutes to accomplish a task. In web-based software (or websites), users quit a website if they can't accomplish a task within seconds (Liu et al., 2010), so details about terms, labels, or other software design elements may be critical. For CBM assessments and CBM data interpretation tasks, *block* considerations were related to relevance and understanding of the tasks themselves. Some of the block considerations are not specific to the tasks; such considerations are listed as “Others” in the *Block Considerations* column of Table 1. *Block* considerations include technical considerations (such as bandwidth, device, or browser considerations), provisions related to login, and relevance of CBM tasks. It is recommended that records of *block* considerations are maintained across design iterations, so that they are addressed later. In many cases, *block* considerations may lead to critical failures; maintaining records helps prevent other critical failures.

Success considerations for AvenuePM are listed for CBM assessment tasks and CBM data interpretation tasks. For assessments, usability measures such as ease of use are used for both *access* and *success* considerations. For *access* considerations of assessment tasks, targets of task completion (within specified time limits) and meeting recommended usability metrics (Bangor et al., 2008; Sauro, 2012) were considered acceptable. Since CBM tasks are the primary tasks within AvenuePM, related *success* considerations have additional considerations related to the frequency of use: weekly or monthly frequency may be needed for effective progress monitoring. CBM data interpretation tasks have *success* considerations related to frequency, identifying trends (student progress levels), and decision-making. The class management tasks, assessment tasks, and data interpretation tasks are tasks related to progress monitoring, so *engagement* considerations are also given where behavioral analytics data from the software is used to ensure that users are performing such tasks.

Figure 4 shows the AvenuePM homepage when the task analysis was done, while Fig. 5 shows the redesigned homepage based on the task analysis and other feedback from teachers and students. The BASE design considerations are being maintained across the design iterations. Initially, the BASE design considerations were used to make modifications to designs. In later design iterations (and now), the list is being used to ensure that new designs also incorporate previous design considerations.

Fig. 4 Initial design of the AvenuePM homepage

Fig. 5 Redesigned home page of AvenuePM

Summary

Design has the potential to address wicked problems (Buchanan, 1992), such as learning that results in human development (Barron, 2006; Simon, 1998). However, researchers can find that designing for better learning is challenging, as teachers, students, and others often have different backgrounds and make sense of designs differently (Clark et al., 2018; Coburn & Turner, 2011). In such settings, designers and researchers can alleviate differences by acknowledging the context and constraints of school settings, helping people, and ensuring that newly designed alternatives don't make tasks more difficult (Dillenbourg et al., 2019). The framework of BASE design considerations attempts to take a holistic approach in the design of learning environments. In this chapter, using task analysis, we applied the BASE design considerations to progress monitoring software: block considerations track failures across design iterations; access considerations focus on whether the software can be used by people of different abilities and backgrounds; success considerations are about intended learning goals; engagement considerations are about participation in ongoing activities. The task analysis and subsequent studies conducted by the authors suggest that design often results in unexpected tasks, undesirable outcomes, and failures. But outcomes and failures can be addressed proactively as part of the iterative design process. Substantial improvements can be made by incorporating feedback from participants and ensuring design considerations focus on improving outcomes across the design iterations. We hope that the BASE framework helps other researchers and designers in designing better learning environments.

References

Ackoff, R. L. (1989). From data to wisdom. *Journal of Applied Systems Analysis, 16*(1), 3–9.

Anderson, T., & Shattuck, J. (2012). Design-based research: A decade of progress in education research? *Educational Researcher, 41*(1), 16–25. https://doi.org/10.3102/0013189X11428813

Angeli, C. (2008). Distributed cognition: A framework for understanding the role of computers in classroom teaching and learning. *Journal of Research on Technology in Education, 40*(3), 271–279. https://doi.org/10.1080/15391523.2008.10782508

Bailey, R. W. (1996). *Human performance engineering: Designing high quality, professional user interfaces for computer products, applications, and systems*. Prentice Hall PTR.

Bangor, A., Kortum, P. T., & Miller, J. T. (2008). An empirical evaluation of the system usability scale. *International Journal of Human-Computer Interaction, 24*(6), 574–594. https://doi.org/10.1080/10447310802205776

Barron, B. (2006). Interest and self-sustained learning as catalysts of development: A learning ecology perspective. *Human Development, 49*, 193–224. https://doi.org/10.1159/000094368

Benford, R. D., & Snow, D. A. (2000). Framing processes and social movements: An overview and assessment. *Annual Review of Sociology, 26*(1), 611–639. https://doi.org/10.1146/annurev.soc.26.1.611

Blumenfeld, P., Fishman, B. J., Krajcik, J., Marx, R. W., & Soloway, E. (2000). Creating usable innovations in systemic reform: Scaling up technology-embedded project-based science in urban schools. *Educational Psychologist, 35*(3), 149–164. https://doi.org/10.1207/S15326985EP3503_2

Bransford, J. D., Brown, A. L., Cocking, R. R., & National Academy of Sciences - National Research Council DC. (2000). Commission on Behavioral and Social Sciences and Education. In M. S. Donovan & J. W. Pellegrino (Eds.), *How people learn: Brain, mind, experience and school*. National Academy. National Academies Press.

Brown, A. L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *Journal of the Learning Sciences, 2*(2), 141–178. https://doi.org/10.1207/s15327809jls0202_2

Brown, A. L., Ash, D., Rutherford, M., Nakagaroa, K., Gordon, A., & Campione, J. C. (1993). Distributed expertise in the classroom. In G. Salomon (Ed.), *Distributed cognitions: Psychological and educational considerations* (pp. 188–228). Cambridge University Press.

Buchanan, R. (1992). Wicked problems in design thinking. *Design Issues, 8*(2), 5. https://doi.org/10.2307/1511637

Burgstahler, S. (2009). Universal design in education: Principles and applications. *Disabilities, Opportunities, Internetworking, and Technology*, 1–6.

Caldwell, B. S. (2008). Knowledge sharing and expertise coordination of event response in organizations. *Applied Ergonomics, 39*(4), 427–438. https://doi.org/10.1016/j.apergo.2008.02.010

Card, S. K., Moran, T. P., & Newell, A. (1986). The Model Human Processor: An engineering model of human performance. In K. R. Boff, L. Kaufman, & J. P. Thomas (Eds.), *Handbook of perception and human performance* (Vol. 2, pp. 1–35). Wiley.

CAST. (2018). *UDL: The UDL guidelines. Universal design for learning guidelines version 2.2*. Retrieved from http://udlguidelines.cast.org/

Clariana, R. B., Engelmann, T., & Yu, W. (2013). Using centrality of concept maps as a measure of problem space states in computer-supported collaborative problem solving. *Educational Technology Research and Development, 61*(3), 423–442. https://doi.org/10.1007/s11423-013-9293-6

Clark, D. B., Tanner-Smith, E., Hostetler, A., Fradkin, A., & Polikov, V. (2018). Substantial Integration of Typical Educational Games Into Extended Curricula. *Journal of the Learning Sciences, 27*(2), 265–318. https://doi.org/10.1080/10508406.2017.1333431

Coburn, C. E., & Turner, E. O. (2011). Research on data use: A framework and analysis. *Measurement: Interdisciplinary Research & Perspective, 9*(4), 173–206. https://doi.org/10.1080/15366367.2011.626729

Cole, M., & Engeström, Y. (1993). A cultural-historical approach to distributed cognition. In G. Salomon (Ed.), *Distributed cognitions: Psychological and educational considerations* (pp. 1–46). Cambridge University Press.

Demie, F. (2019). *Educational inequality: Closing the gap*. UCL Institute of Education Press.

Deno, S. L. (1985). Curriculum-based measurement: The emerging alternative. *Exceptional Children, 52*(3), 219–232. https://doi.org/10.1177/001440298505200303

Deno, S. L. (2003). Developments in curriculum-based measurement. *Journal of Special Education, 37*(3), 184–192. https://doi.org/10.1177/00224669030370030801

Dillenbourg, P., Prieto, L. P., & Olsen, J. K. (2019). Classroom orchestration. In International handbook of the learning sciences (pp. 180–190). Routledge. https://doi.org/10.4324/9781315617572-18

Dunleavy, M., & Dede, C. (2014). Augmented reality teaching and learning. In J. Spector, M. Merrill, J. Elen, & M. Bishop (Eds.), *Handbook of research on educational communications and technology: Fourth edition* (pp. 735–745). Springer. https://doi.org/10.1007/978-1-4614-3185-5_59

Ellis, N. C. (2019). Essentials of a theory of language cognition. *Modern Language Journal, 103*, 39–60. https://doi.org/10.1111/modl.12532

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive-developmental inquiry A Model of Cognitive Monitoring. *American Psychologist, 34*(10), 906–911.

Follmer, D. J., & Sperling, R. A. (2016). The mediating role of metacognition in the relationship between executive function and self-regulated learning. *British Journal of Educational Psychology*. https://doi.org/10.1111/bjep.12123

Friel, S. N., Curcio, F. R., & Bright, G. W. (2001). Making sense of graphs: Critical factors influencing comprehension and instructional implications. *Journal for Research in Mathematics Education, 32*(2), 124–158. https://doi.org/10.2307/749671

Fuchs, L. S., & Fuchs, D. (2002). Computer applications to curriculum-based measurement. *Special Services in the Schools, 17*(1–2), 1–14. https://doi.org/10.1300/J008v17n01_01

Ghosh, S. K., & Caldwell, B. S. (2006). Usability and Probabilistic Modeling for Information Sharing in Distributed Communities. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 50*(15), 1492–1495. https://doi.org/10.1177/154193120605001507

Gillborn, D., & Youdell, D. (2000). *Rationing education: Policy, practice, reform, and equity*. Open University Press.

Goffman, E. (1974). *Frame analysis: An essay on the organization of experience*. Northeastern University Press.

Hackos, J. T., & Redish, J. C. (1998). *User and Task Analysis for Interface Design* (1st ed.). Wiley. https://www.wiley.com/en-us/User+and+Task+Analysis+for+Interface+Design-p-9780471178316
Halverson, R. R., & Clifford, M. A. (2006). Evaluation in the wild: A distributed cognition perspective on teacher assessment. *Educational Administration Quarterly, 42*(4), 578–619. https://doi.org/10.1177/0013161X05285986
Hokanson, B., & Hooper, S. (2004). Educational Technology Publications, Inc. levels of teaching: A taxonomy for instructional design. *Technology, 44*(6), 14–22.
Hooper, S., Miller, C., & Rose, S. (2013). Considering the design of an electronic progress-monitoring system. In R. Luckin, S. Puntambekar, P. Goodyear, B. L. Grabowski, J. Underwood, & N. Winters (Eds.), *Handbook of design in educational technology* (pp. 256–268). Routledge.
Hutchins, E., & Klausen, T. (1995). Distributed cognition in an airline cockpit. *Cognition and Communication at Work*, 15–34. https://doi.org/10.1017/cbo9781139174077.002
International Organization for Standardization. (2018). *ISO-13.180 - Ergonomics*. https://www.iso.org/ics/13.180/x/
Jordan, B., & Henderson, A. (1995). Interaction analysis: Foundations and practice. *Journal of the Learning Sciences, 4*(1), 39–103. https://doi.org/10.1207/s15327809jls0401_2
Kelley, C., & Dikkers, S. (2016). Framing feedback for school improvement around distributed leadership. *Educational Administration Quarterly, 52*(3), 392–422. https://doi.org/10.1177/0013161X16638416
Kieras, D. E. (2004). Task analysis and the design of functionality. In A. B. Tucker (Ed.), *Computer science handbook* (2nd ed., pp. 46-1–46–25). Chapman and Hall/CRC.
Kieras, D. E. (1994). GOMS modeling of user interfaces using NGOMSL. *Conference on Human Factors in Computing Systems - Proceedings*, *1994-April*, 371–372. https://doi.org/10.1145/259963.260467
Kirsch, D. (2014). Metacognition, distributed cognition, and visual design. In P. Gardenfors & P. Johansson (Eds.), *Cognition, education, and communication technology* (pp. 161–194). Routledge. https://doi.org/10.4324/9781410612892-12
Land, S. M., & Zimmerman, H. T. (2015). Socio-technical dimensions of an outdoor mobile learning environment: A three-phase design-based research investigation. *Educational Technology Research and Development, 63*(2), 229–255. https://doi.org/10.1007/s11423-015-9369-6
Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge University Press.
Leont'ev, A. N. (1974). The problem of activity in psychology. *Soviet Psychology, 13*(2), 4–33. https://doi.org/10.2753/rpo1061-040513024
Liu, C., White, R. W., & Dumais, S. (2010). Understanding web browsing behaviors through weibull analysis of dwell time. *SIGIR 2010 Proceedings - 33rd Annual International ACM SIGIR Conference on Research and Development in Information Retrieval*, 379–386. https://doi.org/10.1145/1835449.1835513
Martin, N. D., Dornfeld Tissenbaum, C., Gnesdilow, D., & Puntambekar, S. (2019). Fading distributed scaffolds: The importance of complementarity between teacher and material scaffolds. *Instructional Science, 47*(1), 69–98. https://doi.org/10.1007/s11251-018-9474-0
McKenney, S., & McKenney, S. (2018). Contributions to theory and practice. In *Conducting educational design research* (pp. 34–66). Routledge. https://doi.org/10.4324/9781315105642-4
Miller, C., Hooper, S., Rose, S., & Montalto-Rook, M. (2008). Transforming e-assessment in American Sign Language: pedagogical and technological enhancements in online language learning and performance assessment. *Learning, Media and Technology, 33*(3), 155–168. https://doi.org/10.1080/17439880802323980
National Academies of Sciences, Engineering, and Medicine. (2018). *How people learn II: Learners, contexts, and cultures*. National Academies Press. https://doi.org/10.17226/24783
Nelson, H. G., & Stolterman, E. (2012). The design way: intentional change in an unpredictable world. The MIT Press.

Nickerson, R. S. (1993). On the distribution of cognitions: Some reflections. In G. Salomon (Ed.), *Distributed cognitions: Psychological and educational considerations* (pp. 229–262). Cambridge University Press.
Norman, D. (2013). *The design of everyday things.* Revised & Expanded Edition. Basic Books.
OECD. (2018). *Equity in education: Breaking down barriers to social mobility*. https://doi.org/10.1787/9789264073234-en
Panadero, E. (2017). A review of self-regulated learning: Six models and four directions for research. *Frontiers in Psychology, 8*(APR), 1–28. https://doi.org/10.3389/fpsyg.2017.00422
Pea, R. D. (1993). Practices of distributed intelligence and designs for education. In G. Salomon (Ed.), *Distributed cognitions: Psychological and educational considerations* (pp. 47–87). Cambridge University Press.
Pea, R. D. (2004). The social and technological dimensions of scaffolding and related theoretical concepts for learning, education, and human activity. *Journal of the Learning Sciences, 13*(3), 423–451. https://doi.org/10.1207/s15327809jls1303_6
Pellegrino, J. W. (2019). Assessment of and for learning. In F. Fischer, C. E. Hmelo-Silver, S. R. Goldman, & P. Reimann (Eds.), *International handbook of the learning sciences* (pp. 410–421). Routledge. https://doi.org/10.4324/9781315617572-40
Perkins, D. N. (1993). Person-plus: A distributed view of thinking and learning. In G. Salomon (Ed.), *Distributed cognitions: Psychological and educational considerations* (pp. 88–110). Cambridge University Press.
Pontier, R., & Gort, M. (2016). Coordinated translanguaging pedagogy as distributed cognition: A case study of two dual language bilingual education preschool coteachers' languaging practices during shared book readings. *International Multilingual Research Journal, 10*(2), 89–106. https://doi.org/10.1080/19313152.2016.1150732
Puntambekar, S., & Kolodner, J. L. (2005). Toward implementing distributed scaffolding: Helping students learn science from design. *Journal of Research in Science Teaching, 42*(2), 185–217. https://doi.org/10.1002/tea.20048
Puustinen, M., & Pulkkinen, L. (2001). Models of self-regulated learning: A review. *Scandinavian Journal of Educational Research, 45*(3), 269–286. https://doi.org/10.1080/00313830120074206
Rappolt-Schlichtmann, G., & Daley, S. G. (2013). Providing access to engagement in learning: The potential of universal design for learning in museum design. *Curator: The Museum Journal, 56*(3), 307–321. https://doi.org/10.1111/cura.12030
Rogers, Y. (2005). An introduction to distributed cognition and communication - Open Research Online. In K. Brown (Ed.), *The encyclopedia of language and linguistics* (pp. 181–202). Elsevier. http://oro.open.ac.uk/19545/
Rose, S. (2007). Monitoring progress of students who are deaf or hard of hearing. In *National center on student progress monitoring*. National Center on Student Progress Monitoring. Washington, DC. http://www.studentprogress.org.
Salomon, G. (1993). No distribution without individuals' cognition: A dynamic interactional view. In G. Salomon (Ed.), *Distributed cognitions: Psychological and educational considerations* (pp. 111–138). Cambridge University Press.
Sannino, A., Engeström, Y., & Lemos, M. (2016). Formative interventions for expansive learning and transformative agency. *Journal of the Learning Sciences, 25*(4), 599–633. https://doi.org/10.1080/10508406.2016.1204547
Sauro, J. (2012). *MeasuringU: 10 things to know about the single ease question (SEQ)*. https://measuringu.com/seq10/
Schmidt, W. H., Burroughs, N. A., Zoido, P., & Houang, R. T. (2015). The role of schooling in perpetuating educational inequality: An international perspective. *Educational Researcher, 44*(7), 371–386. https://doi.org/10.3102/0013189X15603982
Schot, J., & Steinmueller, W. E. (2018). Three frames for innovation policy: R&D, systems of innovation and transformative change. *Research Policy, 47*(9), 1554–1567. https://doi.org/10.1016/j.respol.2018.08.011

Schraw, G., & Dennison, R. S. (1994). Assessing metacognitive awareness. *Contemporary Educational Psychology.* https://doi.org/10.1006/ceps.1994.1033
Shah, N., & Lewis, C. M. (2019). Amplifying and attenuating inequity in collaborative learning: Toward an analytical framework. *Cognition and Instruction, 37*(4), 423–452. https://doi.org/10.1080/07370008.2019.1631825
Shannon, C. E., & Weaver, W. (1948). A mathematical theory of communication. *Bell System Technical Journal.* https://doi.org/10.1002/j.1538-7305.1948.tb01338.x
Shannon, C. E., & Weaver, W. (1949). *The mathematical theory of communication*. The University of Illinois Press.
Shogren, K. A., Gross, J. M. S., Forber-Pratt, A. J., Francis, G. L., Satter, A. L., Blue-Banning, M., & Hill, C. (2015). The Perspectives of students with and without disabilities on inclusive schools. *Research and Practice for Persons with Severe Disabilities, 40*(4), 243–260. https://doi.org/10.1177/1540796915583493
Simon, H. A. (1973). The structure of ill structured problems. *Artificial Intelligence, 4*(3–4), 181–201. https://doi.org/10.1016/0004-3702(73)90011-8
Simon, H. A. (1988). The science of design: Creating the artificial. *Design Issues, 4*(1/2), 67. https://doi.org/10.2307/1511391
Simon, H. A. (1998). What we know about learning. *Journal of Engineering Education, 87*(4), 343–348. https://doi.org/10.1002/j.2168-9830.1998.tb00363.x
Ursu, A. S., Panisoara, I. O., & Chirca, R. C. (2020). The changes brought by digital technology to cognitive learning. In J.-É. Pelet (Ed.), *Handbook of research on user experience in web 2.0 technologies and its impact on universities and businesses* (pp. 161–182). IGI Global. https://www.igi-global.com/chapter/the-changes-brought-by-digital-technology-to-cognitive-learning/264577
Vossoughi, S. (2017). Access and equity in out-of-school learning. In K. Peppler (Ed.), *The SAGE Encyclopedia of Out-of-School Learning* (pp. 1–5). SAGE Publications, Inc. https://doi.org/10.4135/9781483385198.n7
Vygotsky, L. S. (1978). Interaction between learning and development: Mind in Society. In M. Gauvain & M. Cole (Eds.), *Readings on the development of children* (pp. 79–91). Harvard University Press. https://doi.org/10.1016/S0006-3495(96)79572-3
Wharton, C., Rieman, J., Lewis, C., & Polson, P. (1994). The Cognitive Walkthrough Method: A practitioner's guide. In J. Nielsen & R. L. Mack (Eds.), *Usability inspection methods* (pp. 105–140). Wiley.
Wong, L. H., & Looi, C. K. (2011). What seams do we remove in mobile-assisted seamless learning? A critical review of the literature. *Computers and Education, 57*(4), 2364–2381. https://doi.org/10.1016/j.compedu.2011.06.007

Neurotechnologies and the Neurodiversity Movement for Defining Learners, Designing Multimedia Learning Spaces, and Evaluating Learning

Jamie Bernhardt

Introduction

The term "neuroplasticity" has become a keyword through which many people now make meaning about themselves, others, health, and learning (Vidal and Ortega, 2017). Many companies have elevated the term "neuro" in messaging about design and development of technologies used to help people change their brains. A new category called *neurotechnologies* refers to combinations of hardware and software said to be designed based on brain science or neuroscience in order to enhance monitoring or training of brain states to help people improve their abilities, health, or personal wellness. For example, Eaton and Illes (2007) define *cognitive neurotechnologies* as "technologies that enable the monitoring and/or modulation of the function of the brain" which "may offer new treatments for mental illness, enable enhancements of mental performance and cognitive capacity, and open up new opportunities for commerce" (p. 393). Commercially available cognitive neurotechnologies currently include interventions like brain training games or neurofeedback training that aim to positively impact daily living through noninvasive training of cognitive abilities.

This chapter focuses on cognitive neurotechnologies—specifically examples of brain training games and neurofeedback training. First, it characterizes how these kinds of interventions emphasize cognitive abilities and neuroplasticity. Next, it considers commercial and social controversies about examples and explains how some companies have appealed to a medical model of health conditions in their marketing claims that views neurodevelopmental conditions as things to be cured. A systematic review of either category of interventions is beyond the scope of this

J. Bernhardt (✉)
Georgia State University, Atlanta, GA, USA
e-mail: jbernhardt2@student.gsu.edu

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*, Educational Communications and Technology: Issues and Innovations, https://doi.org/10.1007/978-3-030-85078-4_24

chapter, but the chapter finds insights about socially inclusive design from considering analysis of example claims alongside analysis of popular design features. Whereas current designs restrict learners to consuming messages and products for training their brains and cognitive abilities, other approaches (i.e., Universal Design for Learning, Adult Learning, and Neurodiversity Design) ask us to co-create learning designs with and for active learners who make and express meanings. This chapter proposes using a Neurodiversity Design approach for future design and evaluation research for including a neurodiversity of learners.

Cognitive Neurotechnologies

Cognitive neurotechnologies emphasize improving both cognitive abilities and neuronal connections in one's brain that support the use of cognitive abilities. As cognitive neurotechnology companies promise change in cognitive abilities, they often use the terms "cognitive abilities" or "cognitive improvement" without defining them. This chapter assumes that the term "cognitive ability" can be understood to mean working memory abilities and that commercial or research claims about cognitive improvements from cognitive neurotechnologies can be interpreted in terms of working memory abilities. A working memory ability allows a person to temporarily store sensory information in one's mind and to manipulate it (Baddeley & Hitch, 1974). Claims about neurotechnologies from companies or researchers also involve the concept of neuroplasticity—that is, the phenomenon of neuronal connections and networks of them changing through active use of abilities during experience (Greenwood & Parasurman, 2010). Researchers and companies who make cognitive neurotechnologies claim that these interventions target and train both networks of neuronal connections in one's brain and cognitive abilities. Researchers have also made a distinction about cognitive transfer in the context of cognitive neurotechnologies: when a training outcome involves improvements in the targeted cognitive ability used in the training, then this is called near transfer. If the training results in improvements beyond the ability targeted, to more complex cognition, then this is called far transfer (Simons et al., 2016).

Brain training games are one kind of cognitive neurotechnology. A brain training game is a gamified cognitive task marketed with the promise of improvement to cognitive abilities from benefits of neuroplasticity achieved through practice on gamified cognitive tasks. For example, a company named Focus Education marketed a game called Jungle Rangers with the promise that it could improve children's ability to focus. Another kind of cognitive neurotechnology is neurofeedback training interventions, which show learners information ("neurofeedback") about their own brain states to aid them in their performance on a task. A key difference between brain training games and neurofeedback training is the type of information given back to the player or learner: Brain training games show information about cognitive performance, whereas neurofeedback training shows information about their own neuronal states. A cognitive neurotechnology can fit into both categories, so long as it fits both descriptions. This chapter section will consider examples of the marketing claims made about these products or services.

Some cognitive neurotechnologies specifically mention targeting specific kinds of audiences, such as people identified as having a condition, symptom, or experience. Others leave the question “Who is this for?” open and general, targeting all people as potential beneficiaries of neurotechnology-enhanced change. Focus Education is an example of doing both in its claims. In the early part of the previous decade, Focus Education marketed and sold Jungle Rangers with marketing messages that playing with this game not only trains one’s neuronal networks and cognitive abilities but also permanently improves children’s focus, attention, memory, behavior, and school performance—including permanent gains for children with ADHD (FTC, 2015a). Jungle Rangers is an example of a brain training game. The US Federal Trade Commission (FTC) evaluated the marketing against available scientific research but found insufficient evidence to support such claims. The FTC charged this company with public deception and ordered the company to stop making such unsubstantiated claims.

A recent wave of research and systematic meta-analyses has focused heavily on the effectiveness of brain training games, including commercially available interventions like Jungle Rangers and lab-made working memory training interventions. The wave influenced competing online public statements from groups of researchers (Allaire et al., 2014; Jara, 2014; Merzenich, 2014) about the effectiveness of brain training games. It also influenced regulatory efforts—viz., lawsuits and charges of public deception by the Federal Trade Commission (FTC) against Focus Education (FTC, 2015a), Carrot Neurotechnology Inc. about its visual ability training app, Ultimeyes (FTC, 2015b), and Lumos Labs Inc. about its product, Lumosity™ (FTC, 2016a). For an in-depth systematic review and meta-analysis of the effectiveness of brain training games, see Simons et al. (2016).

Another example of a neurotechnology company under regulation is a company named Neurocore Brain Performance Centers. In recent years, it has marketed and sold a neurofeedback training intervention that combines in-person interaction with the use of its neurotechnology. It lists conditions like ADHD and autism as under its expertise. For example, we can see from its 2017 web marketing that it presents autism and symptoms of autism as a health condition to be treated or cured (Neurocore, 2017). In 2017 and 2018, several regulatory agencies—namely, Truth in Advertising, the National Advertising Division of the Better Business Bureau, and the National Advertising Review Board of the Council of Better Business Bureaus—documented an absence of sufficient research for sustaining many of the company’s claims about the effectiveness of Neurocore, including effectiveness for populations with autism or ADHD (Furfaro, 2018). Since then, Neurocore changed much of its web marketing in response to advertising regulations. Yet, we can still see, as recent as November 1, 2020, that the company presents conditions like autism as a health condition that should be cured, if possible (Neurocore, 2020).

Regulation of marketing claims relative to existing research is an important theme in the examples explored. Another socially relevant issue at stake in this commercial controversy is that the companies in these examples view conditions like autism or ADHD as a disease-like thing or set of symptoms to be cured. An alternative is to view autism and ADHD as neurodevelopmental conditions that a person can live with as part of human diversity with support. Focus education appeals to a *medical model* of health, abilities, and learning, like what Susan Havercamp describes in a National Academy of Sciences, Engineering, and Medicine (NASEM) report:

> The traditional medical model views disability as a characteristic or attribute of the individual, where the disability is caused by disease, trauma, or another health condition and requires an intervention to correct or compensate for the problem. In contrast, the social model views disability as a socially created problem, not a personal attribute, resulting from an unaccommodating and inflexible social or physical environment. In this model, management of the problem requires social action, and it becomes the responsibility of society at large to modify the environment in a manner that allows those with disabilities to participate fully in all activities (NASEM, 2018, p. 4).

The examples explored so far in this chapter are part of a trend in the fields of cognitive neurotechnologies involving a medical model that pathologizes developmental conditions as symptoms or diseases that should be treated or cured. The trend has been to commercialize off of the medical model and its popularity. For example, even though a company called LearningRx offers in-person brain training interventions, the company used search terms like "cure" with developmental conditions in its marketing to target people searching those terms in order to show them ads (FTC, 2016b). To clarify, not all companies in the neurotechnologies field follow this trend, but many have. An alternative way of understanding the overall spectrum of human differences is to use the concept of *neurodiversity*. A neurodiversity approach aims to include all people as learners by embracing their neurodevelopmental differences and helping them engage their own quality of life, not to view them as learners who should be cured to become or be like others who are regarded as the neurotypical (Bennett et al., 2019; Robertson, 2009; Silberman, 2015; Waltz, 2013). In a neurodiversity model, disabilities or neurodevelopmental conditions are often referred to as neurodiverse conditions. Also, in the absence of an authoritative standard of normal brainhood, the difference between neurodiverse conditions and neurotypical development is a difference of typicality, not normativity based on an ideal normal brain. Inspired by Havercamp, if we will take a social model seriously, then we should reexamine how current design features of cognitive neurotechnologies can better include, accommodate, and support a neurodiversity of the learners who may use them. (Fig. 1)

Reexamining Feature Designs and Social Implications

Neurotechnologies are combinations of software with hardware like a laptop, desktop computer, or a smart phone. As shown in Fig. 3, current neurotechnologies in companies' commercial offerings (Fernandez et al., 2015; SharpBrains Inc., 2013; 2016), and in the research literatures, are designed to include a cognitive

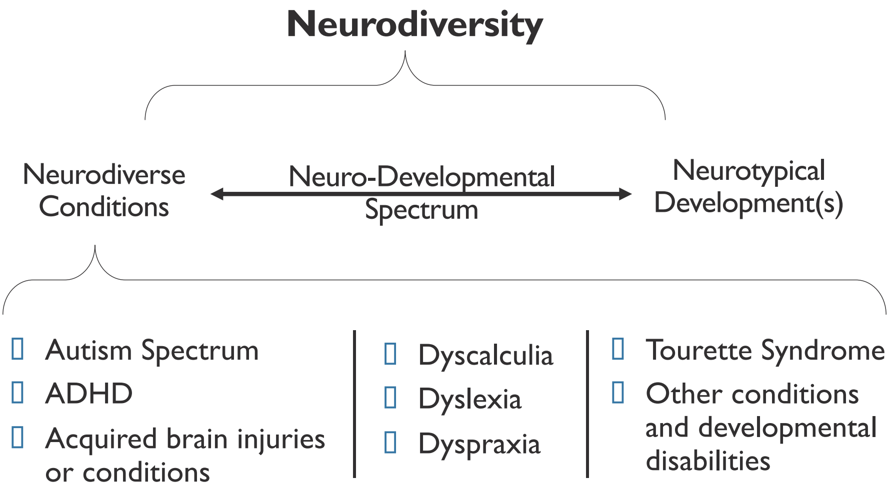


Fig. 1 Neurodiversity as a kind of diversity

intervention, with or without monitoring of brain or other biological data through optical devices. Whereas a navigation interface includes stimuli and response controls for navigation of the options and information in the intervention, a training task interface includes stimuli and response controls for attempting training tasks.

A cognitive neurotechnology's capacities for data monitoring, storage, analytics, and retrieval allow for multimedia messages shown to the learner about their personal performance data on tasks. This allows what Swan (2013) calls self-tracking and quantified self. Self-tracking is the use of technologies for data collection and analysis in a process of monitoring aspects of oneself, such as psychological states, physiological states, or cognitive states. A "quantified self" is a person's use of quantitative data to make meanings and mediate their experience of reality about themselves. It enables them to relate the different data sources and relations of data to oneself. Current cognitive neurotechnologies are *information-centric*—that is, designed to collect and analyze data in order to give learners information about themselves, impacting quantified self-constructs like health, abilities, and identity.

Whether in marketing, or in interventions themselves, messages about health and abilities matter for how people practice self-identity and self-improvement. An information-centric use of instructional or intervention features would focus on design of a product or system to facilitate display of and access to information. This reduces learning to what Freire (1970/2000) calls a "banking model" of education as giving and receiving information, perhaps without encouraging criticality toward information. Current designs of cognitive neurotechnologies focus on training abilities and giving messages, not on creating other kinds of learning spaces within the multimedia of the intervention. Their designs restrict learner to consuming messages and products for training their brains and cognitive abilities. As shown in Fig. 2, they limit leaners to a banking model that prioritizes consuming messages about oneself.

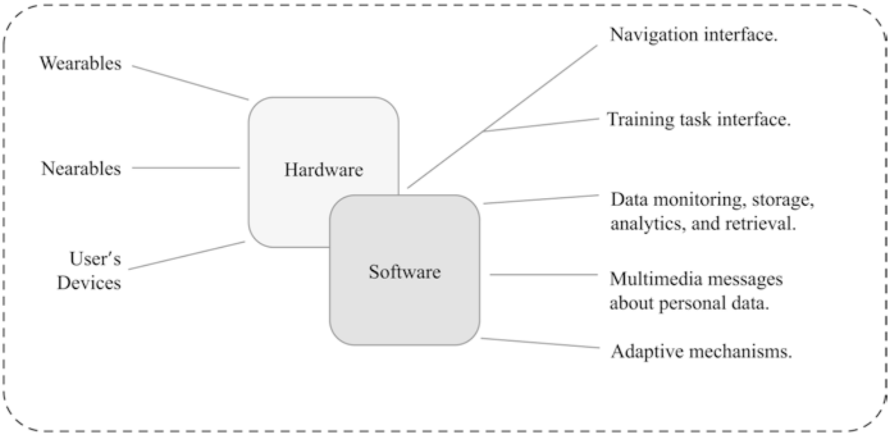


Fig. 2 Current cognitive neurotechnologies through an informational lens

When a product is designed on the basis of a medical model, it designs interventions to cure symptoms and can rely on an information-centric banking model of learning that frames the learner's self-tracking and quantitative self around symptoms to be cured. Applying a medical model to an information-centric design entails giving messages about changes in brains and cognition that appeal to, or imply, a distinction between normal brainhood and abnormal conditions to be cured. However, if a medical model of neurodevelopment determines the visual and textual messages in a neurotechnology, then this can create stigma for learners as an experience that undermines "a person's humanity and overshadows the fullness of their identity by placing assumptions about negatively perceived qualities over openness to their actual personhood" (Gates, 2019, p. 13). For any person, neurodevelopment and neuroplasticity constitute possibilities of ways of being human (Rees, 2016). Personal identity is a meaning-making practice in which the same concepts used to analyze self are also used to create self (Fuhrer, 2004). Whether one identifies as neurotypical, neurodiverse, or otherwise, it is through a cultural practice of identifying as being a brain (Vidal & Ortega, 2017). Yet, some brain terminologies, and design or research practices based on them, can marginalize or harm people. When inscribed into identity, discourses about autism or ADHD as brain abnormality can lead to stigma (Gates, 2019) or reduced engagement in meaningfulness in one's life.

Redesigning for Neurodiversity and Learning

Designers can aim to create technologies and experiences that help individuals feel confident that they are learning "where they wouldn't be mocked or stigmatized for their behavior" (Silberman, 2015, p. 479). While there is no normal brain (Armstrong, 2015; Bennett et al., 2019; Waltz, 2013) for which to design interventions, we can aim to design for a diversity of learners who may train or self-track with interventions, including individuals with neurodevelopmental conditions. How can we redesign neurotechnologies to apply a neurodiversity approach to inclusion and personal quality of life as part of the learning and the outcomes? To start, it is helpful to set goals and use methods of avoiding that appeal to a medical model of health, cognition, or neurodevelopment. Message design processes can involve examining and revising to remove instances of pathologizing language that a medical model would involve. However, redesign efforts should not start and stop at message design. Past medical model trends in design of neurotechnologies have also limited the learning experiences to the learner(s) having of messages crafted by others. The learning spaces within these technologies currently do not encourage or engage the learner's critical thinking development or active meaning-making beyond given messages.

What theories or approaches might we draw from in order to design technologies that encourage or engage the learner's critical thinking development or active meaning-making beyond given messages? One such theory is transformative adult learning—or TAL for short—with roots in the works of Knowles (1973) and Mezirow (1991). Applying this theory of learning involves aiming to engage learners to make and document meanings, not just consume messages made by someone else. TAL aims to engage learners into personally meaningful learning and transformation of one's self and relations to one's environment. TAL is a type of learning, supported by applying principles, and it includes theoretical, empirical, and logistical flexibility for including direct instruction (e.g., giving information/messages), engagement of personally meaningful goals and efforts, and support for active expression of dissonance(s) and reflections.

Another useful approach is Universal Design for Learning (UDL) , which aims to include all learners by minimizing or removing barriers to access and to engaging learning through active expression (Meyer et al., 2014). UDL is a framework for supporting different types of learning through applying principles, guidelines, and checkpoints (CAST, 2018; 2019) (Table 1):

Both UDL and TAL ask us to co-create learning designs with and for active learners who make and express meanings. Both also call for the meanings learners express to inform evaluation of learning and intervention design, implementation,

Table 1 Applying Universal Design principles and guidelines

Provide multiple means of ENGAGEMENT:	Provide multiple means of REPRESENTATION:	Provide multiple means of ACTION & EXPRESSION:
Provide options for RECRUITING INTEREST.	Provide options for PERCEPTION.	Provide options for PHYSICAL ACTION.
Provide options for SUSTAINING EFFORT & PERSISTENCE.	Provide options for LANGUAGE & SYMBOLS.	Provide options for EXPRESSION & COMMUNICATION.
Provide options for SELF REGULATION.	Provide options for COMPREHENSION.	Provide options for EXECUTIVE FUNCTIONS.

and evaluation. To truly apply concepts of neurodiversity into designs, it would also be helpful to engage a neurodiversity of individuals into the design process itself to inform design efforts. With this in mind, several researchers recently proposed using an approach called Neurodiversity Design (Dalton, 2013; Motti & Evmenova, 2020; Rapp et al., 2019). Whereas TAL is a theory of learning and set of principles for supporting personally meaningful learning, and UDL is a set of principles for designing learning for all, Neurodiversity Design is simply a process for design. It is compatible with blending other approaches like TAL and UDL together but does not itself assume any particular theory or principle. Neurodiversity Design aims for the value of inclusion as part of the intervention design, learning experiences, research, and the outcomes. It emphasizes inclusion of both people with neurotypical development and neurodiverse conditions as participants in the same study. Such participation can be in any or all stages of design or iteration. Figure 3 shows what is possible for designing future neurotechnologies from blending TAL and UDL together in a Neurodiversity Design process.

While there is no universal brain for which to design neurotechnologies, a Neurodiversity Design approach calls for more inclusive human-computer interaction design informed by neurotypical and neurodiverse learners. It calls for design to explore design features in an inclusive research process that evaluates how active participants engage with design iterations.

Neurodiversity Design and Evaluation of Multimedia Learning Spaces and Learning

For Neurodiversity Design of learning, we need replicable and responsive design strategies and processes, such as design-oriented research (Fallman, 2007) or educational design research (McKenney & Reeves, 2014), not merely limited to product-oriented (Fallman, 2007) or design-based research (McKenney & Reeves,

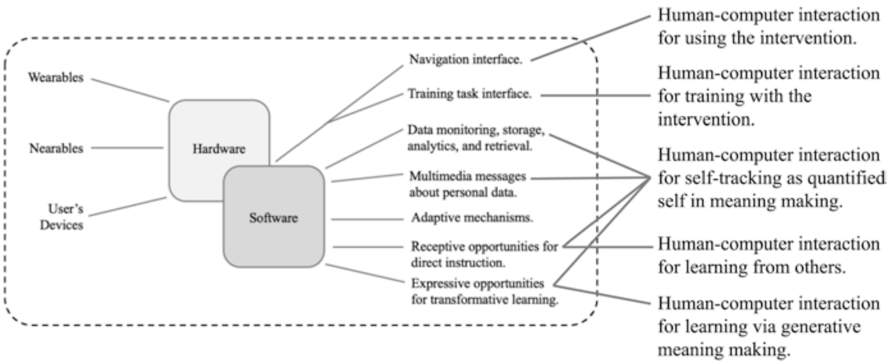


Fig. 3 Future cognitive neurotechnologies through a transformative lens

2014). The former approaches to design research emphasize generating a public knowledge of design strategies generalizable to design processes, whereas the latter approaches prioritize creating a product or multimedia artifact to benefit a particular group of learners for a particular range of contexts. In order for design and evaluation to be more universally inclusive—in both process and in knowledge generated for subsequent application to design of learning experiences—design research should include a neurodiversity of learners and strive to generate design strategies for making learning designs relevant to a neurodiversity of learners. To do this, instructional and multimedia design can take inspiration from other related or sister fields like engineering and product design (McKenney & Reeves, 2014) or other design-related fields (Gibbons et al., 2014) like human experience design and human interface design.

Participation of people with and without diagnoses of neurodevelopmental conditions could occur in any and all stages of an iterative process. This chapter proposes using the domain-and-theory-agnostic (Molenda, 2003) ADDIE processes—Analysis, Design, Development, Implementation, and Evaluation—for informing neurodiversity design and evaluation of multimedia learning spaces in neurotechnologies with voices of neurotypical and neurodiverse adult learners. The ADDIE process is the most widely practiced and researched process for facilitating learning in the field of instructional design and its applications to other applied learning sciences (Branch, 2009; Branch & Dousay, 2015; Gustafson & Branch, 1997, 2002). While ADDIE was originally associated with instructional systems design, it need not be tied to any one theory (Gibbons et al., 2014). ADDIE should be understood as a process that is agnostic about domains of learning or models of how to evaluate learning (Molenda, 2003), allowing for a freedom to blend domains and theories in the iterative process of design, facilitation, and evaluation (formative and summative). For example, Bernhardt et al. (2020) used ADDIE as a program evaluation framework for mixing preordinate and responsive measurement strategies (Stake, 2004) in an on-campus residential program for adults on the autism spectrum. This kind of willingness to use an iterative process like ADDIE with both preordinate and responsive measurement (Stake, 2004) aims, and openness to mixing qualitative and quantitative data, may also work well with a neurodiversity approach to the design of a neurotechnology informed by evaluation of how a diversity of leaners learn with it.

Neurodiversity Design can take design of learning spaces in neurotechnologies beyond consumption of messages toward design and evaluation informed by expressed voices of neurodiversity. Uses of ADDIE can blend the perspectives explored in Fig. 3, with several options for intervention or study design and exploration of commercial issues and research challenges for studying how adult learners use neurotechnology products:

1. Study a person's naturalistic use of an off-the-shelf product made freely or commercially available by a company.
2. Study use of an off-the-shelf product with a willing participant, without expressed or prerequisite permission from the company selling the product.

3. Study use of an off-the-shelf product with a willing participant, with expressed or prerequisite permission from the company selling the product.
4. Create a design iteration from scratch, or from a prior noncommercial research project, and study use of the intervention with a willing participant through a design process.

The field of cognitive neurotechnologies has been as much an industry of companies selling products as it has been a field of inquiry or human services (Fernandez et al., 2013). Many companies are filing more and more new patents for neurotechnologies (Fernandez et al., 2015; SharpBrains Inc., 2013; 2016), and this is important to consider in both study and intervention design. Whereas option 1 above involves a person already using a product as a consumer, option 2 involves introducing them to a product they have perhaps never used before. In options 1, 2, and 3, it may be important to consider the intellectual property (e.g., patents), data privacy statements, terms and conditions of intervention use, and research partnership stipulations by the companies selling the product. Also, some companies may only want to do product-oriented research, which limits conclusions of research to findings about interactions with a commercial product, but excludes testing or exploration of multiple design iterations, as well as design-oriented findings. While doing design-oriented research or educational design research with a company is possible in options 1 or 3, it depends on the company's willingness, and the partnership may necessitate financial conflict of interest reporting if a researcher profits from it or serves on a scientific advisory board for development of commercial products. For researchers looking for a route without dependencies on a company or immediate financial conflicts of interest, and with maximum flexibility and control of design iterations and design process, option 4 is most viable.

References

Armstrong, T. (2015). The myth of the normal brain: Embracing neurodiversity. *AMA Journal of Ethics, 17*(4), 348–352.

Allaire, J. C., Bäckman, L., Balota, D. A., Bavelier, D., Bjork, R. A., & Bower, G. H. (2014). A Consensus on the Brain Training Industry from the Scientific Community. Stanford Center on Longevity and Max Planck Institute for Human Development. Retrieved from http://longevity3.stanford.edu/blog/2014/10/15/the-consensus-on-the-braintraining-industry-from-the-scientific-community-2/

Baddeley, A. D., & Hitch, G. (1974). Working memory. In *Psychology of learning and motivation* (Vol. 8, pp. 47–89). Academic Press.

Bennett, M., Webster, A. A., Goodall, E., & Rowland, S. (2019). *Life on the autism spectrum: Translating myths and misconceptions into positive futures*. Springer.

Bernhardt, J. B., Lam, G. Y. H., Thomas, T. Cubells, J. F., Bohlke, K., Reid, M., Rice C. E. (In Press). Meaning and measurement: Evaluating autistic adults' active engagement and expressed interest in quality of life goals. *Autism in Adulthood*. Ahead of Print, 2020 May 4. https://doi.org/10.1089/aut.2019.0081

Branch, R. M. (2009). *Instructional design: The ADDIE approach*. Springer International Publishing.

Branch, R. M., & Dousay, T. A. (2015). *Survey of instructional design models* (5th ed.). Association for Educational Communications & Technology.

Center for Applied Special Technology (CAST). (2018). Universal Design for Learning Guidelines version 2.2. Retrieved from http://udlguidelines.cast.org and: http://udlguidelines.cast.org/engagement/recruiting-interest/choice-autonomy/choice-autonomy-research

Center for Applied Special Technology (CAST). (2019). About universal design for learning. Retrieved from http://www.cast.org/our-work/about-udl.html#.XRfI4JNKjx4

Dalton, N. S. (2013). Neurodiversity HCI. *Interactions, 20*(2), 72–75.

Eaton, M. L., & Illes, J. (2007). Commercializing cognitive neurotechnology—The ethical terrain. *Nature Biotechnology, 25*(4), 393–397.

Fallman, D. (2007). Why research-oriented design isn't design-oriented research: On the tensions between design and research in an implicit design discipline. *Knowledge, Technology, and Policy, 20*(3), 193–200.

Federal Trade Commission. (2015a). Makers of jungle rangers computer game for kids settle FTC charges that they deceived consumers with baseless "brain training" claims (press release). Retrieved from FTC website: https://www.ftc.gov/news-events/press-releases/2015/01/makers-jungle-rangers-computer-game-kids-settle-ftc-charges-they

Federal Trade Commission. (2015b). FTC charges marketers of 'vision improvement' app with deceptive claims (press release). Retrieved from FTC website: https://www.ftc.gov/news-events/press-releases/2015/09/ftc-charges-marketers-vision-improvement-app-deceptive-claims

Federal Trade Commission. (2016a). Lumosity to pay $2 million to settle FTC deceptive advertising charges for its "brain training" program *(press release)*. Retrieved from FTC website: https://www.ftc.gov/news-events/press-releases/2016/01/lumosity-pay-2-million-settle-ftc-deceptive-advertising-charges

Federal Trade Commission. (2016b). Marketers of one-on-one 'brain training' programs settle FTC charges that claims about ability to treat severe cognitive impairments are unsupported *(press release)*. Retrieved from FTC website: https://www.ftc.gov/news-events/press-releases/2016/05/marketers-one-one-brain-training-programs-settle-ftc-charges

Fernandez, A., Goldberg, E., & Michelon, P. (2013). *The SharpBrains guide to brain fitness* (2nd ed.). SharpBrains.

Fernandez, A., Sriraman, N., Gurewitz, B., & Oullier, O. (2015). *Pervasive neurotechnology: A groundbreaking analysis of 10,000+ patent filings transforming medicine, health, entertainment, and business (market report)*. SharpBrains Inc., USA. Retrieved from https://sharpbrains.com/pervasive-neurotechnology/

Freire, P. (2000). *Pedagogy of the oppressed*. New York: Continuum International Publishing Group (Original work published in 1970).

Fuhrer, U. (2004). *Cultivating minds: Identity as meaning-making practice*. Psychology Press.

Furfaro, H. (2018, June 28). Despite dearth of data, firms sell brain training as autism antidote. *Spectrum*. Retrieved from https://www.spectrumnews.org/news/despite-dearth-data-firms-sell-brain-training-autism-antidote/

Gates, G. (2019). *Trauma, stigma, and autism: Developing resilience and loosening the grip of shame*. Jessica Kingsley Publishers.

Gibbons, A. S., Boling, E., & Smith, K. M. (2014). Instructional design models. In J. M. Spector, M. D. Merill, E. Jan, & M. J. Bishop (Eds.), *Handbook of research on educational communications and technology* (pp. 607–615). Springer.

Greenwood, P., & Parasuraman, R. (2010). Neuronal and cognitive plasticity: A neurocognitive framework for ameliorating cognitive aging. *Frontiers in Aging Neuroscience*. https://doi.org/10.3389/fnagi.2010.00150

Gustafson, K. L., & Branch, R. M. (1997). *Survey of instructional development models* (3rd ed.). Syracuse University.

Gustafson, K. L., & Branch, R. M. (2002). *Survey of instructional development models* (4th ed.). ERIC Clearinghouse on Information & Technology.

Jara, P. (2014). Scientists to stanford: Research shows brain exercises can work (Press release). Retrieved from PR Web website: http://www.prweb.com/releases/2014/12/prweb12401341.htm and from Cognitivetrainingdata.org website: http://www.cognitivetrainingdata.org/press-releases/scientists-stanford-researchshows-brain-exercises-can-work/

Knowles, M. S. (1973). *The adult learner: A neglected species*. Gulf Publishing Company.

McKenney, S., & Reeves, T. C. (2014). Educational design research. In J. M. Spector, M. D. Merill, E. Jan, & M. J. Bishop (Eds.), *Handbook of research on educational communications and technology* (pp. 131–140). Springer.

Meyer, A., Rose, D. H., & Gordon, D. (2014). *Universal design for learning: Theory and practice*. Center for Applied Special Technology. Retrieved from http://udltheorypractice.cast.org/login

Mezirow, J. (1991). *Transformative dimensions of adult learning*. Jossey-Bass.

Molenda, M. (2003). In search of the elusive ADDIE model. *Performance Improvement, 42*(5), 34–37.

Motti, V. G., & Evmenova, A. (2020). Designing technologies for neurodiverse users: Considerations from research practice. In T. Ahram, R. Taiar, S. Colson, & A. Choplin (Eds.), *Human interaction and emerging technologies. IHIET 2019. Advances in intelligent systems and computing* (Vol. 1018). Springer.

Merzenich, M. (2014). An open letter to the stanford center for longevity. Retrieved from Cognitivetrainingdata.org website: http://www.cognitivetrainingdata.org/ and http://www.cognitivetrainingdata.org/wp-content/uploads/2014/open-letter.pdf

National Academies of Sciences, Engineering, and Medicine. (2018). *People living with disabilities: Health equity, health disparities, and health literacy: Proceedings of a workshop*. The National Academies Press. https://doi.org/10.17226/24741

Neurocore Brain Performance Centers. (2017). Natural autism treatment for autism spectrum disorder. Retrieved from https://web.archive.org/web/20170122133439/; https://www.neurocorecenters.com/treatment/autism/

Neurocore Brain Performance Centers. (2020). Neurofeedback therapy for autism spectrum disorder. Retrieved from https://www.neurocorecenters.com/treatment/asd

Rapp, A., Cena, F., Frauenberger, C., Hendriks, N., & Slegers, K. (2019). Designing mobile technologies for neurodiversity: Challenges and opportunities. In MobileHCI'19 Proceedings of the 21st International Conference on Human-Computer Interaction with Mobile Devices and Services. ACM.

Rees, T. (2016). *Plastic reason: An anthropology of brain science in embryogenetic terms*. University of California Press.

Robertson, S. M. (2009). Neurodiversity, quality of life, and autistic adults: Shifting research and professional focuses onto real-life challenges. *Disability Studies Quarterly, 30*(1). https://doi.org/10.18061/dsq.v30i1.1069

SharpBrains Inc. (2013). *The digital brain health market 2012–2020: Web-based, mobile and biometrics-based technology to assess, monitor and enhance cognition and brain functioning*. SharpBrains. Retrieved from https://sharpbrains.com/market-report/

SharpBrains Inc. (2016). *The digital brain health market 2012–2020: Web-based, mobile and biometrics-based technology to assess, monitor and enhance cognition and brain functioning* (2nd ed.). SharpBrains. Retrieved from https://sharpbrains.com/market-report/

Silberman, S. (2015). *Neurotribes: The legacy of autism and the future of neurodiversity*. Penguin.

Simons, D. J., Boot, W. R., Charness, N., Gathercole, S. E., Chabris, C. F., Hambrick, D. Z., & Stine-Morrow, E. A. (2016). Do "brain-training" programs work? *Psychological Science in the Public Interest, 17*(3), 103–186.

Stake, R. E. (2004). *Standards-based and responsive evaluation*. Sage.

Swan, M. (2013). The quantified self: Fundamental disruption in big data science and biological discovery. *Big Data, 1*(2), 85–99.

Vidal, F., & Ortega, F. (2017). *Being brains: Making the cerebral subject*. Fordham University Press.

Waltz, M. (2013). *Autism: A social and medical history*. Palgrave Macmillan.

Inward from the Periphery: Communities of Practices, Learning, and Participating in the AECT Summer Learning Symposium

Sharon Flynn Stidham

Entering the Academic Community

Fall 2017, I taught a course in Developmental Mathematics at a branch campus of a community college in rural Illinois. My students had one simple issue in common: they had never learned mathematics without a phone or calculator handy because their school systems did not have the financial resources to hire teachers with adequate expertise. Doing math in their heads was a foreign concept to these young adults, and I wondered if this type of issue extended across all subjects and disciplines and concluded that a change in how education was approached was necessary.

I decided I should be part of the solution, and to pursue doctoral studies which would offer me that opportunity. My searches into various educational disciplines that I found inspiring led me to the field of Instructional Design. January of 2018, I started my studies at Virginia Tech, full of the vim and vigor that characterizes the doctoral neophyte in Education programs. Unlike many others in my classes, I did not have a Master's degree in Instructional Design or Educational Technology, nor did I have extensive experience in academic writing. Instead, I arrived after a business career and a turn into the business college classroom and also created personalized education for nontraditionally served students. In this academic world, I was an outsider looking in, a stranger in a strange land.

S. F. Stidham (✉)
Virginia Polytechnic Institute and State University, Blacksburg, Virginia, USA
e-mail: sharon62@vt.edu

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*, Educational Communications and Technology: Issues and Innovations,
https://doi.org/10.1007/978-3-030-85078-4_25

Encountering Cognitive Apprenticeship

I first encountered the term "cognitive apprenticeship" at the end of my first semester at Virginia Tech. Collins, in his 2006 chapter in the *Cambridge Handbook of the Learning Sciences*, spoke to how teaching and learning had been traditionally based on the apprenticeship model. With a very low teacher-to-learner ratio, this model focused on specific methods for carrying out tasks in a domain. He argued for this model to be leveraged more fully in educational environments, with a focus on cognitive skills and processes. Other models he created included situated learning, communities of practice, and communities of learners. (Collins, 2006). I wondered aloud why we in our doctoral program did not use the cognitive apprenticeship model. My queries were greeted by indulgent smiles. My professors encouraged me to explain my thinking and what it was I thought I wanted and allowed me to explore the concepts at my own pace. I now understand that my advisor, committee members, and professors all were actually using the very precepts I had newly learned and that they were, in their actions, encouraging me to understand the processes I was engaged in as a graduate student.

As an older student, who had come back to school many years after the completion of a Master's degree, as a former math teacher credentialed through an alternative certification process, and as a parent of a Ph.D. student at the same university in a far different discipline, I felt very much the outsider on various levels. Within my classes, I felt that I was far behind my peers. Despite this, I could see clearly how many of the teaching strategies I had developed in my own classrooms were firmly based in theories I didn't know existed. There was a comfort in that, but I could not see how I could ever be an active member of this new domain. I just didn't feel like I could be a part of the academic community of practice.

Herrington and Wood (2000), in examining Lave and Wenger's 1991 work, offered that "a critical aspect of the situated learning model is the notion of the apprentice observing the "community of practice"" and that "participation in a culture of practice can…be observations from the boundary" (p. 24). I have come to see that not only has my program provided the necessary academic content for my success, I was encouraged me to seek out and participate in a variety of communities of practice through my studies and my active participation in situated learning contexts. The annual AECT Conventions enabled me to explore and discover new perspectives and approaches and to discover my path into the communities of practice that include those of my fellow students at Virginia Tech, my student colleagues in AECT, the instructional design discipline, and the greater communities that exist beyond that.

Discovering the World Café at AECT

During my first AECT Convention in October 2018, I worked as a volunteer supervisor and, in the course of executing those duties, found myself in the session hosted by Drs. Phillip Harris and Brad Hokanson, titled "Defining and describing learning: A World Café guided discussion."

Steier, Brown, and Mesquita da Silva (2016) explained the World Café process as a design that

> … enables groups to participate together in evolving rounds of dialogue with varying combinations of others while, at the same time, remaining part of a single, larger, whole, to bring forth new insights into questions that deeply matter to their life, work, or community (p. 212).

The format is an implementation of action research, encouraging knowing via engagement. During the World Café session, the participants addressed questions regarding learning, its nature, and our experiences in learning, and we were further challenged to more deeply understand what learning is and how we know that learning has occurred. At the end, I was invited to participate in that summer's AECT Summer Research Symposium. Unsure of my abilities, and unconvinced that I would be up to the challenge, I chose to forgo the opportunity. Again, during the 2019 convention, I participated in the same session, and again, the invitation to the summer symposium was extended. This time, however, I accepted, and through my attendance, the foundation of what I believed about myself, my understanding of my newfound field, and my research interests fundamentally shifted. As a result of the symposium, the level of my engagement in my communities of practice also changed. I was moving inward from the periphery.

Due to the COVID-19 pandemic, the 2020 AECT Summer Research Symposium was shifted online. I wasn't sure that this format would be conducive to the World Café format—after all, one of the key common elements of a convention, conference, symposium, or World Café is the fascinating conversations that surround you, challenge you, and thus enhance the experience. These events are never "just" about the actual presentations, nor should they be. However, because they are expensive, a conscious decision about expectations and desired outcomes must be made before attending, both as a participant or as a presenter (Haggerty & Doyle, 2015). AECT's website offers the following description and expectations for the symposium:

> The broadest questions that can and should be asked in education are in regards to learning, and yet they remain the deepest as well, but these are not often asked.
>
> It is the goal of the symposium to gather together a select group of scholars to share research for real dialogue and deep discussions about learning experience and learning design (AECT, 2019).

Although I submitted a proposal for the symposium, I did not believe that I was ready to contribute in a meaningful manner. To my relief, I was not accepted as a presenter. As a participant, however, I realized my goal to involve myself legitimately in community practices of the (Collins, 2006). Unlike the traditional academic conference or convention, the emphasis of this symposium is on dialogue-driven collaborative efforts, intended to assist the presenters to more completely develop their chapters for the to-be-published book. My task, therefore, was to interact with the community, which was focused on the paper at hand, and to participate in the discussion in a substantive way, as described in situated learning theory by Collins (2006), and in cultural-historical activity theory as described by Engeström (1987). Engeström presented a model of an activity system, examining the interactions of a community with a subject and an object, as mediated by an instrument. These interactions are further mediated by rules and a division of labor, deepening and enriching the experiences of the community. This phenomenon was fully utilized over the duration of the conversations.

Crossing the Threshold

As preparation for the symposium discussions, participants were provided with copies of the accepted papers and were challenged to select two for each of the four scheduled discourse sessions throughout the event. In these conversations, the participants were encouraged not just to engage with the authors on the content but to provide comments and suggestions on structure, approach, theoretical foundations, and presentation. This was an entirely new experience for me—years in the corporate and teaching worlds had not prepared me to address readings with such rigor and intentionality. As an undergraduate student, I was taught to read, to absorb, and, most importantly, to accept what was written. I have, for years, excelled at summarizing and compiling information and in presenting and packaging it in ways that pleased my teachers, professors, and the executives to whom I reported. In the context of the symposium, however, I finally understood what my professors in my doctoral studies had been trying to gently steer me toward. Reading and absorbing are all well and good, but I needed to learn to unpack sentences, to understand the assumptions underlying the thoughts on paper, and to hold the author's assertions up to the light to find the holes in the fabric.

I was ill-prepared but finally aware that the foundation of understanding that I had been building since commencing my doctoral studies was a latticework, lovely but in need of continued construction. Jeroen van Merriënboer & de Bruin (2014), in his chapter "Research Paradigms and Perspectives on Learning" in the fourth edition of the *Handbook of Research on Educational Communications and Technology*, offers that researchers "should be conscious of the fact that paradigms heavily affect their research methods and findings" (p. 21). Shifting to the point of view of the learner, it is essential that learners be aware that researchers have paradigms that affect their research. As learners, we, too, have paradigms that affect our reading, our understanding, and our individual skill sets in synthesizing the research we have read. Herrington and Oliver's (2000) argument arose from a recognition of students' inability to leverage knowledge gained through the acquisition of an education in a discipline, which drove their research efforts into "…the interdependence of situation and cognition" (p. 23). My excellence as an undergraduate and Master's student was proving my undoing.

While in the symposium discourse sessions, I observed the lively and inspiring conversations and sought to understand the thought processes by which my fellow attendees arrived at their questions and their insights. Reviewers and researchers all, they modeled elements of critical reading and reviewing skills, and the art of giving feedback in a collegial and constructive manner, leaving me alternately motivated and overwhelmed. Engaging in these scholarly exchanges provided new insights into the world of academic writing and, more specifically, an entrée into the IDT scholarly community.

In their examination of learning in an activity system, Greeno and Engeström (2006), tell us that it "involves identifying a change in the practices of the system and giving an account of how that change was accomplished" (p.131). They further explain that "an important mechanism leading to change in practices is *an expansion of the subject's understanding of the object*" (p. 131). *The goal of the discussions occurring in each symposium Zoom breakout room was not only the expansion of learning in terms of the material presented in each document under examination, but the provision of feedback, ideas for improvement, and challenges to the underlying assumptions and theoretical constructs.* The view of human knowledge as a discourse practice itself (Lyotard, 1993, p.3), coupled with the understanding of discourse as a "rule-governed multimodal communicational activity, as the thing that changes in the process of learning" (Sfard & Cobb, 2006, p. 14), frames the outputs of the various discussions, in terms of shared meanings, understanding, and growth in knowledge that occurred.

The opening and closing discussions provided illuminating bookends to the experience, framing our notions about learning, its nature, and our collective view of the 2-day event. As a participant in these exchanges, my movement inward to the various intersecting communities of practice excited me to seek out even deeper understandings and continuing growth as a scholar.

Conclusion David Lynch's 1984 movie adaptation of Frank Herbert's science fiction classic *Dune* opened with the phrase "A beginning is a very delicate time." Perfectly encapsulating my experience of participating in AECT's 2020 Summer Learning Symposium, I realize how my appreciation of my nascent entry into the intersection of the several various communities of practice represented in the symposium has grown even as I penned this piece. It is my sincere hope that my contributions may expand even as my progress inward toward the heart of these communities of practice continues as I further engage in academic discourse and that my time as an apprentice will yield dividends I cannot yet appreciate.

References

Association for Educational Communications & Technology (AECT). (2019). 2020 *AECT Summer Research Symposium*. 2020 AECT Summer Research Symposium – Association for Educational Communications and Technology. https://aect.org/symposium.php.

Collins, A. (2006). Cognitive apprenticeship. In K. R. Sawyer (Ed.), *The Cambridge handbook of the learning sciences* (pp. 47–60). Cambridge University Press.

Engeström, Y. (1987). *Learning by expanding: An activity-theoretical approach to developmental research*. Helsinki.

Greeno, J. G., & Engeström, Y. (2006). Learning in activity. In K. R. Sawyer (Ed.), *The Cambridge handbook of the learning sciences* (pp. 47–60). Cambridge University Press.

Haggerty, K. D., & Doyle, A. (2015). *57 ways to screw up in grad school: Perverse professional lessons for graduate students*. ProQuest Ebook Central. https://ebookcentral.proquest.com

Herrington, J., & Oliver, R. (2000). An instructional design framework for authentic learning environments. *Educational Technology Research and Development, 48*(3), 23–48. https://doi.org/10.1007/bf02319856

Lynch, D. (Director). (1984). *Dune* [Film]. Dino De Laurentiis Company.

Lyotard, J.-F. (1993). *The postmodern condition: A report on knowledge*. University of Minnesota Press.

Sfard, A., & Cobb, P. (2006). Research in mathematics education: What can it teach us about human learning? In K. R. Sawyer (Ed.), *The Cambridge handbook of the learning sciences*. University Press.

Steier, F., Brown, J., & Mesquita da Silva, F. (2016). The world cafe in action research settings. In H. Bradbury (Ed.), *SAGE handbook of action research* (3rd ed., pp. 211–219). SAGE.

van Merriënboer, J. J. G., & de Bruin, A. B. H. (2014). Research paradigms and perspectives on learning. In J. Spector, M. Merrill, J. Elen, & M. Bishop (Eds.), *Handbook of research on educational communications and technology*. Springer. https://doi-org.ezproxy.lib.vt.edu/10.1007/978-1-4614-3185-5_2

Index

B. Hokanson et al. (eds.), *Learning: Design, Engagement and Definition*, Educational Communications and Technology: Issues and Innovations,
https://doi.org/10.1007/978-3-030-85078-4