Educational Communications and Technology:
Issues and Innovations

Kay A. Persichitte
Atwi Suparman
Michael Spector *Editors*

Educational Technology to Improve Quality and Access on a Global Scale

Papers from the Educational Technology World Conference (ETWC 2016)

AECT ASSOCIATION FOR EDUCATIONAL COMMUNICATIONS & TECHNOLOGY

Springer

Educational Communications and Technology: Issues and Innovations

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Educational Communications and Technology: Issues and Innovations
ISBN 978-3-319-66226-8 ISBN 978-3-319-66227-5 (eBook)
https://doi.org/10.1007/978-3-319-66227-5

Library of Congress Control Number: 2017958029

Printed on acid-free paper

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

Preface

From July 31 through August 3, 2016, scholars and students from the field of Educational Technology around the globe gathered in Sanur, Bali, Indonesia, for the inaugural Educational Technology World Conference (ETWC). Participants from over 19 countries were honored with presentations by important government education officials and research scholars. The conference was co-hosted by many Indonesian universities (please see Acknowledgments) and by the Association for Educational Communications and Technology (AECT). As the presiding President of AECT at that time, I was honored to participate in the conference program that was filled with examples of using different technologies to enhance our teaching and to extend the reach of our teaching to learners who do not have physical access to schools and universities. Scholars and practitioners from around the world shared their research and work emphasizing the importance of effectively using and managing technologies to benefit the learner! Participants also shared challenges of their work which reminded us that regardless of our home country or region, we have much in common!

This volume represents the peer-reviewed manuscripts submitted after presentation sessions at 2016 ETWC. The first section contains the papers prepared by four keynote speakers/scholars. In the second section, the 20 authors offer manuscripts describing widely varied topic areas and approaches to their research which are representative of the scope of the conference.

At this conference, we began new collaborations, made new friends, and learned from each other. All conference participants and attendees were welcomed warmly and I will never forget the experience. I close this preface with the words I used to close the conference… *Negara Indonesia indah sekali* (Indonesia is a beautiful country) and *terima kasih* (thank you)!

Laramie, WY, USA Kay A. Persichitte

Acknowledgments

First, I wish to acknowledge the host and co-host institutions for the 2016 ETWC: Universitas Nigeri Jakarta, Universitas Terbuka, Universitas Undiksha, Universitas Pendidikan Ganesha, Universitas Mahendradatta, and Ristekdikti Kopertis 8.

I wish to acknowledge these special people who contributed significantly to the planning of the 2016 ETWC:

- Pak Atwi Suparman, Chair of the 2016 ETWC Organizing Committee
- Pak Djaali, Chair of the 2016 ETWC Steering Committee, Rector, Universitas Negeri Jakarta
- Ibu Tian Belawati, Rector, Universitas Terbuka
- Pak Jampel, Rector, Universitas Undiksha
- Pak Putri Anggraeni, Rector, Universitas Mahendradatta
- Pak Nyoman Jampel, Rector, Universitas Pendidikan Ganesha
- Pak Astawa, Coordinator, Ristekdikti Kopertis Wilayah 8

These reviewers of the manuscripts for this volume also deserve our thanks: Dr. Dennis Beck, Dr. Doris Bolliger, Dr. Tonia Dousay, Dr. Robert Doyle, Dr. Michael Grant, Dr. Dirk Ifenthaler, Dr. Florence Martin, Dr. Megan Murtaugh, Dr. Craig Shepherd, Dr. J. Michael Spector, Dr. Jill Stefaniak, and a *special thanks* for her extensive editorial review support to *Dr. J. Ana Donaldson*.

I also want to recognize the Chairman of our AECT affiliate, the Indonesian Professional Association of Educational Technology (IPTPI), Professor Wibawa, for the continued support and expansion of our field that this professional organization contributes.

Lastly, my acknowledgements would not be complete without a special "Thank You" to His Excellency, the Governor of Bali, for his graciousness and generosity in hosting us at his home for a fabulous cultural dinner and gala during the conference. This was an amazing experience and a wonderful evening with a powerful leader of the Bali people.

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About the Editors

Kay A. Persichitte is a Professor of Learning, Design, and Technology at the University of Wyoming (USA) and President of the Association for Educational Communications and Technology (AECT) during the 2016 ETWC. She holds a Ph.D. in Educational Technology, an M.Ed. in Curriculum and Instruction, and a B.A. in Mathematics and Secondary Education. Her career spans 19 years teaching high school mathematics and 24 years as faculty member and administrator in higher education.

J. Michael Spector is Professor and Former Chair of Learning Technologies at the University of North Texas. He was previously Professor of Educational Psychology and Instructional Technology at the University of Georgia. Prior to that, he was Associate Director of the Learning Systems Institute and Professor of Instructional Systems at Florida State University. He served as Chair of Instructional Design, Development and Evaluation at Syracuse University and was Director of the Educational Information Science and Technology Research Program at the University of Bergen. He earned a Ph.D. in Philosophy from the University of Texas at Austin. His research focuses on intelligent support for instructional design, assessing learning in complex domains, and technology integration in education. Dr. Spector served on the International Board of Standards for Training, Performance and Instruction (*ibstpi*) as Executive Vice President; he is a Past President of the Association for Educational and Communications Technology as well as a Past Chair of the Technology, Instruction, Cognition and Learning Special Interest Group of AERA; he is also an active member of AERA's Instructional Technology and Learning and Technology SIGs. He is editor of *Educational Technology Research and Development* and serves on numerous other editorial boards. He edited the third and fourth editions of the *Handbook of Research on Educational Communications and Technology*, as well as the *Encyclopedia of Educational Technology*, and has more than 150 publications to his credit.

Chapter 1
Instructional Design for Training Programs

Robert Maribe Branch

Abstract This paper examined the need for instructional design as the fundamental paradigm for training programs. The situation is that there has been a substantial increase in the number of training programs throughout the world. The contention here is that the increase in the number of training programs has created a need for designs that systematically generate effective instruction that is student centered. The premise is that instructional design is a complex process that requires more than writing objectives, publishing training manuals, and placing lesson plans online. Instructional design is an applied product development process, which exists to respond to needs that are identified in spaces dedicated to intentional learning. Further, a high-quality training program is achieved through the application of the several core principles of instructional design, such as being student centered, responsive, generative, complex, collaborative, and practical. Each of the core principles of instructional design will be presented in this session.

1 Introduction

This paper expresses the need for instructional design as a fundamental paradigm for developing training programs. There has been a substantial increase in the number of training programs throughout the world, and this same increase in the number of training programs has created a need for designs that systematically generate effective instruction that is student centered. The concept of instruction promoted in this paper moves away from designs that encumber didactic, limiting, passive, singular modes of teaching, and instead, move toward designs that facilitate active, multi-functional, inspirational, situated approaches to intentional learning. The presumption is that intentional learning involves multiple, concurrent interactions among people, places, and things, situated within a context, during a period of time (Fig. 1.1), and thus, complex. This course is about a systematic approach to

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K.A. Persichitte et al. (eds.), *Educational Technology to Improve Quality and Access on a Global Scale*, Educational Communications and Technology: Issues and Innovations, https://doi.org/10.1007/978-3-319-66227-5_1

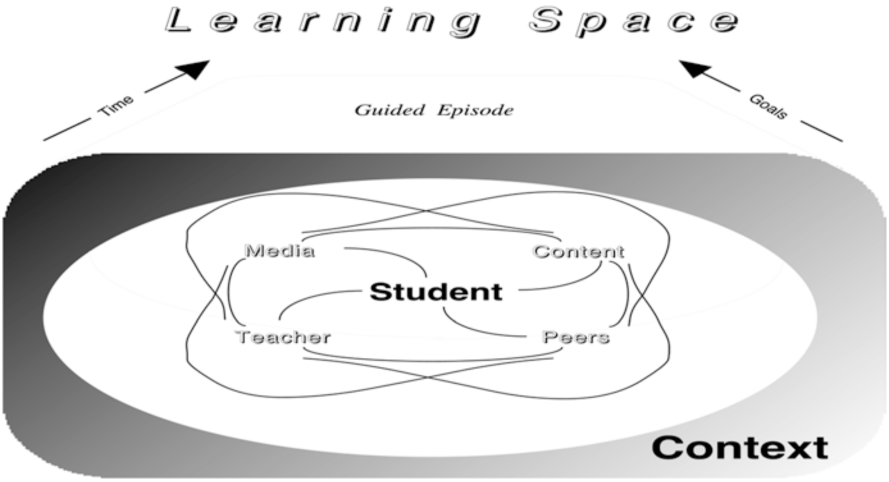

Fig. 1.1 Components of intentional learning

designing, developing, and evaluating instruction as one way to facilitate the complexity of intentional learning.

Learning space means a place where there is a mutually agreed upon set of expectations for the student and the teacher. Such a place can be complex because each of the entities as depicted in Fig. 1.1 are within themselves complex, and become active parts of every lesson, module, and unit of instruction. The complexity of each entity can be observed by the typical questions that need to be answered regarding each entity. The answers to the following questions are essential regarding the *student*:

1. What knowledge and skills does the student bring to the learning space?
2. What does the student already know about the content?
3. What does the student expect to accomplish upon completion of the lesson or unit?

The answers to the following questions are essential regarding the *content*:

4. What is the type of content to be learned?
5. What is the type of skill or knowledge to be constructed?
6. Is there a pedagogy commonly associated with the content knowledge?

The answers to the following questions are essential regarding the *peers*:

7. How many students compose a particular community of learners?
8. What are the knowledge assets available within a community of learners?
9. What are the skill assets available within a community of learners?

The answers to the following questions are essential regarding the *media*:

10. What tools are needed to teach the content?

11. What tools are needed to learn the content?
12. What tools are needed to apply the new skills and knowledge?

The answers to the following questions are essential regarding the *teacher*:

13. What is the role of the teacher?
14. What expertise, knowledge, and skills are possessed by the teacher?
15. When will the teacher also need to be a learner?

The answers to the following questions are essential regarding the *goals*:

16. What are the expectations of the student after he or she leaves the learning space?
17. What needs to be observed within learning spaces?
18. What is the correlation between the goals within the learning space and the goals within the performance space?

The answers to the following questions are essential regarding the *time*:

19. What is the effect of timing on the implementation of the learning being designed?
20. How much time should be permitted for *synchronous* learning events?
21. How much time should be permitted for *asynchronous* learning events?

The answers to the following questions are essential regarding the *context*:

22. What administrative resources are required to support the learning space being designed?
23. What physical infrastructure is required to support a particular learning space?
24. How long is the design expected to remain relevant?

The premise is that instructional design is a complex process that requires more than writing objectives, publishing training manuals, and placing lesson plans online. Instructional design is an applied product development process, which exists to respond to needs that are identified in spaces dedicated to intentional learning. Further, a high-quality training program is achieved through the application of the several core principles of instructional design, such as being student centered, responsive, generative, complex, collaborative, and practical. An example of a visual representation of an instructional design process is presented in Fig. 1.2. Each of the core principles of instructional design are presented below.

2 Principles of Instructional Design

The claim here is that instructional design is student centered, responsive, generative, complex, a collaborative process, a high-fidelity process, and practical. Instructional design is *student centered* because student performance is the focal point of all training activities. While teaching contributes to student performance,

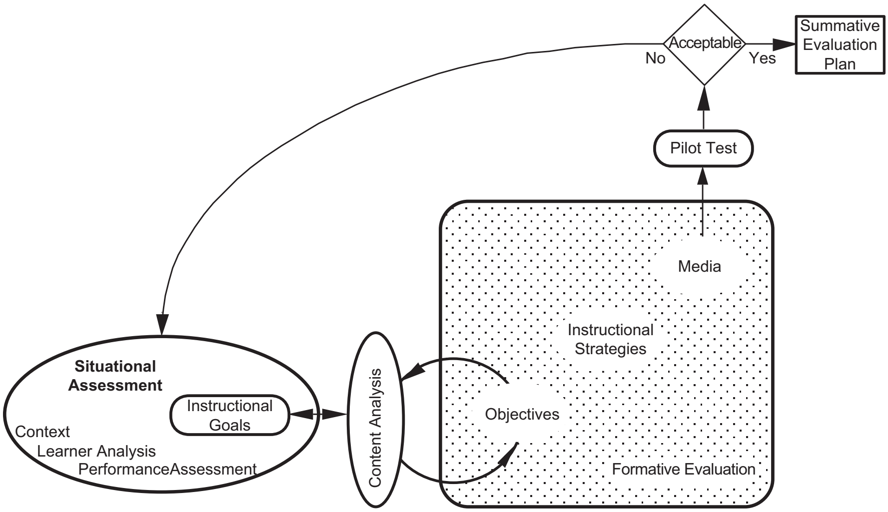

Fig. 1.2 Visual representation of an instructional design process

students are expected to actively participate in determining the placement of their own efforts. Instructional design is *responsive* through the use of goals. Goals are central to the instructional design process, and should reflect the expectations of the primary stakeholders, in this case, the student, the teacher, and the client (who may represent a variety of constituents). Instructional design is *generative*. Generative, within the purview of instructional design, means the focus is on students performing authentic tasks, learning cases will likely represent complicated situations, and the learning tasks evolve around genuine and authentic problems. Certainly, good instructional design avoids tasks that are trivial, contrived, and overly simplified. Instructional design is *complex*. Therefore, assessment tools associated with instructional design should be reliable and valid. Instructional design is a *high-fidelity* process. There should be a high congruence between training environment and the workplace. Instructional design is a *collaborative* process. A partnering relationship is often required due to the size, scope, and technology needed to complete effective training programs, which commonly leads to a need for diverse and specialized knowledge and skills. Instructional deign is *practical*. Professional instructional designers are most effective when they employ appropriate process models, project management strategies, and common sense.

Instructional design for training programs is based on a fundamental assumption that the purpose of training is to move a trainee from being dependent on the instructor to becoming independent of the instructor (Fig. 1.3). Such independence-building is predicated on training programs that effectively implement action learning strategies. Action learning is an instructional strategy used in training and education settings as a way to increase the congruence between the activities that occur in the classroom with the expectations outside the classroom at the workplace. The problem is that training programs are often de-contextualized and

Fig. 1.3 Becoming teacher independent

Action Learning		
Active Strategies	*Avoid* passive techniques	*Promote* mentally and physically stimulating activities
Interactive Strategies	*Avoid* individualism	*Promote* activities that require communication between 1. Student and Content 2. Peers 3. Students and Media
Situated Strategies	*Avoid* activities that are 1. Unreal 2. Unlikely	*Promote* activities that 1. Simulate reality 2. Stimulate metacognition
Authentic Strategies	*Avoid* low fidelity tasks	*Promote* tasks that 1. Result in genuine artifacts 2. Are immediately usable 3.Resemble reality
Cased-based Strategies	*Avoid* un-related tasks	*Promote* tasks that provide opportunities for students to 1. Sample 2. Practice 3. Act

Fig. 1.4 Action learning strategies

incongruent with workplace realities, whereas action learning strategies are active, interactive, situated, authentic, and case-based (Fig. 1.4). Thus, action learning is a successful approach to ***training*** effectiveness, and action learning is a successful approach to ***learning*** effectiveness.

Finally, I recommend that a conceptual framework guides your training development process. The conceptual framework posited in this paper which is appropriate for instructional design is a hierarchy of consciousness (Fig. 1.5). The point being

Construct	Definition	Attributes
Model	*Doing.* An explicit representation of a reality.	1. Scalable. 2. Varies the levels of generality. 3. Manifests a set of propositions. 4. Prescribes relationships. 5. The greater the fidelity between application and supporting theory, the higher the relative level of generality.
Paradigm	*Describing*. A conceptual pattern or example that verbally or visually describes recurring features of a reality.	1. Basis or referent for action. 2. Illustrates fundamental interrelationships. 3. Allows for variation in the way reality is modeled. 4. Facilitates replication of a fundamental concept.
Theory	*Interpreting*. A way to interpret a set of organized principles.	1. Ability to generate hypotheses; and make predictions. 2. Based on empirical evidence or opinion, thought, observation, and supposition.
Concept	*Scheming*. A phenomenon that is conceived in the mind, such as a thought, notion and idea.	1. Provides conceptual explanations formed by philosophical arguments. 2. Covert, idiosyncratic and socially constructed. 3. Explains observable phenomena.
Philosophy	*Rationalizing*. Arguments posited in the search for truth through logical reasoning within an individual [or community] rationalize.	1. Uses precise terminology, analytical statements and narrative to illustrate conditions of an argument. 2. Characterized as a. *Ethical*: System of values governing conduct and expressions of moral approval. b. *Epistemological* : System of belief and its relationship to the study of knowledge, and its extent. c. *Metaphysical* : System of relating to a reality beyond information that is perceptible to the senses.
Phenomenology	*Knowing*. Study of the development of human conscience, and self-awareness.	1. Based on human perceptions about the universe. 2. Expressed as units of life experiences. 3. Motivation for human action. 4. Based on perceived or perceivable events.

Fig. 1.5 Hierarchy of consciousness

made here is that it is important for professional instructional designers who develop training programs dedicated to improving human performance have answers to these questions:

1. What experiences influenced your perspectives?
2. What is your prevailing educational philosophy?
3. How do you conceive design?
4. Do you have a favorite learning theory [*theories*]?
5. What paradigm describes your reality?
6. Do you have a default instructional design model?

3 Summary and Recommendations

The premise expressed in this paper was the notion of instructional design as the fundamental paradigm for developing effective training programs. Further, a good training program requires more than writing objectives, publishing manuals, and placing lesson plans online. The contention here was that the increase in the number of training programs worldwide has created a need for designs that systematically generate effective instruction (both teaching and learning) that is student centered. Instructional design was described as an applied product development process, which exists to respond to needs that are identified in spaces dedicated to intentional learning. Further, a high-quality training program is achieved through the application of the several core principles of instructional design, such as being student centered, responsive, generative, complex, collaborative, and practical. Thus, instructional design for training programs should:

1. Generate designs that account for the complexity associated with intentional learning spaces.
2. Implement action learning strategies as an authentic case-based approach to training.
3. Focus on performances that move the student to becoming teacher independent.

Robert Maribe (Rob) Branch is a Professor of *Learning, Design, and Technology* at the University of Georgia, and the Head of the Department of Career and Information Studies. Rob earned a Bachelor of Science degree from Elizabeth City State University in North Carolina and a Master of Arts degree from Ball State University in Muncie, Indiana. Rob taught secondary school in Botswana as a Peace Corps Volunteer and later joined the University of Botswana as a Lecturer in the Technology Education Department. Rob completed his Doctor of Education (EdD) degree from Virginia Tech in 1989. Dr. Branch joined the faculty at Syracuse University where he taught graduate courses in educational technology, served as a co-Director of ERIC, and conducted research in instructional design. Dr. Branch worked as Fulbright Lecturer/Researcher at the University of KwaZulu-Natal in South Africa, where he co-founded the Master's degree in Educational Technology. Dr. Branch is co-editor of the *Educational Media and Technology Yearbook* and co-author of the book *Survey of Instructional Design Models*. He also authored the book *Instructional Design: The ADDIE Approach*. Dr. Branch's published research focuses on diagramming complex conceptual relationships. He is a Past President of the Association for Educational Communications and Technology.

Chapter 2
Learning 3.0: Rhizomatic Implications for Blended Learning

Johannes C. Cronje

Abstract In a Web 3.0 environment everybody is a producer of knowledge. This means that our learners are automatically also producers of knowledge. In the age of smart devices many of the skills we have been expecting learners to know, have become automated or obsolete. Google Translate means that it is no longer necessary to learn a foreign language before you travel. Google maps means you no longer need to read an atlas. So, as our devices are becoming smarter, we need to re-define what it means to learn. This paper will consider the use of Rhizome Theory to explore the multiple faces of learning in the twenty-first century, and propose an integrated framework for designing rhizomatic learning experiences.

1 Introduction

In a world where *Google* knows what you are asking even before you have finished typing the question becomes, "What is left to learn?"

This paper contains my reflections after a presentation on the topic at a plenary session of the Educational Technology World Conference, Bali from 31 July to 3 August, 2016. The presentation took the form of an interactive Bring Your Own Device (BYOD) activity and thus there was no written text. Now, 6 months later, I am sitting in Pretoria, South Africa reflecting on the thinking that led up to that conference and on how my thinking has been shaped since. I do many similar presentations and thus there may be significant overlaps with other of my work. I therefore request the reader to see this as a bricolage assembled from previous work, rather than as an original piece.

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K.A. Persichitte et al. (eds.), *Educational Technology to Improve Quality and Access on a Global Scale*, Educational Communications and Technology: Issues and Innovations, https://doi.org/10.1007/978-3-319-66227-5_2

There are many definitions of learning, (Malamed, 2016) but a rough synthesis of them all could be: *Learning is being able to do something afterwards that you could not do before*. The main problem with this definition is that, thanks to technology, there are numerous things we are now able to do, which we were not able to do before—such as navigate through traffic taking the optimal route in real time by using GPS, or recognize a piece of music never heard before using *Shazam*, or tell the distance to the flag on a golf course by pointing a cell phone at it. Even converting from one currency to another, taking into account the rate of exchange at any given date, can be done from an internet-enabled cell phone without any calculations. With every new app downloaded to a smartphone a learner can do something new, without having engaged in any mental effort. So from "what is left to learn?" we move to "what should we teach?"

In response to this question Tony Wagner, as early as 2008, made a proposal to help learners achieve seven "survival skills", viz. *Critical Thinking and Problem Solving, Collaboration and Leadership, Agility and Adaptability, Initiative and Entrepreneurialism, Effective Oral and Written Communication, Accessing and Analyzing Information, and Curiosity and Imagination* (Wagner, 2008). For Wagner then it is not the person with the best technology. It is the person with the best technology who knows how (and when) to use it that is most likely to be able to do all these things. Dave Cormier and Bonnie Stewart move closer when they argue that we live in a *rhizomatic* age (D. Cormier & Stewart, 2010).

In this paper, I argue that rhizomatic learning is not so much a matter of learners having to adjust to a hyper connected world, but rather it is that the locus of learning has shifted from the learner to the rhizome. Before the ubiquity of the Internet the knowledge bottleneck was at the duplicating room. Learners could only be expected to learn as much as teachers could duplicate. Now the bottleneck sits between the ears of the learners. Learners can only learn as much as they can take in. However, in the connected rhizomatic world, the whole system is learning and thus what we have to do is connect and ride along. There needs to be a shift in emphasis from evaluating the learner's *load* of knowledge, skills and attitudes to evaluating the learner's *connection* to the system in which they survive using Wagner's skills.

Learning in the twenty-first century has also been called *Learning 3.0* hinting at learning in a Web 3.0 environment (Rubens, Kaplan, & Okamoto, 2014). In a Web 1.0 environment information is presented by the provider to the user on a static web page. Web 2.0 is the social web where users provide information and interact with information of other users through social media such as blogs, and social sites such as *LinkedIn*, *Facebook,* and *Twitter*. Web 3.0 brings the inclusion of the *device* and the *system* as partners in the production of information. When a Web 3.0 user uses an Internet-enabled device to search information on *Google* for instance, then the user's current and previous behaviour, as well as the location of the device, is factored into the search and in that way the user, the device and *Google* have obtained more information. Thus, the more users use their devices, the more *Google* learns about them, and the more able they become to do things that they were not able to do before.

2 Rhizome Theory

Rhizome theory (Deleuze & Guattari, 1987) argues that knowledge is better represented by a web structure than by a tree structure. Where most of our information comes from the World Wide Web a web makes a strong metaphor for knowledge and learning. A tree structure implies a hierarchy with something at the top and some root structure the rhizome implies a non-hierarchical, flat structure that favours organic growth above one of causality and chronology. In fact, the rhizome *becomes* the curriculum (D. Cormier, 2011). The link between Learning 3.0 and the rhizome is clear. There are no hierarchies. The learner, the system and the device are equal partners. The movement is multi-directional and occurs at the time of need, rather than at a time specified by a curriculum.

2.1 Rhizomatic Implications for Learning 3.0

Six principles govern the rhizome: Connection, heterogeneity, multiplicity, asignifying rupture, cartography and decalcomania (Deleuze & Guattari, 1987). It stands to reason that the survival skills of twenty-first century learners need to be measured against the extent to which they accommodate, or even exploit the rhizome.

2.1.1 Connection

Connection implies that "… any point of a rhizome can be connected to any other, and must be" (Deleuze & Guattari, 1987, p. 7). For Twenty-first Century learning this means that learners, teachers, information and technological devices are all connected. Moreover, there are no discrete knowledge areas. All knowledge is connected to all other knowledge. The principle of connection resonates with the educational theory of connectivism, which argues that:

- Learning and knowledge rests in diversity of opinions.
- Learning is a process of connecting specialized nodes or information sources.
- Learning may reside in non-human appliances.
- Capacity to know more is more critical than what is currently known
- Nurturing and maintaining connections is needed to facilitate continual learning.
- Ability to see connections between fields, ideas, and concepts is a core skill.
- Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities.
- Decision-making itself is a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision (Siemens, 2005).

In a world where people's attention is constantly distracted by the multiple stimuli that confront them we need to teach them how to cope with the multi-sensory connected world.

2.1.2 Heterogeneity

Where the industrial age brought with it the idea of batch processing and a desire for homogeneity, the information age has given us the ability to deal with diversity. This section will consider diversity in demographics, interest and learner characteristics.

The Organisation for Economic Co-operation and Development (OECD) shows a major shift in student demographics since 1995. Student numbers in OECD countries have grown from 39% to 60%. The average age of students varies from lower than 19 (Belgium, Japan and Indonesia) years, to over 25 (Iceland, New Zealand and Sweden). There is a strong growth in women entering higher education and generally the percentage of students who study outside their own countries has doubled to 4%. Social sciences, Business and Law are the most popular fields and Science Technology Engineering and Mathematics are the least popular fields (OECD, 2013).

In recent years, much research has been done on learner characteristics, such as learning style (Kolb & Kolb, 2013), cognitive style (Kozhevnikov, Evans, & Kosslyn, 2014), multiple intelligences (Gardner, 2011), emotional intelligence (Goleman, Boyatzis, & McKee, 2013) learning preferences (Fleming, 1995; Vark Learn Limited, 2015) and brain profile (Herrmann, 1995). Nevertheless, there seems to be very little evidence supporting the hypothesis that matching a learner's style will lead to improved performance (Klein, 2003; Pashler, McDaniel, Rohrer, & Bjork, 2008). Very recently, it was shown that individual differences do not lead to differences in decision making (Galotti, Tandler, & Wiener, 2014). Nevertheless although accommodating individual differences may not significantly improve results, it may well add to learners' enjoyment or motivation to learn and in that way lead to attitudinal, rather than scholastic improvement (Dunn & Dunn, 1993; Schick, 1979).

Heterogeneity in education has a number of advantages. It gives access to more students, teaches tolerance and respect for the 'other', encourages cooperation and mutual help, allows for the development of richer personal resources and challenges teacher development (Class & Class, n.d.). It has been found that dealing with heterogeneous groups by ability grouping has a significant effect when high achievers are grouped together and given enriched learning, but no improvement has been shown for low-achieving groups (Good, 1997; Kulik & Kulik, 1982). Another way of dealing with such diversity has been to adjust for individual needs, which seems impractical. A solution lies in creating a context in which a class is seen as a group of individuals who make their own meaning (Millrood, 2002). Such a context is created by keeping students motivated through variation and interest, reaching individuals by collaboration, individualisation and personalisation, and providing for different levels by open-ended assignments and providing a variety of compulsory and optional work (Class & Class, n.d.).

The implications for teaching and learning for heterogeneity, is a move towards teaching for diversity. One needs to ask questions such as:

- Is the material adequate for the age of the learner?
- Has the instructional design accounted for language barriers?
- Have learners been asked to add personal value to the content based on their particular style or preference?
- Has the learning event encouraged learners to value the significance of the 'other'?
- Is collaboration encouraged?

2.1.3 Multiplicity

In terms of Rhizome theory multiplicity holds that the multiple is the unit (Deleuze & Guattari, 1987). In other words, everything has a multiple. Bergson (2001) identifies two types of multiplicity: continuous and discrete multiplicities. Table 2.1 shows a comparison between the two types.

The types of multiplicity can be identified across various multiples. This paper will consider three multiples: Multiple lives, multiple devices and multiple truths.

In a world of ubiquitous connectedness and with the flat, rather than hierarchical structure of the rhizome the number of roles played by teachers and learners have both increased and blurred. Teachers have become learners—learning not only about the subject, but also about the learners. Galloway and Lesaux (2014) identify five roles of a twenty-first century teacher: Leader, teacher, diagnostician, colleague and change agent. It is therefore necessary to recognise the tensions that arise as teachers re-adjust to their changed position (Taylor, Klein, & Abrams, 2014). Learners, on the other hand, have as much access to Internet-based information as the teachers have, and thus have become teachers or themselves, their peers and their teachers. As their portfolios become digital rather than paper-based, so they become focused more on an online portfolio as an identity, rather than an archive; at the same time they become more future-focused, recognising the value of the portfolio as a way of getting a job (Bennett, Rowley, & Dunbar-Hall, 2014).

Table 2.1 Continuous and discrete multiplicities (Adapted from Bergson)

Continuous multiplicities	Discrete multiplicities
Differences in kind	Differences in degree
Divides only by changing in kind	Divides without changing in kind
Non-numerical—qualitative	Numerical—quantitative
Virtual differences	Actual differences
Continuous	Discontinuous
Succession	Simultaneity
Fusion	Juxtaposition
Duration	Space

Multiplicity in devices is both continuous and discrete. There are numerous devices that can perform the same functions, and one device can perform numerous functions. Thus, for instance one can use a smartphone, a tablet, an e-reader, a computer or a printer to read a document. Then again one can use a smartphone to make and receive voice calls, read emails, send text messages, communicate on social networks, perform calculations, listen to voice and music and watch videos. The divergence and simultaneous convergence of technology has enabled the multiple to be the one, and the one to be the multiple. Multiplicity brings with it complication as well as simplicity. Life is simplified since at any given time one can perform any given function with whatever device is handy. Life is complicated since one has to navigate the complexity of various devices and platforms with which a task can be done.

The rhizomatic nature of knowledge has meant that there are numerous ways to arrive at information. Nevertheless there are also multiple truths, and it is may be difficult to distinguish between options. On the other hand, two different truths may hold for the same situation under different circumstances, as is shown by the two explanations of the shape of the Fish River in Namibia in Fig. 2.1.

The mythological explanation for the shape of the river is placed first—that it was shaped by a snake trying to escape from San hunters. The scientific explanation, that it flows on a low-gradient plane without direction is second. Although this is a humorous dichotomy, there are some that are more serious—particularly those that are subject to scientific debate while having life-changing implications for the rest of us: Is the Banting diet good or bad? Is there a relationship between high-cholesterol foods and heart disease?

The implication of multiplicity is that the teacher needs to understand that there are many interpretations to learning materials, and many applications of what is to be learnt. The purpose of facilitating learning is to address as many as possible of the multiple identities of the learner. What should be addressed is the learner's ability to manipulate various devices across various platforms to reach specific objectives or achieve particular outcomes. The learner should be taught to balance

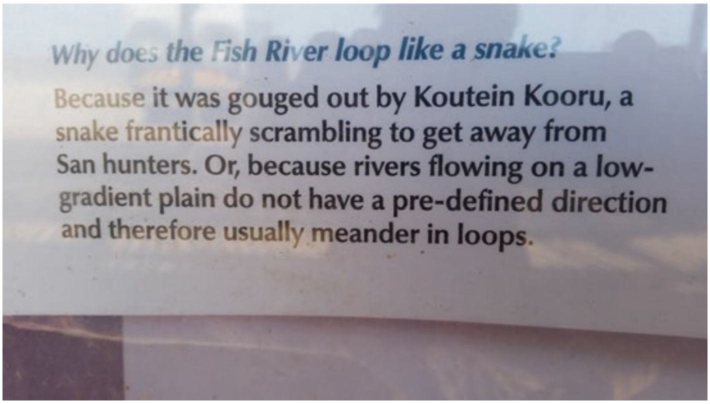

Fig. 2.1 Why does the Fish River loop like a snake?

efficiency and effectiveness by selecting the optimal too for a given task. Moreover, the learner should be taught to cope with the information overload which results from the redundancy inherent in multiplicity.

The learner should be taught to distinguish the truth in a given context, and the teacher needs to realize that the result of an assessment of such learning is but one truth out of many others that exist simultaneously.

2.1.4 Asignifying Rupture

Whenever a piece of the rhizome breaks off it begins to grow afresh. Every piece of knowledge has the potential of growing into a new set of insights. The principle of transfer is not new in education, but in a rhizomatic environment it is central. "The transfer of learning is universally accepted as the ultimate aim of teaching" (McKeough, Lupart, & Marini, 2013, p. vii). Transfer, however, is always difficult to measure (S. Cormier & Hagman, 2014). Aspects to consider in the discussion of transfer include the direction and the extent of transfer, as well as the nature of transfer, be it motor, cognitive or metacognitive (S. Cormier & Hagman, 2014). Gagné (1985) distinguishes between vertical transfer, where the subsequent skill depends directly on the acquired one, and lateral transfer, when the learner realises that a skill acquired in one field, can be used in another—such as fractions in a classroom translating to dividing slices of pie. Motor transfer relates to physical skills—whether weight lifting might lead to increased performance on the sports field, while cognitive transfer relates to knowledge and metacognitive transfer concerns attitudes.

The main problem in teaching for transfer is that the skills being taught may need to be developed outside of the environment in which they will be used. It is not possible to measure transfer in the classroom—it needs to be assessed in the workplace. Here is where portfolios, peer tutoring and workplace learning become important.

2.1.5 Cartography

The concept of cartography holds that the rhizome represents a map rather than a tracing. This means that each learner has an individual map and that one learner cannot trace another's map. Recently, the mapping of understanding as a form of learning has become very popular. It makes sense to use a map that shows connections when one deals with a connected environment. Davies (2011) distinguishes between mind maps, concept maps and argument maps, pointing out that each type may have a different application. Nevertheless for the sake of this paper the concept of getting a learner to draw a map linking various pieces of information is good enough.

Learners should be encouraged to generate their *own* maps, rather than simply to trace those that the teacher had drawn. Traditionally, a teacher would set learners a task of taking a piece of material and converting it into a map. Invariably such a map ends up with having the headings and sub-headings of the chapter as branching structures. The result is then a tree of knowledge, rather than a web of knowledge.

Instead, learners should be encouraged to have three foci in the map. They put themselves in the middle, the learning material to one side and the environment, both physical and intellectual on the other side. The map then shows the relationship between the learner, the material being learnt, other connected material and the environment in which the learner is. In this way no two maps can be the same, since no two learners are the same.

2.1.6 Decalcomania

Decalcomania refers to the production of endless series of repeating patterns that are usually fractal by nature. All learning, grammar, history, poetry, mathematics involves recognising the underlying patterns and how they repeat themselves, as well as the exceptions.

Learners need to be taught how to recognise patterns—and also distinguish between similar and dissimilar patterns. They also need to understand how those patterns develop over time, and what governs their formation. The patterns that learners need to recognise are not just subject-related. There are the cultural patterns in the community, and the patterns of behaviour expected from them in their place of learning. A good example of such pattern recognition beyond the textbook would be the school pupil who starts of looking exactly the same as all the others, but soon realises what it takes to become a part of the leadership group in the school. When that learner moves to another school or moves up to university it does not take long before he or she again fits into the leader group. It is a matter of recognising the pattern and emulating it.

3 Conclusion

Designing rhizomatic learning may be possible along a matrix where the principles of the rhizome are plotted against the desired outcomes and the resultant cells get populated with a substantiation of the learner's performance in a particular field. In this way the design is not hierarchical, but rather a flat plane describing the points where the best connections for a particular learner occur.

In this way Tony Wagner's (2008, 2012) survival skills could form the outcomes for which a rhizomatic learning event is designed. Table 2.2 shows how such a matrix could be assembled. Say, for instance, an instructor designs an assignment. The instructor can then consider the extent to which the principles of the rhizome can be matched with the survival skills. In the hypothetical situation contained in Table 2.2 the designer may have found that the principle heterogeneity should contribute to critical thinking and problem solving, since the learner will have to take a variety of different perspectives into account. The principle of connection will be useful in developing leadership, since the learner will have to deal with a group of associates in doing the assignment. The principle of multiplicity means that the learner has to be agile and adaptive. Since the learner has to produce an individual

Table 2.2 Proposed assessment matrix

	Connection	Multiplicity	Heterogeneity	Asignifying rupture	Cartography	Decalcomania
1. Critical Thinking and Problem Solving		x	x			
2. Collaboration and Leadership	x			x		
3. Agility and Adaptability		x				
4. Initiative and Entrepreneurialism					x	
5. Effective Oral and Written Communication	x					x
6. Accessing and Analyzing Information		x		x	x	
7. Curiosity and Imagination		x		x		x

assignment that was unlike any other, the work is a map, and not a tracing—following the principle of cartography. The learner has to develop patterns of communication and write the assignment according to a specific format. The endless transformation of assignments into the same format relates to the principle of decalcomania. Asignifying rupture means that the information has to be accessed and analysed for its usefulness and transfer, as does obtaining the information through curiosity and imagination.

The table could be refined ever further if each cell were to be filled in with a narrative explaining how those aims will be achieved. Moreover, those cells where there are no overlaps could contain narrative explaining why such overlaps do not occur. Finally, of course, the various intersections could be linked up, and in that way could produce an actual rhizomatic sketch of the learning event.

4 Recommendations

The integrative matrix suggested in this paper is but one possible application of Rhizome theory to the design of learning in a Web 3.0 environment. Of course, it could well be possible to put any other set of outcomes on the vertical axis and determine the extent to which they have to be realized rhizomatically. Furthermore, the patterns that form when multiple learners work together and form their own maps could lead to even more complex descriptions. Traditional design is mainly nomothetic. The design first concentrates on the whole population, and then aims to plot the individual learner somewhere inside the bell curve during the assessment. Such an assessment, however, does very little in explaining the extent to which an individual learner has been able to cope with a particular context—and tells us nothing about how a learner's performance might change if the context changes. In essence what this article calls for is an ideographic design that accommodates of the rhizomatic nature of learners' personal learning situations, rather than a nomothetic rating of their performance in a standardized test. In this way then the design will shift from the *accumulation* of the learner's knowledge, to the *connection* of the various knowledges in the system.

Acknowledgements If you wish to acknowledge persons who contributed or sponsoring agencies, do so here in this optional section.

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Chapter 3
Technology, Society, and the Future

Stephen W. Harmon

Abstract Science and technology are advancing in the world today at a rapid pace that is difficult to appreciate. Humans have not traditionally been very good at using new technologies in new ways. In order to take advantage of new and emerging technologies in education, we must embrace theoretical underpinnings that position us to keep up with the pace of change and allow us to further the development of humanity.

1 Introduction: Exponential Growth

In order to consider the future of technology in society and education, I think it is useful to begin back in the past. Let us go back to the days when the game of chess was invented. Legend has it that the Emperor in the kingdom where the game was invented was so delighted that he wanted to reward the inventor and offered him anything his heart could desire. Now the inventor of the game was very clever and said to the Emperor "Your Majesty all I want is a simple grain of rice, doubled each day for every square of the chess board." The Emperor said "No no, that's not enough. You must have something more than only grains of rice." But the inventor insisted and the Emperor agreed. The problem was the Emperor did not understand exponential growth and the inventor of the chessboard did.

The first day the inventor was given one grain of rice; on the second day that doubled and he was given two. On the third day that doubled again and he was given four. On the fourth day eight, on the fifth day 16, on the sixth day 32, and so forth. Exponential growth is a concept that is easy to understand theoretically but hard to appreciate realistically. If you continue doubling the grains of rice, for the first half of the chessboard, 32 of the 64 squares, you get about two billion grains of rice. In the second half of the chessboard though, things really begin to take off. By the seventh week the Emperor has to deliver about six trillion grains of rice. Now a trillion is another hard number to understand. If you took US $6 trillion in $100 bills and

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K.A. Persichitte et al. (eds.), *Educational Technology to Improve Quality and Access on a Global Scale*, Educational Communications and Technology: Issues and Innovations, https://doi.org/10.1007/978-3-319-66227-5_3

stacked them all up, you end up with a stack about as big as a 12 story building covering an entire city block.

By the time the inventor is given all the rice grains due to him, in other words on the 64th day, it works out to about 508,342,815,082 tons of rice (The Old Wolf, 2012). That's another incomprehensible number. If you took all those grains of rice and you laid them end to end, how far would they stretch? Would they stretch from Indonesia to Australia? From Jakarta to New York? From the Earth to the Moon? The actual answer is amazing. The grains of rice laid end to end would stretch from here to Alpha Centauri, the closest star, and then back again (Sanders, n.d.).

I tell this story to illustrate the human intuitive perspective of technological advancement. As humans, even though we theoretically understand exponential growth, practically we don't appreciate it. If you think about the advancement of technology along an exponential growth pattern, in 5 years the new technology, growing exponentially, will be 32 times more advanced than it is now. In 10 years, that same technology on the same growth pattern will be 1000 times more advanced than it is now, and the first 5 years will look like a flat line from the perspective of the most recent 5 years. In 20 years the technology will be one million times more advanced, and the first 10 years will look like nothing really happened. In 50 years that same technology will be a quadrillion times more advanced. A quadrillion is another incomprehensible number. But if you graph it, if it looks like for the first 40 years nothing happened, and then the technology finally took off (The Emerging Future, n.d.).

This idea of exponential growth matters to us, because we are living in a time of exponential growth. This growth is occurring across many areas of human endeavor, but in particular it is occurring with our digital infrastructure. We see exponential growth in computer processing, and communication bandwidth, in storage, and in the development of content (Brown, 2001). Computer processing doubles about every 18 months. This is known as Moore's Law (Moore, 1965). Communication bandwidth, sometimes called Fiber Law (Ross, 2009), doubles every 9 months. The amount of storage, sometimes referred to as Kryder's Law, doubles every 12 months (Walter, 2005). And the amount of content, sometimes called Community Law or Metcalfe's Law, doubles at a rate of two to the *N* where *N* equals the number of people contributing content (Metcalfe, 1995). Given the number of people active on the Internet, that is a truly staggering number. And remember, these four areas are growing exponentially. Even though the pace of change may seem rapid to us today, 10 years from now it will look like there was no growth at all in the last 5 years. Let's look at these areas a little more closely.

In processing, if you look at the calculations per second available for US$1000, about the cost of a new desktop computer, you can project that by the year 2017 a desktop computer should have about the same processing power as a mouse brain. That seems to be accurate. By about the year 2020, a desktop computer should have about the same processing power as one human brain. And by the year 2040 that same $1000 desktop computer should have the same processing power as all human brains (Kurzweil, 2001). This is the power of exponential growth and we seem to be on track to achieve this. In 2016 the world's fastest super supercomputer, the Sunway TaihuLight, could calculate at a rate of about 93 PetaFlops (Barrett, 2016), which is well past the capacity of one human brain. Some people think that Moore's Law is not sustainable and will end in the next few years. However, advances in chip making technology and in new computing paradigms, such as neuromorphic chips, quantum computing, and photonic computing seem to offer pathways to extend Moore's Law indefinitely.

In order to understand, by which I mean both grasp at a theoretical level and appreciate at the scale of daily life the growth in the amount of information, it is necessary to again look at some very large numbers and try to get a feel for what they mean. We are all familiar with the concept of a megabyte (MB) which is equal to about the contents of four books. We are also familiar with the concept of a gigabyte (GB), which is 1000 MB, and equals about 4400 books. Many of us have already moved on to the next large common number in computing, a terabyte (TB). 1000 GB equals 1 TB. More and more frequently hard drives come in terabyte sizes. Let's scale up a little more. 1000 TB equals 1 petabyte (PB). 1000 PB equals 1 exabyte (EB). And 1000 EB equals one zettabyte (ZB). How much is that? If 1 GB had the same volume as one cup of coffee, then 1 zettabyte would have the same volume as the entire Great Wall of China.

Why does that matter for us? Well, from the dawn of time to the year 2003 humanity produced a total of about 5 EB of information. Now we produce 5 EB every 2 days. In the year 2013 we produced about 4 ZB of information. By the year 2024 will be producing one ZB every 2 days (Khoso, 2016). That is a truly staggering amount of information. We come into contact with more information now in the course of 1 year than our grandparents (if you are my age) may have come into contact with in their entire lifetimes. It seems likely that the increasing barrage of information is having an effect on us and certainly having an effect on society.

2 Technological Advances

Let's look at some other areas where there has been rapid and perhaps exponential growth. One of these is neuroscience. In the last 5 or 6 years there's been truly enormous progress made in neuroscience. Some of it seems almost like science fiction. Researchers have learned to create memories without the subject ever perceiving the content of those memories (Berger et al., 2011; Shibata, Watanabe, Sasaki, & Karats, 2011). In other words, the subjects are able to learn something without ever having been taught it, or even having encountered it through their senses. Researchers do this through something called optogenetics, which involves using light pulses to directly stimulate neurons. In essence, this is the first step toward being able to implant knowledge directly in a person's brain. Researchers have also been able to record signals that travel through the hippocampus, an organ in the brain directly involved in memory (Ramirez et al., 2013). It seems that memories are stored all over the brain and at present it is too complex to re-create a memory from the many storage places. However when we recall a memory the brain assembles all of those many pieces, and routes that information through the hippocampus. By recording the signals passing through the hippocampus researchers have been able to, in effect, capture memories. They can then play those same signals back in a different person's hippocampus and impart that memory to a new subject. Imagine what this could mean for teaching and learning.

Many researchers are working on direct brain to brain communication. In the year 2013, researchers at the University of Washington successfully had one person control another person's hand movements just by thinking about them (Rao et al., 2014). And in 2014, researchers had conscious brain to brain communication halfway across the world over the Internet (Grau, Ginhoux, Riera, Nguyen, & Chauvat, 2014). One researcher thought the word "hello" and another researcher halfway across the world received that word in his brain. By the way, some of this research is moving so rapidly that you can now order kits that allow you to control another person's hand movements on the Internet. At this writing they retailed for about US$250.

Another area that is growing rapidly is that of augmented intelligence, increasing our intelligence through technology. Since the 1980s, researchers have been aware of something called transactive memory (Wegner, Erber, & Raymond, 1991). This is a phenomenon in which humans store memories in other humans. You probably do it yourself. A couple that has been together for a long time probably has certain areas in which one member of the couple is more responsible for keeping track of a certain kind of information. For example, I rarely can recall when someone's birthday is or when someone is having an anniversary. I don't need to recall those things, because my wife recalls them easily. On the other hand my wife rarely knows how to get anywhere; she counts on me for that. I carry a pretty good map in my brain we can use to easily get around our city. As a species, we are used to this type of memory storage outside of ourselves. What has been happening in the last several years though is that we are replacing humans for this sort of storage with our technology. My wife doesn't need me to get around anymore because she has Google maps. On the other hand, I have Google calendar so I don't need her to remind me when it is someone's birthday. I will come back to this notion a bit later, but first let me discuss another area of rapid growth, artificial intelligence (AI).

In 1997, world chess champion Garry Kasparov became the first grandmaster human chess player to lose to a computer. That computer was IBM's Deep Blue. It later led to another system called Watson, which went on to defeat world champion players on the US game show "Jeopardy." Today Watson is used for a myriad of activities. There is a version of Watson that is a chef. It analyzes ingredients and cooking techniques and comes up with new recipes. There is a version of Watson that analyzes medical records and comes up with diagnoses of illnesses. It is being used to predict crime in London, and to provide banking advice for customers. More recently, and closer to my home, a researcher at the Georgia Institute of Technology used Watson as a basis for creating an artificially intelligent teaching assistant in a class.

Ashok Goel, a professor at Georgia Tech was teaching an online class about artificial intelligence. He had ten teaching assistants helping him in the class. Nine of them were human, but one was an artificial intelligence he called Jill Watson. The students in the class did not know that one of their teaching assistants was an AI. Not only did the students never realize that Jill Watson was an AI, at the end of the class two of the students nominated Jill for a teaching award because she was so responsive. But AI has gone even further than that. In late 2016 an AI developed by Google called AlphaGo defeated a human Grand Master player at the game of Go for the first time. Go is much more complicated for AIs to play than chess. After the first two moves in a chess game there are about 400 possible next moves. After the first two moves in a Go game there are closer to 130,000 next moves. In fact, there are more possible moves in the game of Go than there are atoms in the universe. Deep Blue played chess using sheer computational power. It calculated all of the possible moves and selected the best one. Because there are so many moves in the game of Go that technique would not work. Human players play Go largely using intuition. Did AlphaGo use intuition to win? We don't know, because AlphaGo taught itself to play. Rapidly developing techniques and machine learning are leading to unprecedented advances in artificial intelligence.

So where are all of these exponential advances in technology heading? It is hard to know, but perhaps we can make some inferences based on our recent experience. Advanced technology has a subtle way of integrating more and more closely with our daily lives. In the last 10 years we've seen such varied things as cameras, spreadsheets, money, radios, telephones, stethoscopes, recording studios, airline tickets, and a host of others all be replaced, or rather become integrated into, a small device we carry in our pockets—the smartphone. And smartphones have become ubiquitous. There are around 2.6 billion smartphone users worldwide today (https://deviceatlas.com/blog/16-mobile-market-statistics-you-should-know-2016). It is estimated that about 90% of people in the world have access to cell phone networks (https://www.technologyreview.com/s/427787/are-smart-phones-spreading-faster-than-any-technology-in-human-history/).

As the smart technologies spread and become more integrated into our daily lives, it seems likely that this integration will become even more personalized. We may be headed toward a time when we truly begin to physically merge with our technologies. In 2015 researchers at Harvard and in Beijing invented a new neural lace designed to be implanted directly into our brains to allow us to have brain/machine interfaces. (http://www.ibtimes.co.uk/neural-lace-has-been-invented-organically-connect-your-brain-computer-1506481). In 2017, Elon Musk launched a new company called Neuralink, which aims to create and presumably commercialize direct brain to computer interfaces.

How do we as humans respond to this remarkable pace of change? Chances are, not very well. Humans have historically been bad at using new technologies in new ways. It seems to be our natural tendency to use new technologies in old ways. For example, when the automobile first became popular we still tended to treat it as if it were some kind of horse-drawn conveyance. In fact, one of the nicknames of the automobile was the horseless carriage. It wasn't until we began to see the differences between automobiles and horses that we were able to truly take advantage of the unique affordances offered by this type of transportation. Another example lies in the "Iron Bridge" over the River Severn in England. This was the first bridge built using a new technology of the time, wrought iron. Unfortunately, the builders did not really understand the capabilities of wrought iron and so they built with it as if it were wood. They used the same sorts of jointing and supporting techniques that you might use in a wooden bridge. The end result was that when the bridge was finished it was so heavy that it immediately began to collapse under its own weight. The designers were forced to realize that wrought iron was a new technology and had to be treated in a new way.

We've seen the same thing happening again and again with educational technology. Far too often, technology is thrown into a classroom with the expectation that it will change everything, even when using it to do exactly the same things students and teachers did without it. This has resulted in many years, at least in the United States, of students not using technology "in" school so much as they use technology "for" school. Technology has become an important part of our daily lives and many students spend the day without technology in school, only to come home and be immersed in technology and therefore use it to complete their school work. Reigeluth (1994) illustrated major paradigm shifts in society in several different sectors. As society advanced from the agrarian to the industrial, to the information, and now to the knowledge age, sectors of society advanced with it. Transportation went from the horse to the train, to planes and cars, and now to diverse methods that often involve telecommuting, moving electrons instead of atoms. Families went from extended to nuclear, to single-parent, to global villages. Businesses went from family-run businesses to bureaucracies, to teams, to distributed networks. But education has not progressed at the same pace. It went from the one room schoolhouse in the agrarian age to our current system and the industrial age and has remained largely unchanged through the information and knowledge ages. In higher education, while we do see pockets of change, the predominant instructional mode is still the lecture, and that is a poor pedagogy that has been around for hundreds of years.

This lack of change is especially problematic given the pace of change in the rest of society. Former Secretary of Education in the United States, Richard Riley, put it well when he said "we are currently preparing students for jobs that don't yet exist, using technologies that haven't yet been invented, in order to solve problems we don't even know are problems yet." We have refined our basic classroom techniques to a very high level, but it seems unlikely that we will be able to get much better at what we do in the classroom without taking advantage of the affordances of technology (Demillo, 2016). So given this, what are some possibilities for the future of learning?

3 The Future of Learning

To begin, the future of learning is inextricably tied to the future of teaching. Our old models of teacher centered instruction depended on knowledge and experience being filtered through the teacher and then transmitted to a class of learners. Today though, student centered models of instruction seem to offer more promise. Teachers and students work directly with the knowledge and experience bases, both drawing from and contributing to them. They are able to take advantage of essentially all the information in the world in every single classroom. No longer is the teacher the sole source of epistemological authority in a classroom. But in order to truly take advantage of this change in the fundamental model of instruction, we need to systemically change all aspects of our educational institutions.

The future of learning will be more social. Vygotsky (1978) found that learning occurs in social contexts through dynamic interactions with teachers, peers, and content. This social interaction can only occur in a limited extent in a given traditional classroom. However, through the affordances of modern communications technologies we can now vastly expand the ability for learners to socially interact in educational settings. Consider for example the crowd-sourced encyclopedia, Wikipedia. Many teachers don't trust Wikipedia as an information source and forbid their students from using it. Wikipedia is probably just as accurate if not more so than many traditional published encyclopedias, but using it as an information source may be the least beneficial way to use it for teaching and learning. Instead of having students draw information from Wikipedia, consider having students contribute information to Wikipedia. There is a vast community of Wikipedia editors who rigorously control what appears on the site. In order for a student to contribute something to Wikipedia that student has to construct the entry, and then socially negotiate the meaning and expression of it with dozens, if not hundreds of other people who are also using the resource. In constructing this knowledge the student gains a better understanding not only of the content, but also of how that content relates to the rest of the knowledge universe.

Another example of the growing social aspect of learning is found in constructionism. Constructionism is a term coined by Seymour Papert and Harel (1991) to describe the process of learning as "building knowledge structures" in social contexts. Today, you can see this happen quite literally in multiplayer online games such as Minecraft. Minecraft is a game in which students use raw materials, which they mine in a virtual environment, to construct, well anything they can conceive of. It could be models of existing buildings and cities. It could be complicated circuits and even working computers within computers. Students can use the game to design and build virtually anything found in the real world, and do so while interacting with other students from around the world. By building in this public context students take great pride in what they do and get immediate feedback from their peers, motivating them and guiding them to better solutions.

The future of learning will be more contextual. Brown, Collins, and Duguid (1989) in their seminal paper showed that knowledge should be acquired in the same context in which it will be used. They noted that children learn language at a prodigious rate, which drastically slows once they get to school. One possible reason for this slowing is that school creates an artificial context. The knowledge they get there doesn't necessarily relate to what happens in their real lives. It risks becoming inert if they are not able to apply it. One way to counter this artificial context is to have students learn in settings in which they will actually apply the knowledge they are acquiring. For example, students might learn basic mathematics in the context of a grocery store, calculating the costs of items that they want to purchase. It is not scalable however to take students out of the classroom and into real settings to learn all of their content. Fortunately, technology allows us to create virtual contexts in which students can acquire knowledge in authentic settings. For example, in the United States a generation of firefighters is about to retire. When the leaders of these firefighters, the captains, became captains they had fought around 300 serious fires. The people that are replacing them today have fought far fewer fires, maybe as few as 10. There are just fewer fires to fight today. This may be because buildings are safer these days and often contain more fire retardant materials and sprinkler systems. Yet the critical need for the ability to fight serious fires remains. Using virtual environments we can provide the upcoming fire captains with simulated experiences that prepare them to be just as, or even more effective than the firefighters of the previous generation.

The future of learning will involve more informal learning. Just as with the game Minecraft, students are also learning from other video games. For example in the popular games World of Warcraft and OverWatch, students learn to work in teams and to devise complex strategies to solve seemingly intractable problems. In these games, students are frequently paired with a group of strangers who may have vastly different motivations. They must learn to quickly work as a team and to identify and assign multiple roles within that team. Ironically, this is a skill that leaders in business and industry often complain is missing from our public school curriculum. In a similar vein, a game called Factorio requires learners to master the tenants of advanced systems engineering in order to manufacture increasingly complex components. While trying to defeat aliens and escape from the planet, students are actually learning many of the primary tenets of manufacturing leadership.

The future of learning may not necessarily belong to our current educational institutions. Consider the popular video hosting service YouTube. Over 60 hours of video are uploaded to YouTube every minute. Over 5 months every hour. Over 10 years every day. And YouTube has over four billion page views every day (https://fortunelords.com/youtube-statistics/). It is probably the most commonly used resource for just-in-time learning that has ever existed. One can find on it everything from how to forge iron, to how to stitch up a wound, to how to solve differential equations. Where only a few years ago learners would have to go to school and spend weeks learning often extraneous content to get to that single gem they needed, now all of this is available at the touch of a button on their smartphones. YouTube and the rise of organizations such as the Khan Academy or Wikihow illustrate a growing number of educational service providers that are outside our traditional structure.

The future of learning will be more data-driven. Educational and learning analytics are enabling us to get a better and better understanding of just where learners are and where they need to go. For example, Georgia State University has been using educational analytics to improve graduation rates (https://www.eab.com/technology/student-success-collaborative/members/videos/the-challenge-at-georgia-state-university). They analyzed 10 years of student data and identified 800 factors that seem to have some influence on graduation rates. Now, every night they run the data for their students in a program that analyzes these factors and identifies those students who are at some risk for not graduating on time. Using this process, in only a few years they've been able to improve their graduation rate by nearly 20%.

This improvement comes among those students who traditionally have had the worst graduation rates and the least amount of success. On a more micro level, we are gathering more and more data about what happens within a given course. Just as advertisers collect data about every website you visit on the Internet and use that data to target goods and services to sell you, we can now collect data on everything a student does in an online course or learning management system. We are beginning to understand how to analyze these massive data sets to make real-time predictions about learner success, and eventually give prescriptions to improve their success.

In the more distant future anything is possible. Advances in understanding how the brain works are leading to rapid advances in new learning technologies. A technique called transcranial direct current stimulation involves running an electrical current across specific places in the frontal lobe while students are trying to master content. Doing so enables the student to master the content in a remarkably short time, to a very high degree of proficiency. The United States Army is using this technique to train some of its soldiers, and we are finding that more and more learners are trying to do it on their own (Fields, 2011). Where do they go to learn how to do this? You can find many videos explaining it on YouTube. We should note however that this could be very dangerous if you don't know what you're doing.

Whatever the future of learning, we know it must focus on a different set of cognitive skills. Students graduating from high school today may have not just five different jobs in their lifetime, but five different careers, each comprising multiple jobs. The rapid pace of knowledge advancement almost ensures that whatever training and education students get during their formal schooling will not be sufficient to last the rest of their lives. Students must become expert learners. But this expertise is slightly different than that which would have sufficed a generation ago. Students must master adaptive expertise rather than routine expertise (Hatano & Osuro, 2003). Adaptive expertise is the ability to unlearn what you already knew and to master metacognitive techniques that will allow you to succeed in complex and ill structured environments. Whereas a routine expert is very good at doing one thing over and over, an adaptive expert is very good in assessing new situations and creating techniques and strategies that allow her to succeed in these situations (Schwartz, Bransford, & Sears, 2005). For example, a line cook is a routine expert. He can make the same limited number of meals with the same limited number of ingredients very reliably over and over with a high degree of efficiency. But if you put him in a new unfamiliar kitchen, with new unfamiliar tools and ingredients, he may be at a loss to cook anything. A chef, on the other hand, is an example of an adaptive expert. Given a new set of ingredients and a new set of tools, the chef understands the fundamental principles that allow him to combine these new ingredients and tools to create new meals that meet a high standard of proficiency and deliciousness.

As we look at the type of jobs that are being created, and are being replaced, by technology, we see that adaptive expertise is becoming more and more important. At a rough level you could create a matrix of types of jobs, dividing them into routine and non-routine tasks on one axis, and manual and cognitive tasks on the other. Routine manual tasks might be something like production on an assembly line. A non-routine manual task might be something like driving a delivery truck.

A routine cognitive task might be something like bookkeeping. A non-routine cognitive task might be something like pharmacology. Routine manual tasks have been replaced with technology decades ago. Robotic assembly lines are now the norm for most types of production. Routine cognitive tasks have also been replaced with technology. Automated spreadsheets drastically reduced the need for bookkeepers. Today though, even non-routine tasks are rapidly being replaced by technology. The transportation industry seems like it is about to be drastically transformed by autonomous vehicles. The pharmacology industry has already been transformed by robotic systems that flawlessly create and manage pharmaceuticals. It is likely that more and more industries will become more and more automated, leading workers to continuously need to find new areas for employment (Dvorkin, 2016).

Does this mean we are in for a bleak future? One where there will be no jobs for people? Perhaps some of that will occur. However, if we are smart in the way we take advantage of the affordances of technology we will be able to adapt. After Gary Kasparov lost the chess match to Deep Blue he decided to create a new kind of chess, called advanced chess or battle chess by some. The rules for this chess are exactly the same as for traditional chess only players can play in teams, and they can use whatever technology they want to in order to compete. In 2011, at the world advanced chess championships, the final match came down to two teams, one comprising three chess grandmasters using a laptop computer, and the other comprising three average chess players using the same laptop computer running the same software as the grandmasters. Who do you think won? It turns out it was the average players. How could they possibly have beaten the grandmasters? It wasn't that they were better chess players than the grandmasters, but it certainly helped them that they were all software engineers. You see the average players were able to take advantage of the affordances of the technology better than the grandmasters. They were able to create a synergy with the technology that allowed them to accomplish something that the routine experts were not able to accomplish. It is in this intersection of human and technology that the true hope for the future of technology in society and education lies. We must be able to adapt and we must be ready to embrace new technologies and new ways. Hoffer (1973, p. 22) reminds us that "in a time of drastic change it is the learners who inherit the future. The learned usually find themselves equipped to live in a world that no longer exists."

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Chapter 4
Smart Learning Environments: Potential and Pitfalls

J. Michael Spector

Abstract The history of educational technology in the last 50 years contains few instances of dramatic improvements in learning based on the adoption of a particular technology. An example involving a smart learning technology occurred in the 1990s with the development of intelligent tutoring systems (ITSs). The success of ITSs was limited to constrained and straightforward learning tasks (e.g., learning how to write a LISP function; doing multi-column addition), and improvements that were observed tended to be more limited than promised (e.g., one standard deviation improvement at best rather than the promised standard deviation improvement). Still, there was some progress in terms of how to conceptualize personalized instruction. A seldom documented limitation was the notion of only viewing learning from the perspective of content and cognition (i.e., in terms of memory limitations, prior knowledge, bug libraries, learning hierarchies, and hierarchical sequences). Little attention was paid to education conceived more broadly than simply developing specific cognitive skills with highly constrained problems. Recent technologies offer the potential to create dynamic, multi-dimensional models of individual learners, and to track large data sets of learning activities, resources, interventions, and outcomes over a great many learners. Using those data to personalize learning for a particular learner as they develop knowledge, competence, and understanding in a specific domain of inquiry is now a real possibility. While the potential to make significant progress is clearly possible, the reality is less promising. There are many as yet unmet challenges and pitfalls some of which are mentioned in this paper. A persistent worry is that educational technologists and computer scientists will again promise too much, too soon, at too little cost, and with too little effort and attention to the realities in schools and universities.

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K.A. Persichitte et al. (eds.), *Educational Technology to Improve Quality and Access on a Global Scale*, Educational Communications and Technology: Issues and Innovations, https://doi.org/10.1007/978-3-319-66227-5_4

1 Introduction[1]

Advances in computer science have historically made their way into educational technology, usually with at least a one-generation delay (see Spector & Anderson, 2000; Spector & Ren, 2015). As *artificial intelligence knowledge and expertise* have advanced in the last 20+ years, there have emerged powerful new technologies and some are finding their way into education as history suggests would happen. However, these new artificial intelligence (AI) technologies should not be embraced simply because they are new or have had some success in non-educational contexts. Dijkstra (1972) suggested in his famous essay entitled, *The Humble Programmer* that computers had not solved a single significant problem on a sustained basis; rather, computers have introduced a new problem—namely, learning to use them effectively. This seems to be the situation in which the world of educational technology now exists with regard to artificial intelligence and various AI devices and technologies.

The main message in this article is twofold: (a) there are indeed many possibilities for smart technologies to improve learning and instruction; however, (b) these possibilities have yet to be realized on a large scale and sustained beyond the efforts of demonstration projects. The challenges to making effective use of AI in education are many and varied, and we should be realistic with regard to recognizing and addressing these challenges.

First comes a context for these remarks. Then there is an elaboration of that context with key definitions. Afterward there is a discussion of some promising demonstration projects, and then there is a discussion of the challenges referenced earlier. Following that discussion, there are closing remarks with a few recommendations for how to proceed in a responsible and productive way with regard to making effective use of smart technologies in learning and instruction. The subsequent discussion is based on a broad view of technology integration in education from an evaluation perspective (see Spector & Yuen, 2016).

In 1978, the President of the American Educational Research Association collected and discussed a number of cases of effective educational research (Suppes, 1978, 1979). Suppes (1978, 1979) noted that educational research had only had a minimal impact on educational practice and policy. This is still the case some 40 years later, and it seems particularly true with regard to information and communications technology, including artificial intelligence and other smart technologies. The goal of educational technology and smart technologies in education research should be to do what is possible to ensure that smart technologies have a significant, sustained, and systemic positive impact on learning and instruction.

[1] A similar presentation and paper was also delivered at the annual Smart Learning Conference in Beijing, China in March 2017.

2 Definitions and Terminology

In order to create a clear and coherent context for these remarks, we begin with a few simple definitions (see Gagné, 1985; Laney, 2001; Merrill, 2013; Spector, in press, Spector & Yuen, 2016).

- *Learning*—learning can be characterized by stable and persistent changes in what a person or group of people know, believe, and/or can do.
- *Instruction*—instruction is that which is designed and/or intended to support, enhance, or improve learning.
- *Education*—education consists of systematic efforts to develop (a) basic knowledge and skills, (b) simple problem-solving skills, (c) productive workers, (d) critical thinkers, (e) responsible citizens, and/or (f) life-long learners.
- *Technology*—technology consists of the systematic and disciplined application of knowledge for a purpose recognized and valued by others.
- *Artificial*—artificial refers to that which is created or caused by one or more humans rather than something that occurs naturally without human intervention. An example of a natural occurrence is a volcanic eruption or the orbiting of planets around the sun in the solar system. There is a fuzzy boundary between that which is natural and that which is caused or created by humans. For example, the increase in earthquakes in Oklahoma might be caused by human activity—namely, fracking by the oil industry as opposed to other naturally occurring earthquakes caused by the movement of earth's tectonic plates (see https://www.bloomberg.com/news/articles/2016-11-08/why-oklahoma-can-t-turn-off-its-earthquakes). A clear example of an artificial device could be one of B. F. Skinner's teaching machines (see https://en.wikipedia.org/wiki/Teaching_machine).
- *Intelligence*—intelligence is even more difficult to define than that which is artificial. Common synonyms for "intelligence" include, among others (a) understanding, (b) comprehension, (c) critical reasoning, (d) smartness. Each of those terms is somewhat fuzzy as well. For example, "smartness" may refer to *street smarts*, which refers to an ability to deal effectively with everyday situations one is likely to encounter, whereas other uses of "smart" include things like being clever, or the ability to solve complex problems. In addition to multiple uses of the adjective "intelligent," there are multiple dimensions discussed about intelligence, including (a) cognitive, (b) emotional, (c) visual, (d) social, (e) kinesthetic, and more (Gardner, 1995).
- *Artificial intelligence*—AI is a branch of computer science, and also of cognitive science, that generally includes the notion of using computers to simulate human intelligence or to perform activities normally performed by a trained and educated person. For example, a house-cleaning person may have previously used a vacuum cleaner or even a broom to clean a floor; now there are robotic vacuum cleaners that can do that task reasonably well without human intervention.
- *Smart learning technology*—a technology that supports learning and instruction in a manner similar to that of a smart person and that is effective, engaging,

efficient, and empowering that typically is also adaptive, context aware, responsive to individual learner interests and progress, flexible, and likely to improve with use; examples include intelligent tutoring systems, as well as systems that track eye movement, emotions, and other learner characteristics that can be used to improve the quality of learning and instruction.

There are now a number of technologies in commercial and popular use that might be called intelligent, including (a) robotic vacuum cleaners, (b) self-parking automobiles, (c) advertising agents that can be found on many commercial sites, and (d) fraud detection algorithms now used by many banks and credit card companies. However, there are also many technologies which are called smart or intelligent that actually do not make use of computer algorithms to make decisions similar to those a smart person makes. Among these technologies that are not genuinely smart in the sense defined earlier are (a) smartphones, (b) smartboards, (c) smart watches, (d) intelligent tablet computers (e.g., iPads), (e) iText used to create and manipulate portable document format (PDF) files (see https://sourceforge.net/projects/itext/), and (f) refridgermagtons that scan your refrigerator and send a message indicating things in short supply. There is a fuzzy boundary with some of these cases. With regard to tablet devices and computers, there is now speech recognition software that allows for and supports a conversational interface, and speech processing is definitely a smart technology.

The devices that are genuinely smart technologies have yet to have an impact on learning and instruction, with the exception of natural language processing. The case for emphasizing natural language processing will become clear in the next section.

3 Trends and Demonstration Projects

Prior to discussing smart technology trends and some demonstration projects, there is a need to provide additional context in terms of lessons learned from educational research in the last 50+ years, as these are worth remembering when evaluating smart technology applications in education. There are at least three major lessons learned about that which predicts learning outcomes (Spector & Ren, 2015):

- Prior knowledge and experience—that is to say that students who have done well in the past are likely to do well in the future and that students with prior understanding in a particular domain are likely to progress more quickly than a novice in that domain; this lesson from the past has implications for using smart technologies to personalize learning and instruction, especially with regard to structuring activities appropriate for specific learners.
- Time-on-task—that is to say that students who spend more time on a particular learning activity or task are likely to do better than those who spend less time of those activities and tasks; this lesson also has implications for using smart tech-

nologies to support learning and instruction, especially with regard to motivation and engagement.
- Formative feedback—that is to say that learners who receive timely and informative feedback during learning activities are likely to develop knowledge and expertise more quickly than those who do not; this lesson has implications for using smart technologies to support dynamic feedback during and immediately after a learning experience and is one of the growth areas for smart technology in education in addition to the important area of conversational interfaces.

There also some lessons that have yet to be learned from past experiences with educational technology. One important unlearned lesson from the past is that replacement strategies rarely take into account the full potential of a new technology. For example, using an interactive smartboard the same way that a whiteboard had been used in a classroom fails to take full advantage of new affordances, such as engaging learners with the technology. Another common shortcoming of the past is believing that a single technology or pedagogical approach will solve most or all learning challenges. For example, some advocates of computer-supported collaborative learning argued that all learning activities should be collaborative, which has never proven to be completely effective (see, for example, Spector & Anderson, 2000). A third example is failing to appreciate the Clark-Kozma media debated of the 1990s (Clark, 1994; Kozma, 1994). In that debate, Richard Clark (1994) argued that what accounted for learning outcomes was primarily the quality of the instructional design, while Robert Kozma (1994) argued that new technologies made possible learning activities that were not possible without that technology or that use of media (e.g., interactive simulations). The resulting resolution of that debate was that new technologies did make new learning experiences possible, but what still mattered most was the design of the learning activities and the use of the technologies.

3.1 Trends in Smart Technologies in Education

One source for monitoring educational technology trends is the New Media Consortium's Horizon Reports (see www.nmc.org). The *2017 Horizon Report: Higher Education Edition* (see http://cdn.nmc.org/media/2017-nmc-horizon-report-he-EN.pdf) is summarized below with discussion of the implications for smart technology in education.

3.1.1 Key Trends

- Short-term (1–2 years): (a) blended learning designs, and (b) collaborative learning.
- Mid-term: (3–5 years): (a) growing focus on measuring learning, and (b) redesigning learning.

- Long-term (5+ years): (a) advancing cultures of innovation, and (b) deeper learning approaches. [The educational community uses "deep learning" to refer to an emphasis on critical thinking and complex problem solving whereas the computing community uses that term to refer to machine recognition of patterns hidden in disparate and large data sets.]

Where smart technology can play a key role in these trends is in measuring learning (especially with regard to dynamic, real-time formative feedback) and in fostering deep learning with regard to critical thinking and complex problem solving.

3.1.2 Significant Challenges

- Solvable: (a) improving digital literacy, and (b) integrating formal and informal learning.
- Difficult: (a) resolving the achievement gap, and (b) advancing digital equity.
- Wicked: (a) managing knowledge obsolescence, and (b) rethinking the role of educators.

With regard to responding to these challenges, the role of smart technology is somewhat less clear.

3.1.3 Important Developments

- One year or less: (a) adaptive learning technologies, and (b) mobile learning.
- Two to three years: (a) the Internet of Things, and (b) next generation of learning management systems (LMSs).
- Four to five years: (a) artificial intelligence, and (b) natural user interfaces.

It should be clear that according to NMC (2017) the major role of smart technologies in education has yet to be realized, and that it will involve natural language processing and conversational interfaces. We noted a few areas where smart technology might have an impact somewhat earlier, but the general point is that the future of smart technology in education has yet to be realized. Here are two statements that might serve as useful reminders: (a) it is not about smart technology in support of learning; what matters in the learning; and (b) it is not about a particular smart technology; what matters is how that technology is deployed and used by teachers, instructors, tutors, and trainers.

These two reminders reflect the interconnectedness of pedagogy, content, and technology (Mishra & Koehler, 2006; Shulman, 1986). Accepting these reminders suggests that how smart technologies are effectively integrated into learning and instruction is much more challenging than their use in non-education sectors. Recall the case of using smart technology to improve online sales. Why that works is due to the company having a profile of a current customer along with records of many other customers. Then, when this customer looks at, or purchases, a particular item, the online system can see what other similar customers who looked at and purchased that item went on to view and purchase. Such an advertising system can then suggest additional purchases to this customer. The challenge for us, however, is the learning context is much more complex. First, it is a challenge to identify other similarly situated learners. Then it is a challenge to see what worked for those learners and use those data to customize a learning experience for this learner. As the *Horizon Report* (NMC, 2017) suggests, there is a long way to go before AI, learning analytics, personalized learning, and more generally, smart technology will have a significant, sustained, and positive impact on a large scale in learning and instruction.

3.2 Demonstration Projects

As previously mentioned, the first major phase of applying smart technology in education involved intelligent tutoring systems (ITSs; see Shute & Psotka, 1994). A typical ITS had a static model of the content to be learned, a static model of common misconceptions and misunderstanding, a dynamic model of what a learner had already learned with regard to the content knowledge, and a system to generate a next learning activity appropriate to that learner's progress. ITSs represented a significant advance from earlier efforts in the domain of programmed instruction including the teaching machines of B. F. Skinner. Content domains with recorded impact on learning included multi-column arithmetic for young children and LISP programming for college students.

4 Key Challenges

When the effort to effectively integrate learning analytics, big data, personalized learning, and smart technologies into education begins, as is quite likely, then the suggestion here is to take evaluation seriously (for a detailed elaboration, see Spector & Yuen, 2016). A few simple ideas to help one get started are presented here. While these ideas may seem simple and obvious, they have been overlooked for many years with regard to prior generations of educational technology innovations.

ITSs became prominent again in recent years with the development of cognitive tutors (Koedinger & Aleven, 2007). Cognitive tutors addressed more complex problem tasks than had been addressed by the previous generation of ITSs and they placed emphasis on dynamic formative feedback to learners. Cognitive tutors also began to represent more than a learner's progress in that domain including things such as interests and other knowledge.

A third case of progress with regard to smart technology applications in education involves advances in student modeling (Graf & Kinshuk, 2013). In this case, learning styles are explicitly recognized as relevant in addition to what the learner has already mastered. This area is using AI to address learners in a more holistic manner that takes into account more than previous performance in the ITSs (see also Spector & Anderson, 2000).

Other demonstration cases of successful smart technology applications in education can certainly be found. Our point is that none of these cases has yet to be embraced on a large scale, nor is there documented evidence of improving learning in significant ways beyond the research studies conducted in a variety of contexts. The potential for improved learning and transformed instruction surely exists, but the impact has yet to be fully realized.

5 Recommendations for Smart Technology in Education

Recalling NMC (2017) middle term key trends, there is the issue of growing emphasis on measuring learning. Given the additional emphasis in many countries on critical thinking and complex problem-solving skills, the issue of using smart technologies to provide dynamic formative feedback should be given high priority. An early example of the potential can be found in the Highly Integrated Model-based Assessment Technology and Tools (HIMATT) system (Pirnay-Dummer, Ifenthaler, & Spector, 2010).

Going forward, it is worth taking into account the lessons learned from prior educational research and those not learned. Adaptive and personalized learning should be well aligned with the lessons learned. This can be done by taking into account all that can be known about a particular learner to promote ongoing learning in a particular subject domain. Highly interactive and engaging learning activities and environments can be used to gain and maintain learning interest and promote motivation when learning to solve a complex problem becomes challenging. The third lesson learned from past research involves timely and informative feedback which we have already mentioned.

With regard to lessons not yet learned, careful and thoughtful attention should be paid to the training and ongoing support of teachers in the effective use and integration of new technologies. In addition, when introducing a smart technology into learning and instruction, it would be advisable not to claim that the technology will solve all problems. Rather, it would be advisable to engage teachers in identifying the problems to be addressed by the technology, how it might be used in the current or anticipated educational setting, and how its effectiveness can be determined. Finally, the strategy to be used when introducing a new technology should be to focus on the specific affordances of that technology and not simply try to replace a prior technology or methodology with a new one.

6 Concluding Remarks

What is evident from the discussion above is that powerful technologies continue to emerge that have a significant impact on learning and instruction. What is not clear is to what extent the technology can solve persistent problems in education. Intelligent tutoring systems have had limited success. The Internet has yet to revolutionize teaching and learning as promised and predicted. Significant barriers remain, including (a) ongoing support and professional development of teachers, (b) improving digital literacy of teachers, (c) clarifying the roles of technology in education, and (d) effective ways of integrating technology into learning.

Educational technologists have all too often become advocates of the newest technology and overestimated how that technology would impact and reform educational practice. However, what is important for learners is to become inquirers (i.e., have and explore questions), which involves admitting to being in a state of uncertainty or not knowing and to becoming engaged in a search for knowledge rather than learn facts and concepts. Perhaps we ought to place more confidence in properly trained, persistent, and dedicated teachers, designers, and administrators in order to meet the challenges and changes when introducing AI in education.

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Chapter 5
Designing for Creativity in Interdisciplinary Learning Experiences

Tonia A. Dousay

Abstract In theory, a quality education involves multiple facets, including but not limited to content knowledge and twenty-first century skill development such as creativity. Applications for creative projects in classrooms take many forms, from solar system dioramas in elementary science to poetry writing in secondary language arts. However, the emphasis on creativity and its development typically falls to art teachers and art education programs. The emergence of makerspaces and other approaches to project-based learning and problem-based learning, learning environments serve as examples of practical applications for creative, interdisciplinary learning experiences. Exploring ways in which educators design, develop, and implement creativity-based learning experiences and promote innovative design reveals recommended practices and suggestions for both classroom assessment and research to evaluate adoption and outcomes.

1 Creativity and 21st Century Skills

General interest in and perceptions of creativity in formal education settings are increasing (Henriksen, Mishra, & Mehta, 2015). The reasons behind this renewed interest in creativity vary. However, global companies, such as Google and Apple, champion the need for fostering creativity skills by upholding examples of how creative individuals possess the power to innovatively solve problems and propose solutions (Henriksen et al., 2015). The result is a comingling of *innovation* and *creativity* as desirable components in a quality education. Regardless of framework or exclusive definition to define 21st century skills (see Partnership for 21st Century Skills, 2011) for one of the most commonly referenced inventories, creativity consistently ranks among those recognized as essential. From Steve Jobs, co-founder of Apple Inc. to Nikola Tesla, famed inventor of alternating current (AC) electricity supply system, individuals who possess the ability to think and work creatively,

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K.A. Persichitte et al. (eds.), *Educational Technology to Improve Quality and Access on a Global Scale*, Educational Communications and Technology: Issues and Innovations, https://doi.org/10.1007/978-3-319-66227-5_5

Table 5.1 Scenario of two students attempting to solve a math problem, adapted from Kaufman et al. (2016)

Student	A	B
Process	• Memorized the process • Replicated the steps • Provides correct answer • Cannot explain why	• Experience running a lemonade stand • Unconventional approach • Provides correct answer • Can explain how she reached it

brainstorm, use failure as a motivator, and act on ideas to create something new and useful are seen as role models. Kaufman, Beghetto, and Dilley (2016) eloquently described the underlying motive to creativity education, also depicted in Table 5.1:

> Consider two students who are asked to solve a math problem. One student simply memorized and reproduced the procedure demonstrated by the teacher to solve this type of problem. The student can produce correct answers, but doesn't really understand why. Another student had a new and personally meaningful insight about how to solve such problems based on her prior experiences running a lemonade stand. She too can produce correct answers. Her approach is a bit unconventional, but she has a clear understanding of why her method works. Although both students receive the same grade on their assignment, student two likely has a deeper understanding of this type of problem. (pp. 141–142)

The scenario itself describes how two students may approach problem solving, but consider for a moment the role of the teacher in these scenarios. How might the teacher adapt to work with both students? Bolden, Harries, and Newton (2010) noted a global call for teachers to better foster creativity in students in their work examining preservice teacher conceptions of creativity. Similarly, Eckhoff (2011) found that preservice teachers value creativity but are uncertain about how to define creativity education or how to implement it in the classroom. Generally speaking, the preparation for teachers to incorporate creativity education through either preservice teacher education or inservice teacher professional development varies widely from individual assignments within a course or workshop to entire sequences of courses (Bolden et al., 2010; Eckhoff, 2011; Lee & Kemple, 2014).

Without commonly accepted approaches to creativity education, educators will continue to struggle with striking a balance between content knowledge and essential skills when designing instructional strategies. Further, this struggle will continue to overshadow efforts like those demonstrated by Student B, rewarding achievement over proficiency.

Unfortunately, educators and administrators often view creativity as an important skill while simultaneously ignoring ways to foster and incorporate creativity into learning (Aljughaiman & Mowrer-Reynolds, 2005; Beghetto & Plucker, 2006). For example, creativity's role in the classroom has been overshadowed most recently by an emphasis on assessing math and science skills (Halverson, Lowenhaupt, & Kalaitzidis, 2015). The pressure on teachers to implement standardized curricula and/or prepare students for standardized assessments that do not address or foster creativity creates a short-sided dilemma. Yet, this dilemma sits in direct contrast to more than 60 years of research promoting the key role between creativity and learner success (Kaufman et al., 2016). Missing or overlooked from the conversation is the idea of designing and implementing interdisciplinary learning experiences that take advantage of current and emerging technologies to accomplish educational goals. Teachers can make strides toward solving this dilemma by situating creativity within the context of activities that draw from across disciplines and paying equal attention to both content and skills.

1.1 Solving the Dilemma

Approaches to fostering and assessing creativity in twenty-first century learning vary according to context. Developing creativity most often remains irrevocably intertwined with the arts (Deschryver & Yadav, 2015). Yet, continuing to relegate creativity to the arts and music curriculum represents the very heart of the issue, concurrent concern, and neglect. We cannot claim to view creativity as an important skill, on par with media or digital literacy, if we do not empower teachers in all subjects and grades to develop the skill. This lack of prioritization also represents a threat to future development of 21st century skills. Indeed, Kaufman et al. (2016) argued that interest in creativity will wane if we do not develop approaches that foster creativity. How then do we overcome the conflict, solve the dilemma, and give creativity a legitimate place in education?

The answers to these questions lie in drawing upon existing research and recommended practice related to interdisciplinary learning and assessment strategies. Creativity cannot be developed in isolation from other perspectives (Deschryver & Yadav, 2015). In the art classroom, learning strategies and activities incorporate both content skills and creativity skills blended together as teachers help learners grasp and practice both areas. Consider an introductory lesson on color theory where the instructor might use finger paints or even a mobile app that simulates real paint to help learners identify primary colors and begin blending the paints together to create secondary colors. The next step in the lesson might ask learners to paint an animal or scene. It is this latter action that incorporates creativity into the activity, requiring learners to imagine what he or she wants to draw and elaborating on that imaginary thought as the drawing takes shape on paper. To conclude the activity, the teacher might ask students to explain why particular colors were used, the animal or scene depicted, or a story that accompanies the picture. This scenario illustrates the recommendation that creativity should be taught and fostered within content-situated contexts (Mishra & Deep-Play Research Group, 2012). For successful development, both creativity and content deserve equal consideration (Rotherham & Willingham, 2009). Thus, any recommendations for teachers and administrators who truly want to give creativity an equal position in the classroom must work toward integrative strategies. However, the dilemma does not end with instructional integration. Assessment and evaluation methods must also evolve to encompass creativity. The key challenge lies in effectively evaluating creativity within the context of classroom assessment (Henriksen et al., 2015). In the previously mentioned scenario, teachers will most likely grade learners based on how well they applied color theory to the drawing and not apply any formal assessment criterion to the creative output from the learner. Teachers all too often placate children who exhibit creativity in the classroom offering simple praise rather than critical evaluation (Sefton-Green & Sinker, 2000). Rather than assess the creative artifact, it might be displayed in the classroom or taken home to share with family members. The learner's grade in class reflects how well he or she achieved the stated content goals for the instruction. Through their work to better integrate creativity skill development in learning Mishra, Henriksen, and the Deep-Play Research Group (2013) recognized the value in the creative process and recommended that teachers focus on better measurement of the end product. Until we update assessment measurement to more effectively evaluate creative skill development in conjunction with content knowledge, the dilemma will remain unsolved.

The following sections represent a review of the literature to establish guidelines and practices related to developing, assessing, and evaluating creative learning experiences in K12 settings. The rise in project-based (PjBL) and problem-based learning (PbBL), growing popularity of makerspaces, and emphasis on interdisciplinary efforts all afford opportunities to infuse creativity equally in consideration with content. Additionally, continuing research on creativity provides insight into better methods of assessment along with opportunities into scholarly exploration related to both creativity skill development and assessment. Resulting recommendations serve to inform and support practitioners and researchers in the fields of curriculum and instruction, instructional design, and instructional technology as organizations seek guidance and direction with respect to emerging and evolving trends.

2 Creative Learning Experiences

When considering how to approach the design of creative learning experiences, teachers should create a culture of creative thinking from the very first meeting, setting aside traditional activities for those that encourage self-guided exploration and design (Deschryver & Yadav, 2015). The question then becomes how to design and encourage self-guided exploration and structure learning activities to support creative thinking and content knowledge. One strategy involves drawing upon cognitive-creative skills that bisect disciplinary boundaries and provide the necessary context for divergent thinking (Mishra & Deep-Play Research Group, 2012). Cognitive-creative skills include emotional connections, visual representations, and critical thinking patterns (Root-Bernstein & Root-Bernstein, 1999) that assist the learner as he or she engages in the creative process, transforming content, and instruction into a creative product. In addition to engaging in the creative process, technology should be embedded seamlessly in the design with teachers helping learners determine when and when not to use particular technological tools (Halverson et al., 2015). For example, in the STEAM activity described below, the teacher worked with students to determine what technological tools should be used for information gathering purposes and depending upon the specific activity, other digital tools for creating media, such as a video to showcase the results of an activity. The popularity of digital devices contributes to the shift of consuming media to producing media (Deschryver & Yadav, 2015). Thus, activities might also capitalize on digital and media literacy skill development.

Makerspaces and PbBL, as discussed in detail below, represent a specific type of approach to incorporating creativity education in coordination with content that are different from general interdisciplinary approaches. For the purpose of this discussion, makerspaces and PbBL possess inherently interdisciplinary features through the nature of identifying problems and solutions, following the guidelines of a project, and/or engaging in a making activity that requires self-driven investigations. Moreover, not all interdisciplinary approaches occur in or possess the same qualities as makerspaces or PbBL activities. The possibility of an interdisciplinary approach taking a project format serves as the reasoning to differentiate between the two types of PBL strategies, and the two subtopics, makerspace/PbBL and interdisciplinary/PjBL, are addressed separately.

2.1 Makerspaces and Problem-Based Learning

Makerspaces have been defined as facilities that provide the necessary materials and equipment for users to "conceive, create, collaborate, and learn through making" (U.S. Department of Education [USDOE], 2016, *About the challenge*). While not a necessarily new concept, the experienced educator likely recognizes aspects of traditional career and technical education (CTE) programs, the spirit of the *maker movement* embraces open, social, and collaborative learning environments. What makes makerspaces a trending topic is the intersection of constructivism, constructionism, collaborative learning, and PbBL in conjunction with entrepreneurial and innovator interest (Lahart, 2009). The PbBL connection arises in relationship to the inherent situation in an authentic context that challenges learners to solve problems within a specific context (Friesen, 2013). Given the increasing interest of both makerspaces and PbBL, it then follows that teachers and administrators might struggle with how to adopt or adapt the idea in their own schools and classrooms. The emphasis on learning in a makerspace and role of the traditional teacher shifts from that of a traditional learning environment. Rather than instruct or take the lead in learning, adults work jointly with learners to collectively explore and create as the learners guide inquiry and the teacher provides intervention as necessary for skill acquisition (Chávez & Soep, 2005). By extension, the role of the student shifts to be more self-sufficient with reliance on intrinsic motivation to seek out and address gaps in personal knowledge and skill through personal inquiry. While possessing the potential to foster creativity skill development, activities conducted in a makerspace or as part of a PbBL activity are not inherently creative in and of themselves. Table 5.2 below summarizes the characteristics of PjBL and PbBL to help visualize how their concepts are similar and different.

Table 5.2 Project-based learning (PjBL) and problem-based learning (PbBL) characteristics, adapted from Buck Institute for Education (2015) and Larmer (2015)

Characteristic	PjBL	PbBL
Driving question, problem, or challenge	●	●
Sustained inquiry	●	●
Student independence	●	●
Feedback and revision	●	●
Authentic presentation	●	●
Requires 21st century skills	●	●
Interdisciplinary	●	◐
Emphasizes end product	●	
Emphasizes process		●
Prescribed steps		●
Typical classroom duration	Longer	Shorter

For a practical view, consider the following scenario. Students in an elementary science classroom are tasked with solving the problem of how to provide water to a new hydroponic garden in the school. A quick internet search might reveal hydroponic kits for purchase. Simply buying and implementing the kit does not engage the learners in creativity skill development. Alternatively, the students might discover an open-source lesson that instructs them on 3D-printed files to download and print along with a list of supplementary materials to purchase and assembly instructions. This option does require students to engage in some creativity skill development as they elaborate on the materials to customize the solution for their school. A more intensive approach would require the students to design the system from scratch using 3D modeling software and other materials, providing opportunities for students to develop both content knowledge and creativity skills. In the case of this latter example, students would be challenged to brainstorm, draft, develop, test, and redesign within a specific context, thereby practicing creativity skills and processes. Another potential makerspace/PbBL activity for the classroom includes posing a cultural and environmental problem to solve. The Kenya Weaving Project (Homestead Weaving Studio, 2013) highlights the far-reaching implications of PbBL and creativity. James Nampushi, a Maasai tribal member from southwestern Kenya, sought to identify solutions to rampant pollution from plastic bags and a shifting tribal society. Through researching ways to recycle or reuse the bags, communicating with community leaders, and contacting a weaver in Indiana, James learned how to weave and devised a plan that would eventually launch a sustainable business for his tribe. This plan involved learning how to collect and process old plastic bags for cleaning, using large wooden-framed looms to weave the bags into trays and baskets, and sell the woven items to local hospitality businesses to use in hotels and parks. Learners in makerspace or PBL activities who are given real-world challenges to solve must work through the creative process while applying content skills simultaneously.

2.2 Interdisciplinary Opportunities

Much like the makerspace and PbBL approach, classroom activities that cross discipline-specific boundaries also hold creativity opportunities. However, the practice of including creativity in the interdisciplinary approach does not often occur. All too often, mathematics and science lessons and activities fail to provide creative opportunities, and arts are increasingly allotted less time (Berry, R. Q. et al., 2010; Tillman, An, & Boren, 2015). The solution to this assumed dichotomy is to encourage the movement of creativity development into other contexts, as previously discussed. While not the only interdisciplinary approach, the science, technology, engineering, arts, and mathematics (STEAM) framework poses the unique context for applying both emphasized content in conjunction with 21st century skills, such as creativity, problem solving, and critical thinking (Tillman et al., 2015). In this example, the explicit inclusion of art within STEM activities assumes that students will be required to engage in producing something both original and worthwhile as related to the interdisciplinary context. The emphasis on producing sits in contrast to traditional STEM activities such as conducting a scripted chemistry experiment and writing an explanatory laboratory report. The following STEAM activity, depicted in Fig. 5.1, can be found at STEAM Education (2014), a blog dedicated to showcasing STEAM lessons. The teacher, Sarah Weaver, worked with fifth graders on a STEAM lesson that would help students understand the impact of plastic on the environment (S), use the internet and digital literacy skills to research and decide on a topic (T), require students to design and build something (E), teach students about

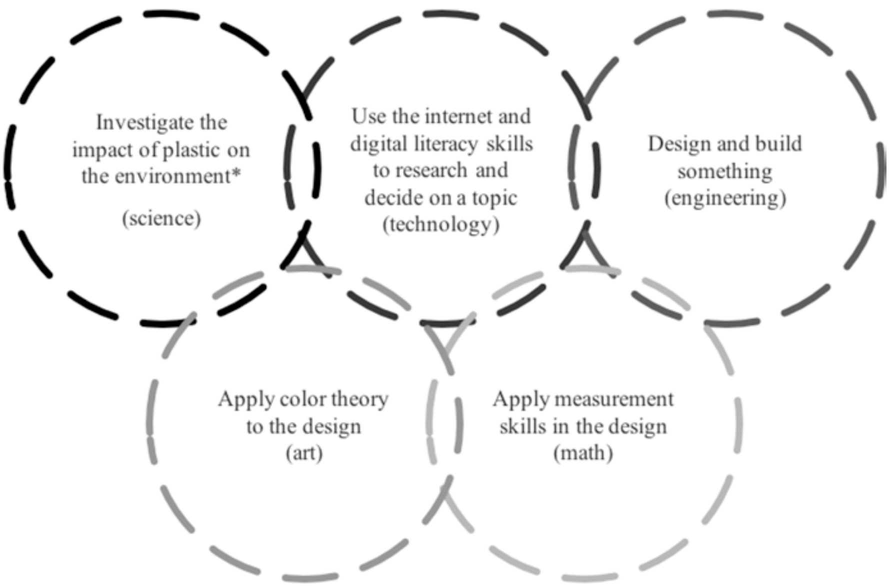

Fig. 5.1 STEAM lesson example

color theory (A), and provide an opportunity to practice applying measurement skills (M). The students ultimately decided to collect and paint bottle caps to create an artistic representation of a whale in the ocean at sunset. In contrast to the makerspace/PbBL approach, the STEAM framework did not necessarily require learners to acquire a new skill nor did the learners have to solve a problem. The STEAM lesson often takes the shape of PjBL and certainly fulfills the requirement of blending creativity skill development along with content.

3 Assessment

The deep connection between makerspaces and informal learning poses a challenge to schools attempting to blend this approach with formal learning. A secondary dilemma exists wherein educators and education leaders express a need to develop and assess 21st century skills like creativity and struggle to identify appropriate mechanisms (Deschryver & Yadav, 2015). Evaluating creativity and creative works happens innately as we observe and interact with the world around us, but creativity assessment in the classroom must move beyond the subjective (Mishra et al., 2013). Yet, evaluating creativity in the classroom eludes most common assessments. Generally speaking, the Torrence Tests of Creative Thinking (TTCT) are by far the most commonly used assessment of creativity (Plucker & Makel, 2010). However, these types of research measurements provide little practical use for classroom teachers (Kaufman et al., 2016). The purpose of the TTCT is to identify students who exhibit creative or gifted skills. When it comes to evaluating the creative process or products, Henriksen et al. (2015) noted that educators often view assessing creativity as subjective, lacking both definition and measurement techniques due to often open-ended structures with unpredictable outcomes. When evaluating a creative artifact, the teacher may be drawn to purely aesthetic qualities that are indeed personal and subjective. Thus he or she must look for other guidance for evaluation. Another challenge of creativity assessment rests in balanced feedback, between harsh and gentle, to learners and must not stifle growth and perseverance nor ignore practical standards (Beghetto & Kaufman, 2007; Kaufman et al., 2016). "Empty praise cheats students from receiving the kind of demanding feedback necessary for creative growth" (Kaufman et al., 2016, p. 146). Even the assessment guide from the Partnership for 21st Century Skills (2009) falls short in this endeavor by leaving out rubrics for assessing each of the identified skills.

To better address this lack of creative product assessment, Mishra et al. (2013) proposed three dimensions by which to measure creativity; novel, effective, and whole (NEW). Per the researchers, a novel creative product possesses unusual, radical, or influential characteristics. Similarly, effectiveness measures consider the product's value, usefulness, and appropriateness. Lastly, the product's organization, meaning, and aesthetic features contribute to evaluating the wholeness. In other words, is the product something new or different, is it comprised of unique characteristics from similar products, and is it complete and useful? The researchers have

Table 5.3 NEW rubric for classroom implementation, adapted from Henriksen et al. (2015)

Criteria	1	2	3	4	5
Novel	Completely lacking any form of unique characteristic and/or lacking content	Most components are standard or conventional with some uniqueness	Average product with a balance between conventional and novel characteristics	Mostly unique, but some conventional components	Strong qualities of novel characteristics
Effective	Confusing, limited, and/or or ineffective in design or application	Design or application is mostly confusing or somewhat limited with some elements of effectiveness	Interesting design with some confusing or limitations in application	Thoughtful design with little confusion or limitations in application	Excellent application with no confusion or limitations
Whole	Little or no consideration to aesthetics or design practice and incomplete	Some aesthetic appeal, but lacking cohesion or design practice consideration or incomplete	Conventional or standard aesthetic appeal, complete, and obvious consideration to design practice	Some aesthetic appeal with some conventional or standard design and complete	Exceptional aesthetic appeal with rich sensory interest and complete

developed and tested a Likert-like rubric for each of the three dimensions, on a scale from 1 to 5 (Henriksen et al., 2015) that teachers may find useful when assessing creative products. Table 5.3 summarizes the NEW framework and how it might be used as a classroom rubric.

Examining this rubric and individual criterion closer, some educators may be able to understand and apply the concepts of effective and whole with relative ease. For example, assessing the artifacts from the aforementioned STEAM lesson would involve evaluating if the bottle cap artwork clearly depicts the intended scene, a whale a sunset, or if the representations could be confused with other creatures or contexts. Similarly, the teacher or other evaluators would be able to assess the artwork for completion; are any bottle caps unpainted, are any scenes of the artwork unfinished/unpainted, etc. In conjunction with the *whole* evaluation, the teacher can also assess aesthetic appeal based upon relevant parameters from the assignment; i.e., "does the final artwork follow color theory in applying complementary colors?" However, teachers may find more of a challenge in defining or capturing the *novel* criterion. The goal of the NEW framework is to reduce the likelihood of subjective evaluation, but unintended subjectivity may arise in this particular element simply due to the evaluator's experiences or lack thereof. In continuing the previous example, consider if the artwork had a visual quality similar to that of Robert Wyland, a famous American painter of whales. If the teacher is familiar with Wyland's work, he or she may score the artifact at a 3 or 4 in terms of novel creative output whereas a teacher unfamiliar with the artist may score the artifact at a 5. Keep in mind, however, that as work continues to develop in the area of assessing creative output, how researchers and practitioners define *novel* now may change over time.

Also warranting discussion, the Buck Institute for Education (BIE, n.d.) provides a number of rubrics related to creativity, collaboration, and critical thinking, but there are issues across the resources. The rubrics are grouped into grades K-2, 3–5, and 6–12 with options to view the latter two rubrics as either aligned or unaligned with the U.S. Common Core State Standards. Unfortunately, the rubrics distinguish between "below standard," "approaching standard," "at standard," and "above standard," and only provide specific guidelines for the first three categories. This incomplete approach to rubric implementation contributes to the subjective potential of evaluation previously noted. Additionally, the divided rubrics are only in name as the content is identical, including references to standards, and there is no information provided to help the instructor gauge how the rubrics were assembled. Interesting to note, however, the BIE rubrics include both the creative process and the creative artifact. There are four categories presented by BIE related to the creative process:

1. Launching the project (define the creative challenge)
2. Building knowledge, understanding, and skills (identify sources of information)
3. Developing and revising ideas and products (generate and select ideas)
4. Presenting products and answers to driving question (present work to users/target audience)

On one hand, BIE distinguishes between what could be assumed to be hierarchical skill development between the 3–5 and 6–12 rubrics by having slightly different criterion descriptions. However, the artistic instructor attempting to use such rubrics may find that the process criterion lean too far away from their traditional processes. See Table 5.4 for a comparison example. There is also a question of why the institute chose to write the K-2 and 3–5 rubrics from the viewpoint of a first-person self-assessment. Perhaps the intent was to transition into a more formal, business-like approach once the student reaches grade 6. However, in the absence of detail or justification, the question remains. Another question to consider rests in the wording of descriptions. What constitutes an "unusual way" of finding information, as noted in in the "at standard" description for "Building knowledge, understanding, and skills"?

Lastly, the product or artifact criteria and corresponding levels included in the BIE rubrics bear a striking resemblance to the NEW rubric discussed previously. Originality relates to novel, value relates to effective, and style relates to whole. The presence of these three similarly themed criteria provides insight into the direction of creativity assessment and how to capture the end product.

While research on the NEW framework is clearly under development and emerging, educators implementing rubrics (see Henriksen et al., 2015, pp. 476–478) might

Table 5.4 BIE rubric comparison for Building knowledge, understanding, and skills

Rubric level	3–5	6–12
Below standard	• I use only the usual sources of information (website, book, article)	• uses only typical sources of information (website, book, article) • does not offer new ideas during discussions
Approaching standard	• I find one or two sources of information that are unusual	• finds one or two sources of information that are not typical • offers new ideas during discussions, but stays within narrow perspectives
At standard	• I find unusual ways to get information	• in addition to typical sources, finds unusual ways or places to get information (adult expert, community member, business or organization, literature) • promotes divergent and creative perspectives during discussions

consider contacting the researchers continue the process of evaluating creative product measurement techniques. In particular, using the NEW rubric, or any other, to assess creative outputs from students might benefit from having multiple evaluators rather than just one, as is traditional in the classroom. Arguably, a single evaluation still leaves room for subjective evaluation arguments, and this is a weakness of the approach lacking further research-based applications. Teachers or administrators who seek to implement any of the suggested activities described earlier could also consider implementing the creativity rubric(s) alongside content evaluation rubrics to complete the classroom assessment process.

Maker activities, which often manifest as PjBL and PbBL, draw upon the strengths of informal and constructivism/constructionism. Thus, the assessments we use to evaluate the learning that occurs in this context cannot rely on standardized testing or traditional forms of assessment for formal learning. As maker education continues to grow in popularity in schools, these rubrics represent ways in which teachers can provide objective assessment of artifacts and the processes in which students engage.

4 Discussion

Despite the growing interest in creativity skill development, teachers struggle to effectively design classroom learning activities to foster this essential twenty-first century skill in conjunction with content instruction and assessment. The reasons for this struggle include a continued segregation of creativity from other disciplines as well as challenges with assessment. Many teachers continue to view creativity as solely artistic or aesthetic in nature (Deschryver & Yadav, 2015; Diakidoy & Phtiaka, 2002). However, creativity is as essential in science and math as it is in art or music (Caper, 1996; Root-Bernstein, 1996; Root-Bernstein & Root-Bernstein, 1999). Creative learning experiences through makerspaces, PbBl, and PjBL provide opportunities for teachers to challenge traditional roles in the classroom while fostering content knowledge and other twenty-first century learning skills like creativity and media literacy. Any preservice teacher currently in studies or inservice teachers with access to professional development might consider looking at some of the international, national, and regional or local design and/or science competitions, such as the Intel International Science and Engineering Fair. Similarly, teachers interested in learning more about maker education can look to organizations like the Nation of Makers, based in the United States, or Make Magazine, the host organization for the worldwide maker faires. Teachers who challenge students with activities like solving a local pollution problem or researching effects of a material on an ecosystem may find assessing creativity challenging, but work such as the NEW framework from Mishra et al. (2013) provides easy-to-implement guidance with a ready-made rubric. While the NEW framework addresses how to assess creative output, more research must be conducted to also identify ways to assess the creative process, perhaps drawing upon the criteria included by the Buck Institute. Any research going forward should critically evaluate, and challenge, existing and proposed rubrics, taking into consideration local/federal reporting requirements, subject area, and grade level. Additionally, case studies and action research methodologies may also help researchers better understand the effectiveness of makerspace, PBL, and other interdisciplinary approaches to blending content and skill development.

The implications of emerging research and practice related to creativity skill development play out in formal classrooms and the more than 700 makerspaces worldwide (see http://makerspace.com/ and http://hackerspaces.org). Federal U.S. initiatives such as the CTE Makeover Challenge from the USDOE (2016) or even China's executive meetings and policy changes to expand entrepreneurship and innovation (The State Council The People's Republic of China, 2015) illustrate the high-level emphasis for developing essential technical and twenty-first century learning skills. As other initiatives develop or as local educational organizations make the contentious decision to equally develop knowledge and skill in the classroom, suggestions for classroom instructional design, technology considerations, and assessment must be informed by the works presented here and those that continue to develop. Scholars researching in the areas of curriculum and instruction, instructional design, and instructional technology will continue to build off of these works, extending recommendations for practice and research into the twenty-second century and beyond.

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Chapter 6
The Importance of a Satisfaction Analysis in a Face-to-Face Tutorial: A Case Study at Universitas Terbuka

Adhi Susilo and Deddy A. Suhardi

Abstract Student satisfaction surveys are useful tools for higher education institutions to gauge perceptions of effectiveness and provide auditable evidence that students have been given the opportunity to reflect on their learning. This study employed a two-dimensional importance-satisfaction survey consisting of 23 items, categorized under 5 dimensions. Items were phrased as positive expectations and students were asked to assess how important it is to them that the institution meets each expectation, using a 5-point, Likert-type scale ranging from not at all important (1) to very important (5). They were then asked to rate their level of satisfaction, using the same scale from very dissatisfied (1) to very satisfied (5). A total of 588 respondents completed the surveys. The surveys were analyzed using SPSS and both quadrant and gap analyses were used. The result showed that graduate students are generally satisfied with face-to-face tutorial programs and services. This study combined both the quadrant and the gap analyses to determine the "Selling Points" and the "Critical Points" for Universitas Terbuka (UT) in light of the learning support services provided to students.

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K.A. Persichitte et al. (eds.), *Educational Technology to Improve Quality and Access on a Global Scale*, Educational Communications and Technology: Issues and Innovations, https://doi.org/10.1007/978-3-319-66227-5_6

1 Introduction

Universitas Terbuka (UT) is a state university for Indonesia dedicated to open and distance learning. UT provides online tutorials as an alternative to face-to-face tutorials, particularly for students who have access to the Internet. Face-to-face (F2F) tutorials facilitate two-way synchronous communication and offer interactive human contact to distance learners (Suparman, 2007). Face-to-face tutorials at UT are mandatory for teacher training students, students with special scheme (students who got scholarship from government or from private company) and students who request it. Face-to-face tutorials are provided only if the number of participants is at least 20. Tutorials for some courses are fee-based and provided according to demand (Belawati, 2001). The targets of face-to-face tutorials are students who need it and who have access to the locations of face-to-face tutorials (Belawati, 2001). The students can ask their regional center if they want to be in face-to-face tutorials. Face-to-face tutorial scores contribute 35–50% to the courses' final scores. In UT, the number of meetings in face-to-face tutorials is eight times/semester. For a traditional university, the number of meetings in a class is 16. These meetings are only half of a regular universities'. Therefore, the tutor should manage the meetings efficiently since he/she must cover many materials. Tutors also need to give three assignments in the meetings and give tutorial scores/grades to the students.

Face-to-face tutorials are learning support services for students provided by UT. In the F2F tutorial, learning activities are carried out under the guidance of the tutor as a facilitator. F2F tutorials discuss things that are considered difficult and very important for students to master. The tutorials are designed to help students solve problems in their independent studies. The tutors do not use their class time for lecturing because the time assigned for the tutorial meeting is limited. The course materials or learning resources provide the content, while the tutors help learners develop the skills needed to comprehend, assimilate, and apply the content. Tutors may suggest how learners approach and work with the content, and sometimes give clarification, but they rarely present content by directly instructing the learners.

The targets of F2F tutorials are students who live in urban areas and those who have access to nearby locations of F2F tutorials. F2F tutorials are managed by UT's regional offices. Therefore, students must contact the regional office if they want to join a F2F tutorial. There are 39 Regional Offices all over Indonesia serving about 550,000 students. Since F2F tutorials are fee based, these activities are a form of revenue services. UT's students, as customers, have to receive good services that fulfill their needs (Herman, 2012).

According to O'Neill and Palmer (2004), universities employ a combination of qualitative and quantitative methods to gauge the quality of services. Qualitative methods include interviews, focus groups, and observation research. In addition, O'Neill and Palmer (2004) described the quality in education as a comparison between what a student anticipates obtaining through their education and their perception of real acquisition. Accordingly, there is a continuing need to define quality dimensions of higher education and to measure the students' satisfaction based on these dimensions to improve higher education systems.

According to Parasuraman, Zeithaml, and Berry (1988), service quality can be defined as an overall judgment similar to attitude toward the service and it is generally accepted as an antecedent of overall customer satisfaction (Zeithaml, Berry, & Parasuraman, 1996). Parasuraman et al. (1988) have defined service quality as the ability of the organization to meet or exceed customer expectations. It is the difference between customer expectations of service and perceived service (Zeithaml, Parasuraman, & Berry, 1990). Perceived service quality results from comparisons by customers of expectations with their perceptions of service delivered by the suppliers (Zeithaml et al., 1990). If expectations are greater than performance, perceived quality is less than satisfactory and customer dissatisfaction occurs (Latif, Bahroom, & Afzhan, 2015; Lewis & Mitchell, 1990; Parasuraman, Zeithaml, & Berry, 1985).

Parasuraman, Zeithaml, and Berry (1988) and Berry, Zeithaml, and Parasuraman (1990) identified five dimensions that form service quality related to customer expectations; namely: Tangibles, Reliability, Responsiveness, Assurance (competence, courtesy, credibility, security) and Empathy (access, communication, understanding of the customer). These terms are defined as:

1. *Tangibles*: These include the appearance of physical facilities, equipment, personnel, communications, use of appropriate materials, etc. Tangibles are more important in face-to-face tutorial services, i.e., conditions of the buildings/classrooms.
2. *Reliability*: The ability to provide the promised service dependably and accurately. For example, tutor quality to perform face-to-face tutorial services.
3. *Responsiveness*: The ability to deal effectively and promptly with customer requirements and complaints. For example, tutor ability to respond to participants/students during face-to-face tutorial.
4. *Assurance*: Knowledge, experience, courtesy, and readiness to maintain client confidence and trust. For example, tutor academic background.
5. *Empathy*: Caring for and providing individualized attention to customers (Berry et al., 1990).

Importance-Performance Analysis (IPA) was first proposed and introduced by Martilla and James (1977) as a means to measure client satisfaction with a product or service. The IPA approach recognizes satisfaction as the function of two components: the importance of a product or service to a client and the performance of a business in providing that service or product. In this way, IPA examines not only the performance of an item, but also the importance of that item as a determining factor in satisfaction to the respondent (Silva & Fernandes, 2010). The combined client ratings for those two components then provide an overall view of satisfaction with clear directives for management about where they should focus agency resources. IPA is also an analytic technique that generates a two-dimensional importance-performance grid, where the values of importance and performance across attributes are plotted against each other. This technique is used to assist service and other firms in prioritizing areas for service improvement when resources are limited (Feng, Mangan, Wong, Xu, & Lalwani, 2014).

This method has proven to be a generally applicable tool that is relatively easy to administer and interpret, resulting in extensive use among researchers and managers in various fields as a way to promote the development of effective marketing programs (Feng et al., 2014; O'Neill & Palmer, 2004; Sarabi & Israel, 2013; Silva & Fernandes, 2010). The performance gap provides a measure as to how well higher education institutions are meeting learner expectations for a quality educational experience. The larger the performance gap for a particular item or dimension (i.e., high importance but low satisfaction), the greater the concern for improvement to increase learner satisfaction (Latif, Sharma, & Bahroom, 2007).

1.1 Objective of the Study

The objective of this study was to examine the extent to which face-to-face tutorial services meet the expectations of the students with regard to the five dimension of students' importance and satisfaction. The customer in the F2F tutorial is the student. Product quality is the tutorial result. Service quality is the tutors' performance. The price of product is the cost of the F2F tutorial. In general, the quality of the tangible product can objectively be measured from indicators such as endurance and the number of product failures. However, service quality and customer satisfaction cannot be measured as easy as a tangible product. Since they are latent variables, they were measured from indicators in students' perceptions of how F2F tutorials were implemented.

If perceived service is less than expected service, the customer will not be satisfied. On the other hand, if perceived service is more than expected service, the customer will be satisfied. There are five dimensions that build customer satisfaction. These dimensions are reliability, responsiveness, assurance, empathy, and tangible (Parasuraman et al., 1988). As stated above, all the variables were measured based on students' perceptions. In terms of F2F tutorials, it was hypothesized that customer value and customer satisfaction were positively correlated.

2 Methodology

2.1 Research Design

This study utilized a quantitative approach where the link to the online survey was sent by emails to students and made available on UT's website from May to September 2015. The web-based survey was designed to empirically assess the importance and satisfaction attributes of the aforementioned constructs. The web-based survey was developed as a multi-item measure using Likert-type scales. Existing validated scales were used to develop the web-based survey. The target population of this study was students of the Open University of Indonesia (Universitas Terbuka-UT).

Descriptive statistics were used to analyze the research findings. An Importance-Satisfaction quadrant analysis was carried out for the four dimensions of face-to-face services. A gap analysis was also carried out together with dependent samples *t*-tests to determine areas of strength and weakness as perceived by the students.

One issue is that Office of Research Ethics (ORE) approval is required to use tutors and students as survey participants. ORE training completion and approval for the specific research study were attained. Permission for authorization for data collection was received from UT. Access to tutors and students to participate in the survey was also an issue. Permission for authorization for access to tutors and students' email address was received.

2.2 Population and Sample

A total of 1277 students from the 39 regional offices in the period May to September 2015 were randomly selected by their email address via the online system. Out of that number, only 588 completed surveys were received, giving an overall response rate 46%.

2.3 Instrumentation

The 23 items related to Importance and Satisfaction with regard to face-to-face tutorial services were adapted from those validated and utilized in the Student Satisfaction Survey by Herman (2014). The instrument was modified to accommodate the evaluation model after these researchers got permission from the author, and translated the survey into the standard Indonesian language to provide clear understanding to respondents, and then created the survey in an online form. In addition, the instrument was evaluated in terms of reliability and validity. The respondents were required to rate the level of importance on a 5-point, Likert-type scale (1) Not at all important, (2) Slightly important, (3) Moderately important, (4) Very important, (5) Extremely important. A similar 5-point, Likert-type scale was also offered for the respondents to rate their level of satisfaction with the performance of face-to-face tutorial services (Table 6.1).

Table 6.1 Cronbach alpha of reliability of dimensions

Dimension	Importance	Satisfaction
Reliability	0.819	0.777
Responsiveness	0.819	0.776
Assurance	0.812	0.757
Empathy[a]	0.819	0.760
Tangible	0.818	0.776

[a]All dimensions consist of five (5) items, except for Empathy (3)

The Cronbach alpha coefficients from the 23 survey result items for the dimensions exceeded 0.7 and these alpha values indicate that as a whole, the Importance-Satisfaction scale has a high internal consistency (DeVellis, 2012).

2.4 Data Analysis

In the quadrant analysis, the overall mean for satisfaction was plotted against the overall mean for importance for each competency dimension. Latif, Subramaniam, et al. (2015) described each of the four quadrants as follows:

1. If the plotted values fall in the upper right quadrant (High Importance and High Satisfaction), the items are considered *Strengths*;
2. If the plotted values fall in the upper left quadrant (High Importance and Low Satisfaction), the items draw attention to *Opportunities for Improvement*;
3. If the plotted values fall in the lower left quadrant (Low Importance and Low Satisfaction), the items are considered of *Low Priority*; and
4. If the plotted values fall in the lower right quadrant (Low Importance and High Satisfaction), these items are considered under *Misallocation of Resources*.

3 Results and Discussion

3.1 Results

The means and standard deviations for each dimension are as shown in Table 6.2. The overall importance mean is 4.56 while the overall satisfaction mean is 3.41.

It is assumed that item score of 4.5 in importance scale is equivalent with 90% importance level. This limit is considered very critical to determine the priority scale. If the score is 4.5 or higher, it is assumed that the value is very important; therefore, it must be maintained or improved for satisfaction. Otherwise, if it is <4.5, this item is still important but it is not priority to be improved.

An item score of 3.5 on the satisfaction scale is equivalent with 70% satisfaction level. A score of 3.5 or more shows the satisfaction scale that is expected by students. If it is <3.5, it means the students expect more satisfaction.

Table 6.2 Means and standard deviations of the dimensions

Dimension	Importance	SD	Satisfaction	SD
Reliability	4.7	0.18	3.6	0.51
Responsiveness	4.6	0.20	3.4	0.44
Assurance	4.7	0.18	3.5	0.46
Empathy	4.5	0.21	3.2	0.45
Tangible	4.4	0.27	3.4	0.52
Average	4.56	0.21	3.41	0.48

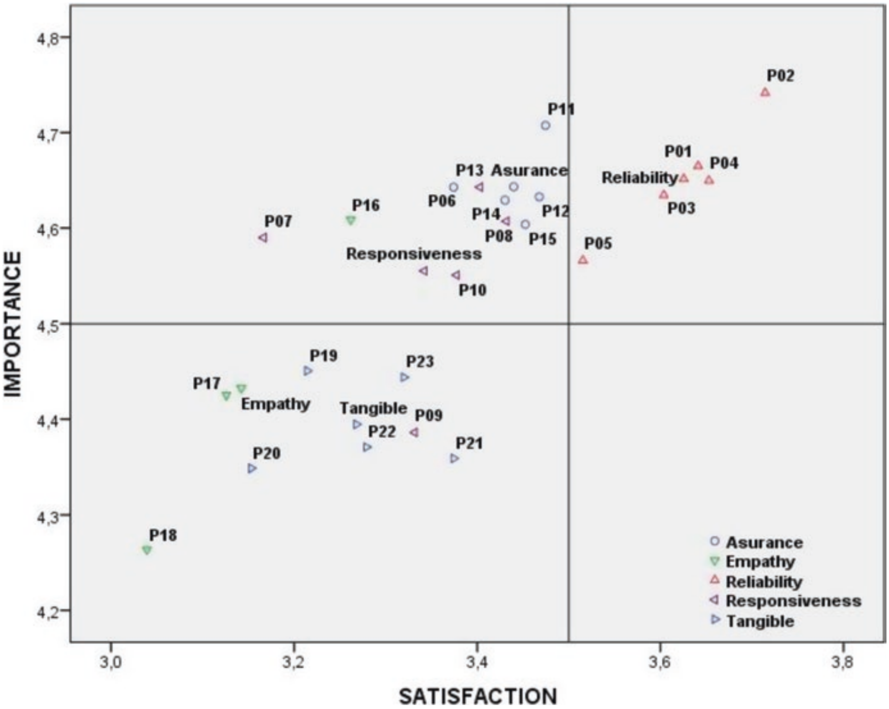

Fig. 6.1 Quadrant analysis for overall dimensions

The scales of 4.5 (importance) and 3.5 (satisfaction) are used as a border to split the high and low priority.

3.1.1 Quadrant Analysis

A visual representation of the ratings given by the participants can be seen in Fig. 6.1 by plotting the importance means and satisfaction means in a scatter diagram, depicted in the form of a quadrant. The Reliability dimension falls in the Strength Quadrant, indicating that UT has successfully produced F2F tutorials that are well equipped with services desired by and to the satisfaction of their students.

3.1.2 Gap Score Analysis

The gap analysis was also carried out with an objective of explicitly identifying the gaps between importance and satisfaction. The gap was measured by subtracting the mean score of satisfaction from the mean score of importance. Items with large gaps are indicative of these items are not meeting students' expectations (Latif & Bahroom, 2014). If the percentage difference of gaps is significant, it is indicative

Table 6.3 Distribution of items by important-satisfaction gap and quadrants

Dimensions/items	IMP	SAT	GAP
Reliability	4.65	3.62	1.03[a]
1. The availability of tutorial plan	**4.66**	**3.64**	1.02[a]
2. The availability of core subject of tutorial	**4.74**	**3.71**	1.03[a]
3. The availability of questions and answers which are concordant with the book	4.63	3.60	1.03[a]
4. Tutorial plan is completed	4.65	**3.65**	1.00[a]
5. Time efficient	4.57	3.52	1.05[a]
Responsiveness	4.56	3.34	1.21[a]
6. Skill to direct the participant to focus on learning subject	4.64	3.40	1.24[a][5]
7. Skill to see the obstacles faced by students	4.59	3.17	**1.42**[a][1]
8. Skill to ask student participate in discussion	4.61	3.43	1.18[a]
9. Skill to feel the classroom environment	4.39	3.33	1.05[a]
10. Skill to receive suggestion from the participants	4.55	3.38	1.17[a]
Assurance	4.64	3.44	1.20[a]
11. Skill to explain learning material	**4.71**	3.47	1.23[a]
12. Skill to present illustration/example	4.63	3.47	1.16[a]
13. Skill to solve the problems in learning materials	4.64	3.37	1.27[a][4]
14. Skill to answer the question from the students	4.63	3.43	1.20[a]
15. Skill to give hint to simplify the concept	4.60	3.45	1.15[a]
Empathy	4.43	3.14	1.29[a]
16. Readiness to response the students' distress	4.61	3.26	1.35[a][2]
17. Readiness to serve the students individually	4.43	3.13	1.30[a][3]
18. Readiness to serve students after office hours	4.26	**3.04**	1.22[a]
Tangible	4.39	3.27	1.13[a]
19. Classroom quality	4.45	3.21	1.24[a]
20. Image projector availability	4.35	3.15	1.20[a]
21. whiteboard quality	4.36	3.37	**0.98**
22. Chair and desk availability	4.37	3.28	1.09[a]
23. Room cleanness	4.44	3.32	1.12[a]
Overall Mean	**4.51**	**3.31**	**1.16**
Overall SD	**0.13**	**0.17**	**0.12**

[a]Percentage difference at 5% or higher
[.] Rank of the highest gaps

of problem areas that need correction, as these items are not meeting students' expectations. Small gap values (not significant) imply that expectations are met. Percentage difference is also computed by subtracting the Satisfaction score from the Importance score and dividing by 5 (since the responses were based on a 5-point scale) and then multiplying by 100 (see Table 6.3).

Empathy dimensions showed the largest gap of 1.29 and this is greater than the overall mean gap of 1.16. The smallest gap was for Reliability (see Table 6.3). The detailed analysis of items by dimension using combined quadrant and gap analysis is given in the following paragraphs.

3.1.3 Reliability

As for the Reliability dimension, the difference between the Importance and Satisfaction mean scores is significant for five items (see Table 6.3). Of the five items with significant differences, all five are in HIHS quadrant (Fig. 6.1).

3.1.4 Responsiveness

In the Responsiveness dimension, the difference in the Importance-Satisfaction scores is significant on all five items. Of the five items, six (6), seven (7), eight (8), and ten (10) are in the HILS quadrant, meanwhile nine (9) is in the LILS quadrant.

3.1.5 Assurance

In the General Skills dimension, the difference in the Importance-Satisfaction scores of all five (5) items is significant. Of these items, five items are in HILS quadrant.

3.1.6 Empathy

In the Empathy dimension, the difference between the Importance and Satisfaction scores for all items is significant. Of these items, only readiness to respond to the students' distress is in the HILS quadrant while the other two items are in the LILS quadrant.

3.1.7 Tangible

Finally, in the Tangible dimension, the difference between the Importance and Satisfaction scores for all items is also significant. All of items are in the LILS quadrant.

As can be seen from Table 6.3, *Skill to see the obstacles faced by students* has the largest gap of 1.42, followed by *Readiness to response the students' distress* (1.35), *Readiness to serve the students individually* (1.30), *Skill to solve the problems in learning materials* (1.27), and *Skill to direct the participant to focus on learning subject* (1.24).

3.2 Discussion

The gaps for all the items in this study range from a low of 0.98 to a maximum of 1.42. These gaps are higher compared to the empirical data obtained by Latif, Subramaniam, et al. (2015). In another study by Latif, Bahroom, et al. (2015), they found that the level of satisfaction was generally below the importance level. The higher values of the gaps obtained in this study compared to other studies seem to suggest that F2F services have not been successful in producing a learning process that meets the expectations of the students with regard to the five different types of customer satisfaction dimensions. The selling points are more focused on the academic aspects such as courses, learning platform, and information. Critical points are very much related to the "human factors."

In the Importance-Satisfaction quadrant as depicted in the tabular form in Table 6.3, 21.7% of all items are located in the HIHS or the Strength quadrant. This shows that a majority of students in this study perceived that regional offices do exhibit the required services in their organization and applied these services to their satisfaction. However, there are substantial items that fall under the LIHS (0%), HILS (43.5%), and LILS (34.8%) quadrants. The LIHS is a low priority quadrant that implies that the students accord low importance to these items even though they are well satisfied with them. For the items in the LILS, even though students are not satisfied, they can be safely ignored.

The items in the HILS quadrant, where students place very high importance but are not satisfied, are of concern to the university. There are ten items in this quadrant, some of them (*skill to direct the participant to focus on the learning subject*, *skill to see the obstacles faced by students*, *skill to solve the problems in learning materials*, and *readiness to respond the students' distress*) are of high importance. This suggests that efforts need to be undertaken by UT to improve on these services/skill sets.

Notwithstanding the positive feedback, there is still room for further improvement. Looking at the top five items with the highest importance-satisfaction gaps, *skill to see the obstacles faced by students* appears to top the list (see Table 6.3). This result first appears to be perplexing in view of the tremendous emphasis on the tutor's social presence.

Closely related to the *skill to see the obstacles faced by students* issue is the perceived *readiness to respond to the students' distress* and *readiness to serve the students individually* which fall into the second and third positions based on the I-S highest gap ranking. UT needs to take heed of these apparent weaknesses among its services and measures to improve them need to be instituted immediately. It is generally agreed that for most of today's tutors, response to and ability to serve the student are their primary inadequacies.

Skill to solve the problems in learning materials and *skill to direct the participant to focus on the learning subject* also need to be further improved. The first, problem-solving skills, is one of the critical factors that will place the graduates ahead of others and ensure success in their career and the second deals with personal integrity, honesty, and trust. In order to prepare learners with these skills, F2F tutorials provide some subjects that are incorporated as part of the curriculum in all of UT's programs.

One of the tools used to develop the above skills is the academic curriculum, which is a vehicle through which attributes can be transferred during the learning process. And, in general, the teaching and learning assumes a self-study format, which is guided by a tutor (face-to-face and online). This self-study approach is actually the tacit goal of higher education as it produces scholars who can work independently. However, the variations among all students in the classroom (face-to-face and online), compounded by variations in their academic levels, and cultural background pose a great challenge. A variety of instructional techniques that simultaneously help learners gain self-study skills and content knowledge have been implemented, but obviously there is ample room for improvement.

Specific to skills to direct the participant to focus on the learning subject, the following instructional components have been cited as potentially helpful to help learners increase their focus: an audience response system, visuals and demonstrations, scaffold instruction, connections to student experiences, student-to-student interaction, appropriate use of supplementary materials, sufficient opportunities for oral presentation, and explicit teaching of learning strategies (Cain, Black, & Rohr, 2009; Elder et al., 2011; Forsten, Grant, & Hollas, 2003; Lehman, Conceição, and ebrary 2014; Smith & Sodano, 2011). Incorporating the above instructional components will most likely lead to better outcomes.

Improving tutors' readiness to serve the students individually may be more objectively measured and has traditionally been the mainstay of tertiary education. Taking up this suggestion, tutors could perhaps be required to assess their own attributes and generic skills on a yearly basis and track their progress toward self-improvement in their classroom.

Last but not least, in order to adequately equip a regional office that meets the challenges and demands of the students, the lifelong learning system in UT and the roles of the tutor need to be further strengthened.

According to Zubaidah (2015), conducting educational delivery in difficult areas with no regular and adequate transportation has caused the regional office to develop specific strategies in making the learning process run as smoothly as possible. Sending a tutor to an area to meet some students and conducting a series of F2F tutorials, which are supposed to be weekly, in several days is one of the strategies. Recruiting local people to manage students in the area is another strategy. The absence of regular transportation from island to island, high tides, and hurricanes are among the obstacles faced by the regional offices in doing their job. Non-geographical barriers such as unavailability of qualified tutors and inadequate tutor payment are problems as well. The learning process, however, has to be completed anyway; otherwise, the distance education mission to reach the unreachable cannot be achieved (Zubaidah, 2015).

4 Conclusion

Importance-Performance Analysis (IPA) is a simple and useful technique that can help managers identify which attributes should be improved to increase overall customer satisfaction. From the research prospective, this study supports the adoption of the IPA as an alternative framework for evaluating students' satisfaction. Such frameworks can be used in further research on students' satisfaction.

Through the Importance-Performance Analysis we concluded that the attributes considered most important by students in face-to-face tutorial services were: the availability of tutorial program, the availability of core subject tutorials, and tutor skill in explaining learning materials.

The results showed that, in general, students are satisfied with the performance of face-to-face tutorial services since the average of all variables is higher than the intermediate value. The attributes perceived to have higher performance included: the availability of core subject of tutorial, the availability of tutorial plan, and the completed tutorial plan. The attribute with the lowest performance was the tutor's readiness to serve students after office hours.

The generalization of these results should not, however, be overstated. It would be interesting to look at institution board management and students' perceptions in terms of education quality attributes and how these differences affect the types of policy and management practices in the UT system.

The feedback from students such as reported in this study is a critical element in the success of our institution's lifelong agenda as it provides the much needed information on the tutor's skills sets that are of importance in the F2F tutorial and whether students are satisfied with the performance of the F2F tutorial services.

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Chapter 7
Developing Online Course Material on Information Literacy: A Design-Based Research Approach

Riche Cynthia Johan

Abstract Teacher librarians have a high commitment to providing the best services in learning and library program development, especially in information literacy. To support the commitment of providing best services, various training options have been developed. This paper describes the steps in developing course materials for an online competency-based curriculum training to support the information literacy skills of school teacher librarians. A systematic research-based design was used to determine the steps to analyze the needs of teacher librarians, to create the materials based on the initial competencies of the teacher librarians, and to apply the materials created which were adapted for online training mode. This paper presents the results of the course materials developed, including competencies elaborated from the existing law on Indonesian teacher librarians and from the practical needs of teacher librarians as well as the needs to develop information literacy skills.

1 Introduction

The profession of teacher librarian is difficult to find in Indonesian libraries and information centers because there are still many teacher librarians who do not have an educational background in library science working at school libraries. According to the Law Number 43 Year 2007 Section 1 Chapter I, librarians are those who have competence obtained through education and or library training, responsible for providing access to resources and managing services. Hence, anyone who does not have library science background can work as a librarian after taking some sort of training. This law impacts libraries and librarians including those in schools, which causes teachers who lack teaching time to take on additional duties as teacher librarians in order to meet the required teaching time of 24 h a week.

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K.A. Persichitte et al. (eds.), *Educational Technology to Improve Quality and Access on a Global Scale*, Educational Communications and Technology: Issues and Innovations, https://doi.org/10.1007/978-3-319-66227-5_7

The competencies of teacher librarians are regulated by the Culture and Education Ministerial Regulation Number 25 Year 2008, which covers managerial aspects, information organization, educational, personality, social, and professional development competencies. Educational competencies include the ability to conduct information literacy guidance.

However, in preliminary research on identifying the needs of information literacy training, Johan (2016) found that many teacher librarians do not yet understand what and how information literacy actually is. Regarding this, the Alexandria Proclamation of 2005 describes information literacy and lifelong learning as the "beacons of the information society, illuminating the courses to development, prosperity and freedom. Information literacy empowers people in all walks of life to seek, evaluate, use, and create information effectively to achieve their personal, public, occupational, and educational goals. It is a basic human right in a digital world and promotes communal inclusion in all nations" (UNESCO, 2015).

As explained above, school libraries and teacher librarians must have information literacy skills and must pay attention to the increasing development of students' skills in using technological tools and accessing various information sources and the growing needs of students. It is a challenge for universities, professional associations, and the government to help teacher librarians gain knowledge of information literacy through a variety of education and training opportunities.

Information literacy training has not been widely developed, especially training for teacher librarians as provided by higher education institutions. This research study is an analysis of information literacy competencies from different sources which includes the law regulating the fulfillment of competencies in information literacy guidance in Indonesia, studies of world library association agencies, and standards of the American Library Association (ALA). The analysis will be followed by developing training materials to meet the competencies that are selected and presented in the form of online materials.

2 Method

Developing training materials is one of the task components of the instructional designer that is important to realize successful training. Design-based research is an option in generating innovations in developing training materials through systematic stages. It is – like all systematic educational and instructional design processes - therefore cyclical in character: analysis, design, evaluation and revision activities are iterated until a satisfying balance between ideals ('the intended') and realization has been achieved (Plomp,T., & Nieveen, N., 2007, p.13).

The analysis phase in developing the course materials was first conducted by studying the concept of information literacy as a supporting element in searching and obtaining information, which has long been understood by teacher librarians, and analyzing the utilization of communication and information technology for library services. The second analysis was conducted on documents related to information literacy needs of both teachers and librarians. This analysis was needed to support teachers' additional position as librarians that require development of information literacy competencies useful not only for instructional development but also for supporting library utilization in schools.

Documents on the competencies of teacher librarians include the following: (1) The Culture and Education Ministerial Regulation Number 25 Year 2008; (2) School Library Guideline from International Federation of Library Association (IFLA); (3) Museums, Libraries, and 21st Century Skills which direct the competencies, information literacy, media and technology that should be mastered; (4) Law Number 83 Year 2012, Indonesia National Work Performance Standards which explain the qualification for the library staff and indicates the need for information literacy competencies; (5) Library Competencies of American Library Association (ALA); and (6) The Big Six Model of Information Literacy from Eisenberg & Berkowitz (1990) which focuses on the steps in becoming an individual who knows how to solve problems through scientific approach and information literacy.

Designing online materials is relatively the same as designing offline materials. A training design is basically an outline of all the "what, where, who, when and how" details of the training for use by coordinators, curriculum developers, and trainers. There are five primary components of a training design (Hamza, 2012): (1) Learning Outcomes: What will participants be able to do as a result of completing the training? (2) Training Materials: What materials need to be developed and what will the materials include? (3) Trainers and Content Experts: Who will facilitate the training and act as content experts to review materials? (4) Training Methods: What methods will be used so that participants meet the learning objectives and learn the content most effectively? and (5) Logistics: Where and when will the training take place? Who will be invited and how will they be notified?

In this research, the stages in developing the course materials technically involve six lecturers of library and information science including the researcher herself who understand the materials theoretically and practically. The writing of course materials and the process of creating learning videos take 1 month each. Before the materials were printed a readability test was performed by an expert lecturer in the field of communication. The design process was conducted through the stage of identifying learning outcomes and course material topics, developing the pattern of material development and evaluating the course materials.

The evaluation and revision stages of material development were carried out through implementation and utilization of learning materials in the training process. Each lesson is in line with the weight of theory and practice taxonomy, with depth and width of materials made in accordance with the competencies set and the evaluation format developed so that the time needed to learn the online materials independently and assisted by technology can be effective and efficient.

3 Results and Discussion

3.1 Analysis of Developing Course Material

A preliminary research study was conducted as a basis to determine the needs for information literacy training, which aimed to find out the perceptions of teacher librarians about the concept of information literacy as well as the ability and the utilization of ICT. The data obtained from teacher librarians are shown in the table below (Johan, 2016) (Table 7.1).

The research suggests that information literacy competencies at school libraries should meet several indicators that include the understanding about information system management utilization in library services, the use of individual internet connections in finding and sharing information, possessing and using email addresses for the exchange of information to coworkers and students. Referring to The Dictionary for Library and Information Science, Reitz (2004:356) defined information literacy as a skill in finding the information one needs, including an understanding of how libraries are organized, familiarity with resource they provide (including information formats and automated search tools), and knowledge of commonly used techniques. The concept also includes the skills required to critically evaluate information content and employ it effectively, as well as understanding of the technological infrastructure on which information transmission is based, including its social, political, and cultural context and impact. The research found that library generally had good perceptions about information system management utilization in library services, yet the possession of email addresses and the use of Internet are rare for the purpose of sharing information.

Basic understanding of ICT and utilization of ICT at school library services as identified in the preliminary research should be possessed by teacher librarians. As stated by Shapiro, Hughes, and Sheller (1996), information literacy refers to a new liberal art that extends from knowing how to use computers and access information to critical reflection on the nature of information itself, its technical infrastructure,

Table 7.1 Competencies underlying information literacy

Indicator	Description
Basic understanding of ICT	Quite understood
Utilization of ICT in the school library on services	Utilized well enough
Information system management utilization in the library services	Utilized well enough
Knowledge on information literacy in school libraries	Already knew but had not yet possessed the information literacy skills
The use of individual Internet connections in finding information	Quite good
The use of individual Internet connections for sharing information	Rarely done
Possessing and using email address for the exchange of information to coworkers and students	Quite good
Information retrieval guidance with ICT-Based	Did not do nor understand
Problem Solving Model for Learning in Schools	Did not know

NOTE: Preliminary research data was taken in 2013 and its social, cultural, and even philosophical context and impact. The preliminary research found that teacher librarians had sufficient understanding of ICT and ICT was moderately used in school library services.

Knowledge of information literacy in school libraries, information acquisition guidance with ICT-based information, and the problem-solving model for learning in schools are determined as the indicators that should be met by information literate individuals. The results revealed that teacher librarians already knew about information literacy but they admitted that they did not fully employ an appropriate information literacy model in assisting the learning process in school libraries. The teacher librarians have not fully provided information acquisition guidance through ICT in the library because of several factors.

Hancock (2004) argued that when the advantage of information literacy is felt by student and teacher, they will be able to master their study on the process of teaching-learning and the student will not depend on the teacher because they can study autonomously using their competencies in information literacy. The phenomenon can be observed from their appearance and activity in learning environment. Educational student will also attempt to study about some informational source and the usage of informational source. After going through needs of identification and analysis of initial possession on information literacy competencies, a more detailed design of the required course materials was prepared to be mastered by school teacher librarians.

3.2 Designing Information Literacy Competencies

Training that emphasizes enhancing competencies is known as competency-based training. In this context, the competency-based training developed was made relevant with the need to enhance the competencies of teacher librarians. Competency-based training is based on actual tasks of successful workers performance on the job rather than on the text book, course outline, or other such sources removed from the job itself. Basing a training program on the actual job task performed in the occupation will help ensure that students will master the skill that will make them competent workers (Blank, 1982).

In designing information literacy competencies, the initial process was to identify the sources of information and the existing established documents contained in the Culture and Education Ministerial Regulation Number 25 Year 2008, International Federation of Library Association (IFLA), Museums, Libraries, and 21st Century Skills, Indonesia National Work Performance Standards (2012), American Library Association (ALA), The Big Six Model of Information Literacy from Eisenberg and Berkowitz (1990).

The table below provides a document analysis leading to information literacy competencies and the dimensions of their references, based on the operational competency analysis and then developed into course materials (Table 7.2).

After conducting the competency analysis on various theoretical references and regulatory laws in Indonesia, compiling the list of information literacy competencies for teacher librarians was conducted. In the present study, these competencies are called joint competencies, of which their relation to every regulation and theory analyzed are mapped below (Table 7.3).

Table 7.2 Analysis of competencies

<table>
<tr><td colspan="3">Law of regulation</td><td>Description of competencies</td></tr>
<tr><td colspan="3">The Culture and Education Ministerial Regulation Number 25 Year 2008 on the Standards of Chair of School Library in School/Madrasah</td><td rowspan="13">It is stipulated in this law that every teacher librarian needs to pay attention to his or her ability in managing information, starting from preparing sources of information, utilization of information technology, organizing information using Dewey Decimal Classification (DDC), and cataloging which ease users of information services in searching and finding information needed and providing guidance in using ICT at the library, as defined in information management competencies.
The ability of teacher librarians that supports information literacy relates to educational ability. Generally, the head of library is a teacher who lacks teaching hours in the subjects of her/his fields and therefore is given additional task to manage the school library. For pedagogic competency, it has been part of teacher competencies.
Teacher librarian competencies demand collaboration between librarians and teachers in learning so that librarians are required to understand the curriculum used at the level of education being guided which in this case should have been possessed because most librarians are subject matter teachers, giving user guidance or user education in school library, and providing information literacy guidance.
Furthermore, details of development focus of information literacy training consisting of two competency dimensions.
Information Management Competency Dimensions
(a) Managing information
(b) Providing information services and sources
(c) Implementing ICT in the library
Educational Competency Dimensions
(a) Possessing educational insight
(b) Developing information utilization skill
(c) Conducting library promotion
(d) Giving information literacy guidance</td></tr>
<tr><td>Dimension of competence</td><td>Competence</td><td>Parts of competence</td></tr>
<tr><td rowspan="11">2. Information Management Competencies</td><td rowspan="5">2.2 Organizing information</td><td>2.2.1 Creating a bibliographic description (catalog) relevant with national standards</td></tr>
<tr><td>2.2.2 Defining the subject description and using Dewey Decimal Classification (DDC) short edition</td></tr>
<tr><td>2.2.3 Using lists of subject heading in Indonesian</td></tr>
<tr><td>2.2.4 Aligning cards catalog</td></tr>
<tr><td>2.2.5 Utilizing information technology and communication for organizing and tracing information</td></tr>
<tr><td rowspan="4">2.3 Providing services sources and information</td><td>2.3.1 Designing and providing information services, including reference</td></tr>
<tr><td>2.3.2 Organizing circulation services</td></tr>
<tr><td>2.3.3 Having knowledge about the source reference</td></tr>
<tr><td>2.3.4 Giving guidance of using the library for school community</td></tr>
<tr><td rowspan="2">2.4 Applying information communication technology (ICT) tools</td><td>2.4.1 Utilizing ICT in accordance with needs</td></tr>
<tr><td>2.4.2 Guiding school community to use ICT</td></tr>
</table>

3.Education Competence	3.1 Having the capacity of education insight	3.1.1 Understanding the purpose and function of the school in the context of national education	
		3.1.2 Understanding the policy of curriculum development	
		3.1.3 Understanding the library as learning resources	
		3.1.4 Facilitating the participants to learn independently	
	3.2 Developing skills making use of information	3.2.1 Analyzing information needed by the school community	
		3.2.2 Utilizing ICT to facilitate the learning process	
		3.2.3 Helping the community school using source Information effectively	
	3.3 Promoting library	3.3.1 Organizing Library promotion	
		3.3.2 Informing the school community about the new material available in the library	
		3.3.3 Guiding school community to utilize library collections	
	3.4 Giving guidance information literacy	3.4.1 Identifying basic information literacy skills of the users	
		3.4.2 Compiling a guide and material of information literacy in accordance with the user needs	
		3.4.3 Guiding the users to reach information literacy skill	
		3.4.4 Evaluating the achievement of information literacy guidance	
		3.4.5 Motivating and developing reading interest of the school community	
		3.4.6 Creating tips to develop the school library	

(continued)

Table 7.2 (continued)

Law of regulation	Description of competencies
The IFLA/UNESCO, about School Library Guidelines (Saetre, Willars, & IFLA, 2002) IFLA in this context generally consists of library guidance on Mission and Policy, Resources, Staffing, Programmes and Activities and Promotion which include Marketing Policy, User Education and Model for a Study Skills scheme and Information Literacy Program	Analysis on the importance of information literacy in school library can be referred to literacy study implementation program. The indicators after taking the program are as follows: 1. They should be aware of their information needs and actively engage in the world of ideas 2. They should display confidence in their ability to solve problems and know what is relevant information. 3. They should be able to manage technology tools to access information and to communicate 4. They should be able to operate comfortably in situations where there are multiple answers, as well as those with no answers 5. They should hold high standards in their work and create quality products.
ALA Executive Board, about Final Report, Library Education Task Force (Special) (ALA, 2009) This ALA Final Report consists of the Core Competencies Library Education comprising Core Competencies of Librarianship which includes Core Competencies Organization of Recorded Knowledge and Information and Technological Knowledge and Skills, followed revised draft of Accreditation Standards, and Task Force Membership	Referring to the convention issued by American Library Association, information literacy can be described as the followings. **Organization of Recorded Knowledge and Information** (a) The principles involved in the organization and representation of recorded knowledge and information (b) The developmental, descriptive, and evaluative skills needed to organize recorded knowledge and information resources (c) The systems of cataloging, metadata, indexing, and classification standards and methods used to organize recorded knowledge and information. **Technological Knowledge and Skills** (a) Information, communication, assistive, and related technologies as they affect the resources, service delivery, and uses of libraries and other information agencies. (b) The application of information, communication, assistive, and related technology and tools consistent with professional ethics and prevailing service norms and applications (c) The methods of assessing and evaluating the specifications, efficacy, and cost efficiency of technology-based products and services. (d) The principles and techniques necessary to identify and analyze emerging technologies and innovations in order to recognize and implement relevant technological improvements.

Museums, Libraries, and 21st Century Skills (Cogan-Drew, 2010) The 21st Century Skills Framework Adapted for Libraries and Museums consists of Learning and Innovation Skills, Information, Media and Technology Skills including Information Literacy, Media Literacy, Communications and Technology (ICT) Literacy and then, Life and Career Skills	In order to support librarian's effort in the twenty-first century, opportunities to acquire information literacy competencies are required, as referred from Museum, Libraries and 21st Century Skills. Below are the indicators of the competencies. **Access and Evaluate Information** (a) Access information efficiently (time) and effectively (sources) (b) Evaluate information critically and competently **Use and Manage Information** (a) Use information accurately and creatively for the issue or problem at hand (b) Manage the flow of information from a wide variety of sources (c) Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information
Academic Content Standard K-12 Technology, about Information Literacy Standard for Student Learning (1998) In general academic content standard consist of alignment of benchmark and indicators including standard Technology and Information Literacy	Referring to students' need for information literacy in AASL and AECT, there are three aspects that the teacher should pay attention to so that students can acquire these abilities by giving learning opportunities on how to access information effectively and efficiently based on the standards below. *Standard 1*: The student who is information literate accesses information efficiently and effectively *Standard 2*: The student who is information literate evaluates information critically and competently *Standard 3*: The student who is information literate uses information accurately and creatively.
The Big Six Model of Information Literacy from Eisenberg & Berkowitz (1990) The Big6 is widely recognize as conceptual but also practical approach to the design and implementation of information and technology skill instruction in school. It is help people learn essential information and technology skill necessary for success The Big6 approach provides the goals and mean to ensure the student learn and apply information literacy in all they do.	The Big 6 is a six stages process model for information problem solving and decision making. Below are the six stages of the information literacy. (a) Task definition (b) Information Seeking Strategies (c) Location and Access (d) Use of Information (e) Synthesis (f) Evaluation

(continued)

Table 7.2 (continued)

<table>
<tr><th colspan="3">Law of regulation</th><th>Description of competencies</th></tr>
<tr><td colspan="3">Indonesia National Work Competency Standards, Law Number 83 Year 2102
On the stipulation of the design of Indonesia national work competencies in community service, entertainment and other individual sectors of library division become the standards for Indonesia National Work Competencies.</td><td rowspan="15">Indonesia National Work Competency Standards of Library Division is grouped into competency unit list consisting of competency units which include: Group of General Competency Unit, Group of Core Competency Unit and Group of Special Competency Unit. Basic computer operation falls into general competency; conducting simple information searching, doing library promotion, doing information literacy activities, and utilizing Internet network for library fall into core competency units; and conducting complex information searching falls into special competency unit.
There have been Indonesia national work competency standards for library work that should be possessed as they support information literacy needs of library work. There are several criteria in general competencies and training needed to fulfill and strengthen the competencies.
General Competencies
1. Operating computer at basic level
2. Performing simple information searching
3. Conducting library promotion
4. Doing information literacy activities
5. Using Internet network for library services
6. Performing complex information searching</td></tr>
<tr><td colspan="3">Indonesian National Competency Standards</td></tr>
<tr><td colspan="3">Competency Units</td></tr>
<tr><td colspan="3">General Competency Groups (01)</td></tr>
<tr><td>Code Unit</td><td>Title Unit</td><td>Description</td></tr>
<tr><td>PRP. LP01.001.01</td><td>Operating Basic Computer</td><td>This unit of competence is knowledge, skills, and attitudes of work needed to operate computer to support the tasks in the library.</td></tr>
<tr><td colspan="3">Core Competency Group (02)</td></tr>
<tr><td>Code Unit</td><td>Title Unit</td><td>Description</td></tr>
<tr><td>PRP. LP02.008.01</td><td>Doing a Simple Information Search</td><td>This unit of competence is knowledge, skills, and attitudes of work required to perform the service tracing simple information for the user on library.</td></tr>
<tr><td>PRP. LP02.009.01</td><td>Doing Library Promotion</td><td>This competency unit deals with knowledge, skills, and work attitude needed to introduce, disseminate, and utilize resources and library services to the public.</td></tr>
<tr><td>PRP. LP02.010.01</td><td>Conducting Information Literacy Activities</td><td>This competency unit deals with knowledge, skills, and work attitude needed for conducting information literacy activities.</td></tr>
<tr><td>PRP. LP02.011.01</td><td>Utilizing the Internet Network for Library Services</td><td>This competency unit deals with knowledge, skills, and work attitudes needed in using the Internet network to serve the reader.</td></tr>
<tr><td colspan="3">Groups of Special Competencies (03)</td></tr>
<tr><td>Code Unit</td><td>Title Unit</td><td>Description</td></tr>
<tr><td>PRP. LP03.004.01</td><td>Conducting Complex Information Search</td><td>This unit of competence is knowledge, skills, and attitudes of work required to perform activities, search specific information about a subject by means of retrieval information system available inside or outside the library.</td></tr>
</table>

NOTE: Analysis of competency and construction by researcher

Table 7.3 Description of theories underlying joint competencies in information literacy online course

Joint competencies in information literacy online course	Description of theories underlying the competencies
1. Having knowledge of curriculum and instruction at a library.	As referred from Ministerial Regulation Number 25 Year 2008 in the dimension of information organization and educational competencies, information literacy competencies include understanding of curriculum development and learning needs in library.
2. Understanding about information literacy at a school library.	Theories and regulations that serve as references for information literacy competencies on understanding about the concept of information literacy in library were mentioned in Ministerial Regulation Number 25 Year 2008 on Information Management Competencies. In the Academic Content Standard of Information Literacy Standards for Student Learning on information literacy standards 1, 2 and 3 are also supported by the 21st Century Skills on information competence and media and technology skills on the part of information literacy competencies.
3. Applying information literacy model by adapting The Big6™	Understanding the concepts of information literacy proceeds with the application of information literacy model which requires a generic model that can be adapted to provide ease of application. After analyzing several models, The Big6™ of Eisenberg & Berkowitz was chosen, supplemented by International Standards of Library Associations and Institutions (IFLA, 2002), on the Model for Study Skills and Information Literacy Program.
4. Having the skills to utilize ICT at a library	The reference to have the skills of ICT utilization in library is contained in Indonesia National Work Competency Standards (SKKNI, 2012) of general competencies, which are elaborated in the general competency group of basic computer operation and which also firmly refer to American Library Association (ALA, 2009) confirming that librarians must master Standard 4, Technological Knowledge and Skills.
5. Having knowledge on the utilization of non-printed media in school library which in this case in the form of *e-book* and *audio book*	To have knowledge on the utilization of non-printed media in school library which in this case in the form of *e-books* and *audio book* is referred from American Library Association (ALA, 2009) in Standard 3, Organization of Recorded Knowledge and Information.
6. Conducting online search and introducing software use in school library.	Conducting online searching and introducing software use in school library is referred from Indonesia National Work Competency Standards (SKKNI, 2012) on the competency of using internet network for library services.
7. Developing media for library promotion	Developing media for library promotion is referred from Indonesia National Work Competency Standards (SKKNI, 2012) on the competency group of doing library promotion and from the Ministerial Regulation Number 25 Year 2008 in the dimension of educational competencies.
8. Developing web/blog as a form of promotional activity and guidance in complex information search	Developing web/blog as a form of promotional activities and guidance in complex information search is referred from Indonesia National Work Competency Standards (SKKNI, 2012) on the competency group of doing library promotion and conducting complex information search. These competencies are also referred from American Library Association (ALA, 2009) of Standard 4 on technological knowledge and skills. They are also mentioned in the Ministerial Regulation Number 25 Year 2008 in the educational dimension of doing library promotion.

NOTE: Analysis of joint competencies construction by researcher

3.3 *Developing the Course*

It was determined earlier that the training mode would be conducted with the help of information technology using Internet network (online) for the learning activities. Each training participant accesses all materials and does learning activities as well as practices with Internet connection available in school or using personal modem.

In learning the lessons, materials are provided in the form of text and materials are packaged in a portable document format (pdf) and video so they can be downloaded first, if it cannot be studied directly. Patterns of communication between learners and facilitators are made available to ease the study of learning materials. Thus, sufficient time is provided to stay connected with learning materials and online facilitator who are available to assist.

In accordance with the explanation from Jolliffe et al. (2001:9), online training characteristics are similar to web-based learning characteristics for several reasons: (1) learning material consists of text, graphic, and multimedia element such as video, audio, and animation that can be accessed wherever and whenever; (2) the existing of communication application which is real-time and not real-time such as chat-room, discussion forum, and video conference so that the facilitator and the training participants can communicate easily, (3) using web browser (4) storage, cultivation, and material administration are held in web server, and (5) using Internet protocol to facilitate the communication among training participants about training material and other sources.

After deciding upon the training mode, the next step is to determine the learning outcomes and the topics to be studied in detail, patterns of learning material development as well as form evaluation used. These are to facilitate the participants in learning and doing assignment analysis and to make sure the depth and broadness of learning materials. As argued by Dick and Carey (2009), the steps in using instructional technology to produce the instruction typically include guidance for learners, instructional materials, and assessments. The term instructional materials includes all forms of instruction such as instructor's guides, student reading lists, power point presentations, case studies, videos, podcasts, computer-based multimedia formats, and web pages for distance learning.

3.3.1 Achievement of Learning Outcomes and Topics of Course Materials

Establishing the training product begins by determining what will be learned or the content of the materials to be given to training participants. The content of the materials is elaborated in learning goals and description of the scope of the materials in order to facilitate learners in reading and developing comprehension on the materials and achievement of course outcomes as depicted in Table 7.4 below. This is in line with Dick and Carey (2009) statement about component of the system models on instructional design; Identifying instructional goals is the first step to determine

Table 7.4 Achievement of learning outcomes and topics of training materials

Element of competency	Indicators as the ability to	Material course
Possessing the knowledge of curriculum and instruction at school library	(a) Apply the functions of library management to the operational activities of the school library in the technology and information era. (b) Apply the functions of school library to school library service activities. (c) Plan and prepare library collections to support the implementation of curriculum and instruction system. (d) Analyze the role of textbooks as basic instruction of subject materials that interact with other library collections in the learning process.	Curriculum Instruction and The Library
Defining about information literacy at school library	(a) Explain the concept of information literacy (b) Analyze information literacy at library (c) Give information literacy guidance	Information Literacy For School Librarian
Implementing the information literacy model by adapting *The Big6™*	(a) Explain the concept, advantages, and implications of the Big 6™ model. (b) Explain and outline the steps taken to solve the problem of information retrieval by using the Big 6™ model. (c) Apply the Big 6™ model at school library	The Big6™ Model
Possessing ICT utilization skills at school library	(a) Explain the concept of ICT used at school library. (b) Explain automation concept at school library. (c) Apply automation system at each respective school library	Information and Communication Technology (ICT) in The Library
Possessing the knowledge of non-print media usage at school library which in this case include e-books and audio books.	(a) The concept of e-books and audio books as new media of information storage. (b) Explain the technicalities of searching, using, and developing e-books and audio books. (c) Practice searching relevant e-books and audio books on the Internet.	e-Books and Audio books
Online Searching And Software Introduction in The School Library	(a) Explain search engines and websites that can be used in online information searching. (b) The strategies for effective online searching. (c) The information system of school library. (d) Explain the software used at school library. (e) Apply information system software at school library.	Retrieving Online and Introducing School Library Software
Developing library promotion media	(a) Identify the needs of library promotion. (b) Design a library promotion. (c) Develop a media for school library promotion	Media on Library Promotion
Developing web or blog as a form of promotion and guidance activities in the library	(a) Develop a weblog that functions as a personal online journal as a teacher librarian. (b) Use weblog to communicate and exchange information with other teacher librarians.	Making Personal/ Institutional Web blog Library

what new information and skill you want learners to have mastered when they have completed your instruction, expressed as goals. The instructional goals may derive from a list of goals, from a performance analysis, from a need assessment, from practical experience with learning difficulties, from the analysis of people who are doing a job, or from some other requirements for new instruction.

In developing the course materials, the description of each course subject helps learners determine the time needed to study both online and offline. The description of the course materials content for each course subject along with the activity and estimated time to study each material is presented in Table 7.5.

Training activities are set for 2 weeks or 10 working days. The study time of each course training is set online within 1 h, when one course in the curriculum structure is offered to be covered within 3 h, this means the teacher librarian as the learner should take time from starting to access the material, perform all assignments, and submit all tasks, accessing formative tests for 180 min. There is a time given in addition if it is not finished to carry out the assignment on another day, after all the material is opened and submitted by the teacher librarian.

In the 1 day training program is offered for two courses, the teacher librarian can access the full day's web training even if the time is set for only 3 through 6 h, for example of lesson to study the courses. This opportunity is given so that the teacher librarian can access the material and practice more flexibly considering the determinant factor in this training is Internet connection in their respective area. The time table and activities of these courses are shown in Table 7.6.

3.3.2 Patterns of Material Development and Evaluation of Course Subject

The development on the courses' material is in the form of narrative writing in a PDF file format with illustrations to facilitate the participants to understand the lesson. In some materials such as Implementation of Information Literacy Adapting The Big6, and e-Book and Audio Book, participants are given a file for the form of PowerPoint presentations. In addition to the forms of teaching materials, the participants are also given material presentation in the form of video tutorials to make it easier to understand the training materials. Patterns to study the learning materials are also provided along with forms of evaluation as shown in this figure below.

(a) Starting with accessing active materials on each session (Fig. 7.1).
(b) Downloading, reading, and learning course materials (Fig. 7.2).
(c) Completing assignments for checking the achievement of indicators of competencies on the materials learned (Fig. 7.3).
(d) Taking formative test functioning as evaluation tools in materials learning process (Fig. 7.4).

Table 7.5 Content description of each course subject and the estimated time

Description of course subject	Credit hours
Curriculum Instruction and The Library This course subject consists of introductory section which talks about the implementation of managerial functions operated within operational management in library, which includes collection development and building, collection processing and maintenance, service to users, and library administration in supporting library service activities. Afterward, learners will be exposed to library and curriculum content which include curriculum components covering aim, content, model, and evaluation. While library and learning contents deal with relationship between learning components and learning activity process as well as support for library and its collaboration.	3 h in the first day
Information Literacy for School Librarian This course subject consists of explanation of competencies and literacy concept, literacy and information technology, information literacy, and media literacy in school library.	3 h in the first day
***The Big6*™ Model** This course subject covers what and why The Big6, concept of The Big6, stages in The Big6 model, advantages of The Big6 Model, and its implementation in school library which include its implication, role and other ideas related to The Big6 model implementation in learning.	4 h in the second day
Information and Communication Technology (ICT) in the Library This course subject covers technology and library development, the implementation of information technology in library, definition of library automation, goals of library automation, benefits of library automation, components of library automation system in library and concept of Library 2.0	3 h in the second day
E-books and Audio books This course subject explains about the concept and ways to utilize e-Books and audio books, their definitions, new learning sources, format and software used, and how to search and download e-Books. As for audio books, it will be exposed on how to search and download audio books in the world wide web as well as audio book player devices.	3 h in the third day
Retrieving Online and Introducing School Library Software This course subject describes the concept of Internet, search engine, and online search, as well as techniques used in conducting online search, library information system, software used in the library information system, and brief explanation on using and installing open sources in the library system management (SLiMs)	4 h in the third day
Media on Library Promotion This course subject describes the steps of library promotion which include need identification, determining priority scale of promotion, determining promotion goals and target, identifying appropriate method in achieving goals of promotion, identifying sources related to promotion, preparing plans for promotion implementation, conducting promotion and media promotion for school library such as library logo, newsletter, brochure, display and bulletin board, poster, book talk, souvenirs making (bookmarker, bag), creation of advertising media and website.	4 h in the fourth day
Making Personal/Institutional Web Blog This course subject discusses steps and ways to develop personal online journal using word press, which include early stages of creating word press blog such as introduction to dashboard, initial setting of logs, setting blog display, and write and how to publish writing.	6 h in the fifth day

Table 7.6 Courses activities

No.	Day	Material/activity	Credit hour	Kind of activity
Week 1				
1.	Monday	Pre-test and pre-registration of participants		Online access
2.	Tuesday	1. Curriculum Instruction and The Library 2. Information Literacy For School Librarian	3 3	Independent learning Exercise and formative assessment Online access
3.	Wednesday	3. Implement the information literacy model by adapting The Big6™ 4. Information Communication Technology (ICT) in The Library	4 3	Independent learning Exercise and formative assessment Online access
4.	Thursday	5. E-book and Audio books 6. Retrieving Online and Introducing School Library Software	3 4	Independent learning Exercise and formative assessment Online access
5.	Friday	7. Media on Library Promotion	4	Independent learning Exercise and formative assessment
Week 2				
6.	Monday	8. Making Personal/Institutional Web blog	6	Independent learning Exercise and formative assessment Online access
7.	Tuesday	Remedial/collect the assignment and practical tasks		Online access
8.	Wednesday	Remedial/collect the assignment and practical tasks		Online access
9.	Thursday	Post-test		Online access
10.	Friday	Announcement of training results and send the email of learning achievement for each participant's		Online access
Total training hours			30	

NOTE: Researcher site http://p2m.risettekpend.org/silabus.php

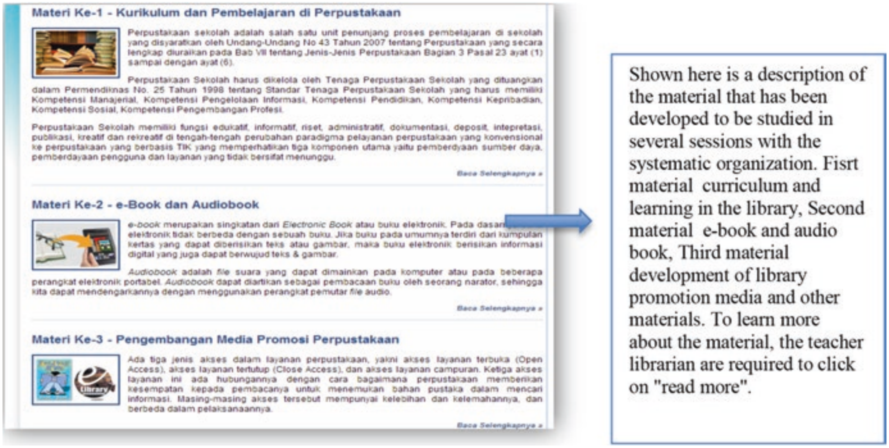

Fig. 7.1 Accessing active material (only to participants with an account: http://p2m.risettekpend.org)

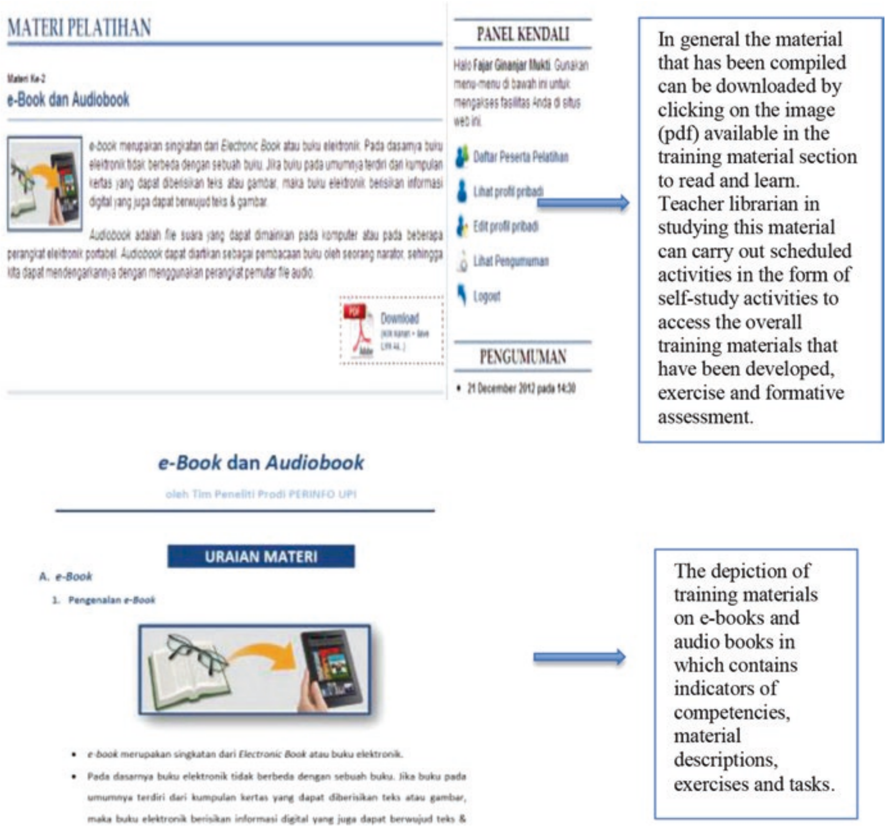

Fig. 7.2 Learning material and content material

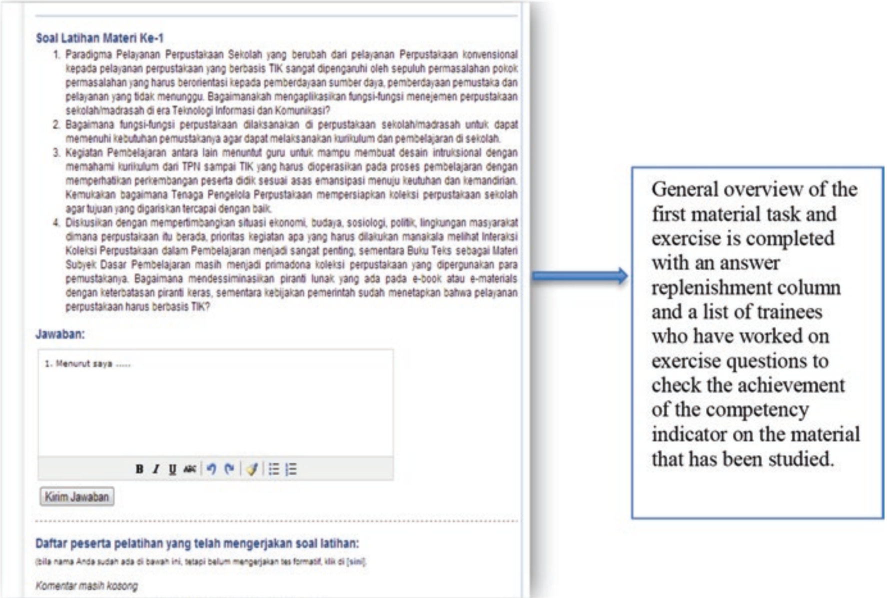

Fig. 7.3 Task and assignment

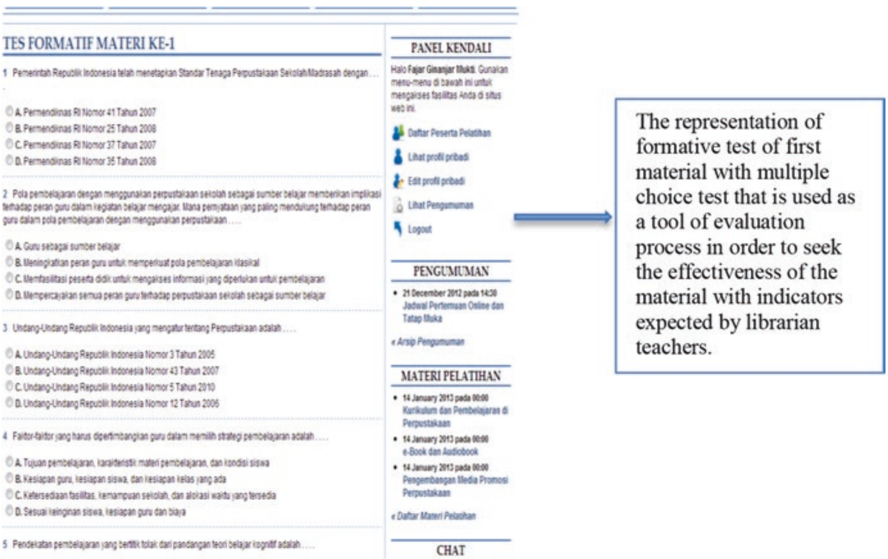

Fig. 7.4 Formative evaluation

4 Conclusions

This research has resulted in the description of the need for the development of information literacy competence for teacher librarians. The competency analysis was completed to produce course materials related to the competency topics in an effort to overcome the problems in learning in the twenty-first century: a necessary competence that must be owned is information literacy.

Information literacy course materials that developed from this research are Curriculum Instruction and The Library, Information Literacy For School Librarian, Implement the information literacy model by adapting The Big6™, Information Communication Technology (ICT) in The Library, E-book and Audio books, Retrieving Online and Introducing School Library Software, Media on Library Promotion, Making Personal/Institutional Web/blog.

The design of the course material begins by establishing a learning outcome, followed by clear and complete course content, the process of learning the material and developing an integrated evaluation tool that fits a program's needs, specific, measurable, and realistic learning objectives.

Acknowledgments This research is part of the writer's thesis in doctoral studies and was funded by community service grant from the Indonesia Directorate General of Higher Education 2013. Writer's gratitude to Prof. J. M. Spector, Prof. Atwi Suparman and Prof. Kay Persichitte who have given an opportunity to publish this article in the edited volume from ETWC Conference 2016.

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Chapter 8
Effects of Role-Play for Problem-Solving Skills and Engagement in Online Forums

Jackie Hee Young Kim

Abstract The body of research found that it is difficult to improve the quality of an online discussion experience because of the affordances and the limitations of asynchronous online communication technologies (An et al., Comput Educ 53: 749–760, 2009; Bachner, Cases on critical and qualitative perspectives in online higher education. Hershey, PA: IGI Global, 2014; Dennen and Wieland, Dis Educ 28(3): 281–297, 2007; Rourke and Kanuka, J Dis Educ 23(1): 19–48, 2009; Thomas, J Comput Assist Learn 18: 351–366, 2002). To address this issue, this study investigated an instructional strategy to increase engagement using a collaborative role-play online discussion where students assumed different roles. This study aimed to assess the quality of interaction by means of the Interaction Analysis Model (IAM) for examining social construction of knowledge and of learning experiences of teachers during computer conferencing designed to learn problem-solving skills. Two major models guided the study: Problem Solving Approach Model (Branford and Stein, The IDEAL problem solver: A guide for improving thinking, learning, and creativity. New York, NY: Freeman, 1993) and Interaction Analysis Model (IAM) for Computer-Mediated Communication rooted in social constructivist theory (Gunawardena et al., J Educ Comput Res 17(4): 397–431, 1997). After analyzing the progress of the discussion transcripts, this study found that the role-play discussion constructed better knowledge socially and improved higher mental operation. The threaded discussion **postings** from four **structured online debates** showed that the algorithmic format of problem-solving steps promoted and were closely interrelated to five phases of IAM. The study also found that this problem-solving exercise through computer-mediated communication helped teachers be equipped with a frame of reference to the problems, which resulted in helping teachers to establish boundaries, name problems, form opinions, and uncover solutions (Entman, J Commun 43(4): 51–58, 1993; Goffman, Frame analysis: An essay on the organization of experience. London: Harper and Row, 1974). This study will benefit online instructors as well as instructional designers who strive to find ways to make online discussion engaging.

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K.A. Persichitte et al. (eds.), *Educational Technology to Improve Quality and Access on a Global Scale*, Educational Communications and Technology: Issues and Innovations, https://doi.org/10.1007/978-3-319-66227-5_8

1 Introduction

With the proliferation of Web-based learning, online discussions have become one of the major means of supporting student learning in online environments (Joeng, 2003; Thomas, 2013). Ensuring the quality of online participation has been one of these challenges because students may fail to engage in deep conversations and provide thoughtful and reflective contributions related to discussion requirements (Dennen & Wieland, 2007). An online discussion requires different pedagogical approaches from the face-to-face discussion because of the affordances and the limitations of asynchronous online communication technologies. The design and development of online discussions that create meaningful learning activities challenge online instructors who are not familiar with the nature of the online discussion. According to Harasim (1993), the key differences between online and face-to-face discussions are time and place dependence along with the richness and the structure of communication.

Researchers believe that asynchronous online discussion forums could provide ideal environments for the social constructivist mode of learning, where the learners actively and continuously negotiate and construct meanings in the social context (Jonassen, 1991; Kanuka & Anderson, 1998; Oztok, Zingaro, Brett, & Hewitt, 2013). More specifically, asynchronous online discussion forums support a more decentralized and collaborative learning environment, where the teacher acts as a facilitator and students take responsibility for their own learning (Jonassen, Davidson, Collins, Compbell, & Hagg, 1995).

Discussion in online courses, however, typically falls short of this ideal (Rourke & Kanuka, 2009). While the majority of online courses rely on discussion boards to facilitate learning, the learning mechanism of the online discussion is too limited to encourage organic conversation that emerges between students and between students and the instructor. Responding to prompts, which are a dominant way of using online discussion boards, frequently takes the place of response papers. The quality and quantity of online discussions are limited to a two-to-three-paragraph response to the prompt after relying on the assigned readings and resources. The comments by students are generally polite and tend to express agreement with one or more points made by the other online students (Bachner, 2014). Students participating in asynchronous online discussion do not automatically interact to construct knowledge (An, Shin, & Lim, 2009; Thomas, 2002), and they make limited efforts to extend and deepen the conversation by building upon others' ideas (Hara, Bonk, & Angeli, 2000; Larson & Keiper, 2002). The focus of online discussion, therefore, often remains at surface levels, such as sharing or comparing information, seldom delving to deeper levels that involve negotiating meanings, synthesizing or applying newly acquired knowledge (Davidson-Shivers, Luyegu, & Kimble, 2012; Gunawardena, Lowe, & Anderson, 1997; Moore & Marra, 2005; Wegmann & McCauley, 2008). If the goal is for students to engage in more dynamic and meaningful conversation, an alternative approach is needed.

The purpose of this study is to increase the quality of interaction by means of Interaction Analysis Model for examining social construction of knowledge and of learning experiences of teachers during computer conferencing while learning problem-solving skills. The study uses the case-based Internet discussion as a tool that fosters problem-solving skills, reflection, and communication for novices (i.e., teachers). In this study, the case-based problem-solving approach stems from the IDEAL approach advocated by Branford and Stein (1993). Interaction Analysis Model (IAM) for Computer-Mediated Communication, rooted in social constructivist theory (Gunawardena et al., 1997), was adopted to assess the quality of interaction. The research project developed an online instructional strategy, which is designed to increase engagement of a collaborative discussion where students assume different roles: team facilitator, problem identifier, strategy analyst, solution implementer, and reflection debriefer. This algorithmic discussion approach was expected to increase students' higher level of thinking to understand the complex nature of teaching and increase their competence in solving problems through gaining the frame of reference to a problem.

Online discussions are generally designed for meaningful, engaging social interaction that leads to students' learning. However, interaction alone does not necessarily mean that students are constructing knowledge or engaging in higher levels of thinking. An asynchronous online discussion should go beyond social interaction to include knowledge construction (Dennen & Wieland 2007; Garrison and Cleveland-Innes 2004; Knowlton, 2001). Then there is a need for a study that tests an online interaction design that fosters a higher level of engagement and a higher level of mental operation.

Thus, this research project attempted to use the asynchronous feature of the Internet, which offers multiple opportunities for students to interact, question, reflect, negotiate issues as a community of practitioners, and generate strategic, tacit knowledge based on their real-life experiences. To achieve these goals, an instructional strategy for discussion, role-playing, was developed to encourage students' structured discussion where student teachers build sound, situated, case-based knowledge about pedagogical methods, students, content, and curriculum for classroom situations. Research suggested that knowledge construction happens when learners make sense of their experiences through interaction with others and constantly restructure and test their mental structures when faced with ideas that contradict those structures (Driscoll, 2000; Osman & Herring, 2007). Making sense of students' experiences was to be achieved through the interchange of questions and reflections about learners, pedagogy, and teachers' instructional and classroom management behavior, between and among students. Constantly restructuring and testing their mental structures is essential for making sense of the complexity of the social macrocosm of classrooms and schools. Thus, specific ways to foster such interchange among students needed to be explored and described.

This paper investigates the nature of the dialogic processes generated among students in an online discussion group. This study is guided by the following research questions:

- How do teachers perceive the advantages and the disadvantages of using online role-play discussion for engaging in collaborative problem-solving?
- Does the problem-solving discussion method serve as an instrumental tool to foster a higher level of mental operation through discussion among teachers?

2 Theoretical Framework

2.1 Collaborative Problem-Solving Approach and Web-Based Learning Environments

Since learning to teach is far from a simple process and is predominantly associated with ill-structured problems, teacher educators need to seek a way to help teachers build the ability to locate, understand, and respond to the dense and multi-faceted problems of the classroom. Web-based learning environments may be well suited for the teaching and learning of ill-structured and complex skills such as problem-solving. Gagne (1985) used the term problem-solving to describe a higher-order intellectual ability and a way of learning. All of these usages have implications within teacher education. Problem-solving is clearly seen as a teaching method with links back to experiential learning. Gagne (1980) also said, “The central point of education is to teach people to think, to use their rational powers, to become better problem-solvers.” Further, the scientific method of hypothesis generating and testing is certainly at the heart of technological problem-solving. In this study, because of the implications for teacher education, “problem-solving” was limited to two usages. First, “technological problem-solving” refers to the systematic way of investigating a situation and implementing solutions. Second, the “problem-solving approach” is used to describe a teaching method that encourages the development of new insights and useful thinking processes through active investigative learning.

In a Web-based environment, a more systematic learning setting can be created where learners access to a vast amount of peers’ experiential experiences and record a great deal of the discussion content for further reflection on and internalization of the discussed materials. According to Laffey, Tupper, Musser, and Wedman (1998), computer-mediated learning on the World Wide Web is suitable for problem-based learning because it provides ample resources, allowing students to do their own planning and present new forms of knowledge, which expand the mechanisms for collaboration and communication. Miller and Miller (2000) suggested that the characteristics of the Internet environment, which provides a hyperlink structure with easy access to relevant information, realistic and enhanced media, and synchronous communication capabilities, make it an effective learning environment for complex skills.

As an effort to develop an online instructional strategy to develop students’ problem-solving and reflection skills, this study adapted the problem-solving approach, particularly the IDEAL approach, advocated by Branford and Stein

(1993). The IDEAL approach was chosen because its active, investigative learning characteristic allows teachers to learn a framework of approaching problems in a five-step iterative process. This algorithmic process leads students to develop a useful thinking process, which is a way of learning that generates new insights about their practice (Gagne, 1985). The five steps of the IDEAL approach are: (1) *I*dentify problems and opportunities; (2) *D*efine goals; (3) *E*xplore possible strategies; (4) *A*nticipate outcomes and act; (5) *L*ook back and learn. The teachers located their problematic cases and looked for the strategies consistent with their goals both in the literature and with their peers.

This research focus of role-playing strategy is based on collaborative learning environments. Research suggests that a collaborative learning environment can positively affect performance on problem-solving tasks (Flynn & Klein, 2001; Johnson, Johnson, & Smith, 1991; Spector & Davidsen, 2000). Collaborative learning is defined as “an activity that is undertaken by equal partners who work jointly on the same problem rather on different components of the problem” (Brandon & Hollingshead, 1999). In several studies conducted to analyze the impact of a collaborative environment on problem-solving, collaboration was found to improve performance on complex or higher-order thinking activities (Johnson & Chung, 1999; Mergendoller et al., 2000). Research indicates that the quality of interaction between learners in a computer-mediated environment may actually be better than interaction in a face-to-face environment. Findings in a case study suggested that computer-mediated groups seemed to put more thought into the comments they made, thus providing higher quality responses than students who worked face-to-face (Camin, Glicken, Hall, Quarantillo, & Merenstein, 2001). Hillman (1999) also found that the interaction patterns of computer-mediated groups resembled thoughtful discussions, whereas face-to-face interaction resembled recitations. And in another study where computer-mediated communication was compared to face-to-face interactions, findings suggest that, in the computer-mediated environment, there was a tendency to share ideas without the restraints of typical social conventions, which resulted in deeper and more thoughtful discussions (Kruger & Cohen, 1996). In the same vein, Markel (2001) also asserted that the advantage of online discussion lies in allowing students time for reflection.

2.2 Social Construction of Knowledge and the Interaction Analysis Model

This study is based on Pea’s (1993) argument that knowledge is commonly socially constructed through collaborative efforts toward shared objectives or by dialogues and challenges brought about by differences in a person’s perspectives (p. 48). Smith (1994) argued that Vygotsky’s (1978) distinction between lower and higher mental functions can be applied to a group’s collaborative skills. The group created their own mechanism to interact to accomplish their learning goals, and they are going through a process in which knowledge or ideas are constructed, negotiated, and improved. The successive stages students went through resulted in forms of higher mental functions.

Researchers continue to further develop and use multiple analysis frameworks to assess the quality of discussion. Clark and Sampson (2008) developed and employed an analytic framework for assessing argumentation in online science courses that examined levels of opposition, discourse patterns, use of evidence, and conceptual soundness. Clark and Sampson (2008) assessed the individual comments in terms of discourse moves, grounds quality, and conceptual quality. Hull and Saxon (2009) detected higher mental processes and more sophisticated interaction patterns than previous frameworks, which may mean the evaluation framework they employed is more elaborate. Heo, Lim, and Kim (2010) employed both social network analysis and content analysis to evaluate levels of interaction and knowledge construction in project-based learning environments. Heo et al. (2010) and Lang (2010) also assessed online discussion based on the framework that measures the following phases of mental operation: sharing/comparing of information, discovery of dissonance, negotiation/co-construction, testing and modifications, and applications of newly constructed meaning. This framework is based on the model developed by Gunawardena et al. (1997) for measuring social interaction patterns. Lang (2010) examined interaction in project-based learning environments at the high school level using asynchronous discussions. This evaluation of discourse focused on information exchange, knowledge construction, and negotiation.

Hull and Saxon (2009) also coded the online interaction with the following categories: direct instruction, sharing new information, situated definition, intersubjectivity, negotiation/co-construction, testing tentative construction, and reporting application of knowledge. Shea et al. (2011) used both the community of inquiry framework and learning outcomes taxonomy to evaluate online asynchronous discourse. Akyol and Garrison (2011) employed transcript analysis to assess cognitive presence in both online and blended communities of learning. Another approach for cognitive presence evaluation is based on Bloom's taxonomy (Valcke, De Wever, Zhu, & Deed, 2009). This approach used Bloom's taxonomy as a scripting tool including the following items: (a) elaborating and clarifying (EC), (b) making connections (MC), (c) challenging (CH), (d) building (BLD), and (e) questioning (QST). The table below summarizes different aforementioned analysis models (Table 8.1).

To measure the effectiveness of the collaborative problem-solving approach to increase higher mental function, this study employed the interaction analysis model designed by Gunawardena et al. (1997). The model describes co-construction of knowledge as five progressive phases. They are sharing, comparing of information; discovery of dissonance; negotiation of meaning/co-construction of knowledge; testing and modification of proposed synthesis; agreement/application of newly constructed meaning. Each phase consists of a number of operations such as stating an observation or asking questions. The Interaction Analysis Model, therefore, begins with what could be described as lower mental functions (the sharing and comparing of information) and moves through cognitive dissonance to higher mental functions.

Table 8.1 Online discussion quality analysis models

Models	Lang (2010)	Hull and Saxon (2009)	Valcke et al. (2009)	Heo et al. (2010)	Gunawardena et al. (1997)
contents of discussion analysis	information exchange, knowledge construction, and negotiation	direct instruction, sharing new information, situated definition, intersubjectivity, negotiation/co-construction, testing tentative construction, and reporting application of knowledge	remembering, understanding, applying, analyzing, evaluating and creating	sharing/comparing of information, discovery of dissonance, negotiation/co-construction, testing and modifications, and applications of newly-constructed meaning	sharing/comparing of information, discovery and exploration of dissonance or inconsistency among ideas, concepts, or statements, negotiation of meaning/co-construction of knowledge, testing and modification of proposed synthesis or co-construction, agreement statement(s)/applications of newly constructed meaning

2.3 Situated, Case-Based Knowledge Context

This study also is grounded in situated, case-based instruction. For each case, students had to take five steps that were specifically targeted to individual cases. A case was a product of the five steps of the IDEAL approach. The specific case that student teachers located became a situated, authentic activity of student teaching. Authentic activity is central to both gaining situated knowledge and transitioning into the culture of a community (Brown, Collins, & Duguid, 1989; Lave & Wenger, 1991).

The situated nature of cognition and knowledge, used to explain how people learn and think, has gained widespread acceptance. Situated knowledge is inextricably tied to the contexts and cultures in which it is used (Brown et al., 1989). Practicing teachers, for example, develop their knowledge about pedagogical methods, students, content, and curriculum for classroom situations through repeated classroom teaching experiences and interactions with teachers (Leinhardt & Greeno, 1986; Shulman, 1986). From a situated cognition perspective, individual communities construct their practices, meanings, identities, and beliefs through shared activities (Brown et al., 1989). Novice teachers, who have taught <5 years, took advantage of collective dialogues and sharing experiences as a community. These sharing experiences helped teachers construct meaning for their own practice from others' experiences. Community members, therefore, do not only understand and reproduce practices through participation; they also change practices: "The generality of any form of knowledge always lies in the power to renegotiate the meaning of the past and future in constructing the meaning of present circumstances" (Lave & Wenger, 1991, p. 34).

Locating specific problematic cases required reflective moments from students. Students had to step back and look at their practice to identify what was really happening. Therefore, locating cases were closely relevant to their practice. A case, a written, problem-based account of an on-the-job teaching dilemma (Shulman, 1992), led student teachers to an active-learning for problem analysis and problem-solving, gaining a variety of viewpoints (Cranston-Gingras, Raines, Paul, Epanchin, and Roselli 1996). There is increasing anecdotal and some empirical evidence that case-based instruction improves a novice teacher's classroom decision-making and problem-solving skills with diverse groups.

As students gain experience and have more complicated cases, case knowledge becomes richer, enabling them to build a personal "case library" (Kolodner, 1993, p. 141). Metaphorically speaking, a case library organizes and indexes conceptual case knowledge according to key concepts, values, and practices of a community. As prospective teachers gain experience and refine individual case libraries, they gain increasingly contextualized understanding about teaching practices. Accordingly, expert teachers' (e.g., cooperating teachers and university supervisors) conceptual case knowledge may be embodied within cases and made accessible to novice teachers.

3 Research Methods and Data Sources

A mixed methods study was employed to capitalize on the strengths of both quantitative and qualitative methods (Greene, 2007). The major data sources for this study were online discussion posting transcripts, descriptive survey data about the effectiveness of online forums of the course, and online discussion data. For the qualitative data, a modified version of typological analysis outlined by Hatch (2002) guided our analysis. In this study, the categories for typological analysis represent the five phases of interaction outlined by Gunawardena et al. (1997).

3.1 Context

The subjects of this study are five graduate students who were enrolled in the Master of Education in Reading Specialist Education program and five undergraduate students who were in an initial certification program in a College of Education at a public university on the East Coast. Graduate students were teachers of record who were experienced in taking a fully online master's program. Undergraduate students were student teachers who participated in the study in the context of the blended format of internship. To strengthen students' problem-solving skills through social interaction, students were asked to identify the problems, solutions, and implementations of their practice. In the syllabus, the professor (author) assigned the roles to play each week and asked students to post the weekly discussion topics based on the steps of the IDEAL approach advocated by Branford and Stein (1993). Each group developed case studies related to the content covered in the course. Members rotated to a different role for each case study. Students utilized the group discussion thread to execute this discussion. Each group wrote a detailed report of the progress and results of the group-determined goal for their class following the steps of IDEAL.

Students had a collaborative working group of their own that consists of the following roles: team facilitator, problem identifier, strategy analyst, solution implementer, and reflection debriefer. Each group developed four case studies related to the content covered in the course. Members rotated to a different role for each case study. These roles should be rotated after solving each case, which should not take longer than 3 weeks. A minimum of five cases should be conducted.

1. Assigned role of each team member:

   (a) *Team Facilitator*: The team leader facilitated the team activities, coordinated the online meetings, led the efforts for all to review, and edited the final draft of the Solutions Report. This person developed a schedule so that all of the team members' documents are sent to her/him by a specified date in order to consolidate all of this information into one document, the Solutions Report, which will be reviewed and edited by the team before she/he submits it to the discussion board as the group assignment. Then this person developed a succinctly written yet thorough and engaging synopsis report of the team's analysis of the case study. This person submitted this synopsis as a post in a related D2L discussion topic. D2L stands for Desire2Learn, which is the university's online management system. All of the team members of this group were responsible for facilitating the discussion by responding to other students' posts to carry on the discussion, asking questions that may further the discussion, and providing additional references, when needed. The team leader also checked to ensure that each member proceeds in her or his role in a timely manner.

(b) *Problem Identifier*: The problem Identifier solicited the problem or improvement plan from the group members. The problem should be related to content literacy instruction. The located problem should be submitted to discussion board.

(c) *Strategy Analyst*: The strategy Analyst searched the instructional strategies in peer-reviewed articles, online resources or the textbook and secured an agreement from the group to use one or two strategies in the real-life classroom. The instructional strategies were submitted in the discussion board.

(d) *Solution Implementer*: This person implemented the suggested strategy in her or his own classroom and shared the results of implementation with the group members in a video format. The instructor gave options to choose technology tools including Voicethread presentation, Glogster presentation, a narrated PowerPoint presentation, Pawtoon presentation, Narrated Prezi presentation, or Screencast-O-Matic presentation.

(e) *Reflection Debriefer*: This person collected the reflections from the implementer and incorporated the implementer's reflections with her or his own for the entire case study in D2L discussion.

All of the team members of this group were responsible for facilitating the discussion by responding to other students' posts to carry on the discussion, asking questions that may further the discussion, and provided additional references, when needed. All students reviewed the group case study synopsis posts submitted by the other groups and compared and contrasted the viewpoints, approaches, and course materials/references used to provide solutions.

To examine the quality of interaction, this study examined teachers' discussion postings by using the Interaction Analysis Model (IAM). The IAM analyzes the online discussion by using five phases: (1) sharing and comparing of information; (2) discovery and exploration of dissonance or inconsistency of advanced teaching strategies; (3) negotiation of meaning/co-construction of knowledge; (4) testing and modification of proposed strategies or co-construction; (5) metacognitive statements/applications of newly constructed meaning.

4 Findings

Five steps of the IDEAL approach promoted a high level of mental operation because the IDEAL steps were closely interrelated to higher phases of the Interaction Analysis Model, which categorized the level of mental operation.

Table 8.2 Comparison of percentage of incidents

Phases	Gunawardena et al. (1997) (%)	Kim, Julie, and Cho (2015) (%)
Phase I	93	35
Phase II	2	23
Phase III	2	15
Phase IV	2	4
Phase V	2	31

When measuring the level of mental operation in online conferencing among professionals, Gunawardena et al. (1997) could not find a high level of mental operation even though they strived to increase the mental operation level with effective moderators. They concluded that it was difficult to arrive at an adequate judgment of the quality of an online learning experience by the application of a single method. They considered having better moderators who could lead the debate skillfully. However, this study found that higher mental functions of social construction of knowledge appeared throughout the postings in analyzing the progress of the entire discussion transcript.

One major finding of the study was that online discussion design promoted higher mental operation compared to the discussion methods without a role-play approach. In the study that Gunawardena et al. (1997) conducted, they used indirect support to improve the quality of discussion, but this study asked for high mental operation by using the IDEAL approach. The IDEAL approach directly asked higher-level cognitive operation questions. The following table reported different levels of mental operation between the Gunawardena et al. study and this study. Even though Phase IV (testing and modification of proposed strategies or co-construction) still rated as low as 4%, both Phase III and Phase V rated at a much higher percentage in this study compared to the Gunawardena et al. study (Table 8.2).

4.1 The Effects of Online Discussion Design Models

I found that our online discussion design was more effective to increase higher mental operation. We used the traditional way of managing discussion activities by asking students to write about the topic and respond in other online courses. This approach led to results similar to the Gunawardena et al. (1997) study. In the Write and Respond approach, the majority of discussion remained in the Phase I level. We also used a discussion design that asked one student to follow the IDEAL steps (Kim & Lee, 2013), which required students to wear all hats for a problematic case. This method increased higher mental operation better than the Gunawardena et al. study. However, assigning roles to different students increased the robustness of online discussion as well as the higher mental operation. Students learned how to play each role by observing others handing the roles. This study found that students' wearing one hat at a time for the IDEAL approach increased the social construction of knowledge by observing others and solving problems collectively.

4.2 Interaction Patterns

I also found the different interaction patterns that the problem-solving discussion created. The Write and Respond discussion method encouraged one-to-many and many-to-one interaction, which are two-way interactions. Wearing all hats for the IDEAL approach also created one-to-many and many-to-one interaction. However, wearing one hat at a time for the IDEAL approach created many-to-many interaction, which is not a two-way interaction, but a multiple-way interaction.

4.3 Students' Perceptions of Role-Playing

Sally (pseudonym), one of the graduate students, noted that the problem-solving discussion "provided meaningful activities to her." She appreciated the interaction opportunities that the problem-solving discussion offered throughout the semester. She reported that "We got together at the beginning of the semester to choose three or four topics to work on. We brainstormed together and talked about it throughout the semester as a team."

Students exchanged email addresses and phone numbers at the beginning of the semester, then constantly exchanged emails and text messages. The text messages were pages after pages reminding about deadlines and discussion of instructional strategy successes and problems. Sally shared her experiences of interacting with classmates: "I tried it out with my students. It is not working. We need to come up with other ways of doing it. We worked together as a team constantly communicating and providing feedback. It appeared that we worked as a team." She believed that team play was the key to success in learning through online discussion. When asked to compare the problem-solving approach with the Write and Respond method, she noted that "It (problem-solving approach) is more engaging and made us learn from each other."

Students also noted that they gained a frame of reference to a problem so that they learned how to respond when faced with a problem in their classroom. The collaborative role-playing activity helped students equipped with a frame of how to grapple with problems. They developed ways of seeing and making sense of their problems. Eventually they were able to name problems, form opinions, and uncover solutions (Entman, 1993; Goffman, 1974).

Another key effect of role-playing in an online environment was to build a community of learners. A student-to-student communication scheme of online discussions—synchronous or asynchronous—played the major role as a tool to develop a learning community (Choi, 1999; Park & Kim, 2000). The responsibility of playing different roles created a sense of collaborative group responsibility, which led to building a learning community beyond the online classroom. Students are in the loop to exchange important information, such as changing plans and reminding about deadlines. Through collaborative discussion practice, students seemed to expand their ability to locate, understand, and respond to the dense and multi-faceted problems of the classroom. In qualitative feedback about teaching effectiveness at the end of the semester, students commented about numerous effective factors. The students' feedback can be summarized as: (1) being able to conduct deep conversation; (2) collaborating with colleagues; (3) discovering different perspectives; (4) finding peers as valuable resource providers; (5) feeling better with what they do; (6) learning how to approach a problem; and (7) learning from one another in a situated context. Learning from one another in a situated context was remarked as the most valuable aspects of the course. The summary of the students' comments on role-playing is in the table below (Table 8.3).

Table 8.3 Comments on role-play approach

Theme	Description	Examples
Deep conversation	Comments about the quality of interaction	Even if we can converse in the hallway, there is no way that we can have a deep conversation.
Teacher-to-teacher interaction	Comments about interaction opportunity	A great tool to begin conversations and to get others' opinions.
Situated interaction	Comments about interaction with people who are in the same situation	I enjoyed talking to people who are in the same shoes. It was good to know I am not only one who was struggling. It was easy to complain to peers about the class.
Different approaches to problems	Comments about interaction with people who show different perspectives	I have gained a new way of looking at a solution I would have not thought about. I have learned the perspectives of other interns. It gives me an insight into what others in my position are experiencing and how they have dealt with similar issues. We all listed the same problem, but all had different solutions.
Valuable human resources	Comments about interaction instrumental to gain best practice	I am able to try something that other teachers have already used and found successful. Or I may not do something that an intern has done and found to be unsuccessful. I learned that peers could be wonderful resources. I enjoyed talking about what works and what does not and how to handle it. We can learn from each other. My cooperating teacher was very resourceful so I had so many resources, but Amanda did not have many. We talked and shared resources.
Relief catalyst	Comments about interaction necessary for emotional support	I felt better after reading others' postings. I was not the only one to have a problem. We all listed the same problem. I have learned that I am not the only student teacher that faces the problems that I face. We share ideas, information, and feedback. My problem was their problem.

(continued)

Table 8.3 (continued)

Theme	Description	Examples
Frame of reference	Comments about interaction beneficial to equip a frame of reference to a problem	My main approach (to a problem) would be to go through the IDEAL approach. Every step is needed to solve a problem. We wrote something that we would not say face-to-face. The IDEAL approach allowed me to evaluate myself and evaluate research-based strategies. Those are things I might skip without knowing the five steps of the IDEAL approach. The IDEAL approach made me think about the problem slowly. I learned to approach a problem in a more systematic way. The IDEAL approach taught me to go through steps to fix the problem. It seemed very instructive about how to solve problems since it breaks down the problem. The IDEAL approach gave me a systematic view of an approach to the issue. We have to have an outline to solve a problem. I need to step back and think about what is the problem and what is my goal.

4.4 Collaborative Construction of Knowledge in Online Forums

In this proposal, we showcased the brief version of interaction analysis for examining social construction of knowledge. Analysis of the discussion transcripts indicated that the majority of postings occurred at Phase 1, Phase 2, and Phase 5. Indicating fairly high quality, as several participants were involved in exploration of dissonance or the negotiation of meaning and co-construction of knowledge (Table 8.4).

5 Conclusion

This study offered insight on how online educators use algorithmic, collaborative role-playing through computer-mediated communication (CMC) to help teachers create engaging, goal-oriented discussion and lead students to build a framework to address issues by “naming the problem, setting boundaries of attention to it, and imposing coherence to provide directions for change” (Achinstein and Barrett 2004; p. 719). This study further confirmed that online discussion design could promote higher mental operation if the discussion method is well structured to lead

Table 8.4 Examples of the five phases in students' posts

Phases	Examples
(1) Sharing and comparing information	I am having difficulties with some students' misbehaviors. I am in a kindergarten classroom where many disabilities and disorders have not yet been diagnosed and, as a result, the classroom environment suffers.
(2) The discovery and exploration of dissonance or inconsistency or advanced teaching strategies	I found many good research articles on how to deal with behaviorally difficult children but the best one was from a woman named Melissa Myers. I found some great ones that speak about using visuals and pictures to teach literacy. I am a visual learner myself and I believe many of my students are as well and using hands-on visual aids really help my students when learning a new skill.
(3) Negotiation of meaning/co-construction of knowledge	We can't teach general second grade ELA content to everyone until we get everyone where they're supposed to be.
(4) Anticipate outcomes and act	As the implementer of Case Study #3, I was charged with testing the hypothesis: Does teaching reading through other content areas help students in the classroom? I decided to connect a Social Studies lesson with teaching the reading strategy: *summarizing*. My co-teacher partner and I have worked very hard this year. The majority of the students in our class (96%) came to us at the beginning of the year reading on a first grade level. Since the beginning of the year, all but one student has shown gains in their SRI scores. However, we still have a long way to go. I will implement this this week and will have the write-up as well as the results no later than Friday.
(5) Look back and learn	Despite the fact that the results of the quiz were low, they are not disappointing to me. In order to create a level playing field, both groups were given the same quiz, with no accommodations. Both groups enjoyed the lessons and showed that they comprehended the information during the lessons, but had a difficult time understanding the grade level vocabulary and reading the questions on the quiz. The result of the study is considered inconclusive. However, my personal opinion is that integrating reading through other content areas does have a positive effect on students.

meaningful dialogue. If Gagne's (1985) notion that problem-solving is a higher-order intellectual ability is valid, it make sense to utilize problem-solving steps for raising the level of mental operations. This research confirmed that problem-solving steps helped students improve the quality of discussion. Students further gained a frame of reference to a problem so that they learned how to face with a problem in their classroom. Through investigative discussion practice, students seemed to expand their ability to locate, understand, and respond to the dense and multi-faceted problems of the classroom. The case-based approach in the role-playing activity also increased active engagement in discussion, which many studies found difficult to achieve in online discussion due to its linear nature of interaction. Because students are required to work with situated cases in their classroom, discussion content became closely relevant and experiential to their practice, which made the patterns of interaction evolving and divergent even outside the online classroom.

Students employed text messages as another, dominant communication channel to discuss their cases beyond the discussion board embedded in the online course.

To develop necessary problem-solving skills, structured training is required. Role-playing activity incorporated with the IDEAL approach allowed students to learn ways of solving problems, which is requisite to the teaching profession. The chief advantage of the online role-play model was to build a community of learners in which students contributed their teaching experiences to their peers' experiential knowledge. Students also benefited from their peers' perspectives and knowledge in broadening their parameter of teaching. Hopefully, this study will guide us in constructing effective online discussion design in higher education.

Acknowledgments I would like to express my gratitude to Mr. Greg Dzuiban for providing solid proofreading tirelessly in the process of editing the manuscript. I also would like to thank my students who participated in my study for providing me with the honest and detailed reflection on their experiences of taking my course. Without their help, this chapter will be not in print.

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Chapter 9
Predicting Student's Re-enrollment in an Open and Distance Learning Environment

Sugilar

Abstract Due to a wide range of flexibilities, student re-enrollment has become increasingly complex in an open and distance learning environment. Students are exposed to numerous factors that include their participation in learning support devices, academic attainment, and personal attributes in terms of re-enrolling from the previous to the subsequent semester at Universitas Terbuka in Indonesia. This study discusses efforts to examine and model these factors as predictor variables. Conducted using a quantitative approach, this study sampled 1195 students, taken randomly at Universitas Terbuka, who were enrolled in the first semester of 2015. Binary logistic regression analysis was used to predict the probability that freshmen in the first semester of 2015 would apply for the second semester of 2015. A test of the full model versus a model with intercept only was statistically significant, $\times^2 = 275.470$ (df = 9, $n = 1195$, $p < 0.01$). The model classified 96.5% of students who were enrolled and 40.8% of those who were not, for an overall success rate of 88.6%. The finding pointed out that (1) students participating in face-to-face tutorials were four times more likely to re-enroll, (2) students earning more than 12 credits were four times more likely to re-enroll, and (3) students with GPA above 2.5 were almost three times more likely to re-enroll.

1 Introduction

Open distance learning (ODL) has a long history of providing access for people who are unable or find it difficult to participate in conventional higher education. However, Sharma (2015) quoted the president of the International Council of Distance Education (ICDE), Dr. Tian Belawati, that the twin messages of open distance learning are access and success. Access is related to ease and flexibility for

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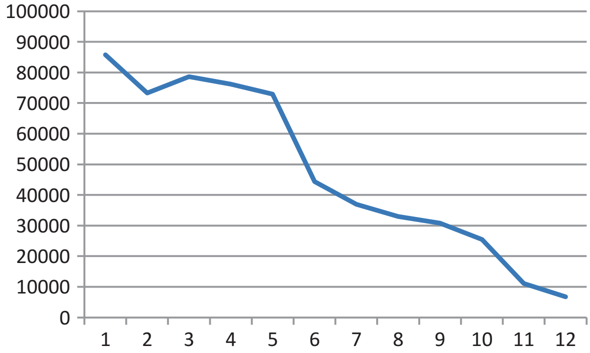

Fig. 9.1 Student attrition of UT 2009–2015

people to participate in higher education, whereas success, in most cases, relates to the completion of a credential degree.

Meanwhile, students are disengaged from re-enrolling in the wake of their inadequate success to meet academic standards. This is especially true for students at an ODL institution given the presumption that non-re-enrollment is most typically an early warning for students' withdrawal. Moreover, Universitas Terbuka (UT) does not apply a drop-out regulation; students are permitted to decline to re-enroll in one term and start to re-enroll in the succeeding term or to decide to stop re-enrolling permanently without officially withdrawing. In this case, predicting the student re-enrollment pattern might thus be an attempt to diagnose students' condition for academic success and to identify particularly appropriate measures to sustain the students' commitment to remain re-enrolled until graduation.

The purpose of this study was to build a model to showcase the prediction of student re-enrollment at UT. Given that students of UT have greater flexibility of re-enrollment, predicting student re-enrollment at UT is not as simple as that in conventional higher education environments. One of the pressing concerns with predicting such a re-enrollment pattern is frequently associated with drop-out or graduation rate. As Simpson (2016) noted, distance institutions are more prone to higher drop-out rates than the UK full-time average. The tendency of student attrition of UT from one semester to the subsequent semester is illustrated in Fig. 9.1.

Re-enrollment in this study refers to the condition that a student who enrolled in one semester will re-enroll in the next semester. A number of extensive terms in the literature cover non re-enrollment in higher education, while the terms of withdrawal, drop-out and attrition oftentimes denote the negative nature of non re-enrollment, retention and persistence stand for a more positive sense of re-enrollment (Draper, 2008). In this study, re-enrollment is largely attributed to an early sign of student success in an open distance learning environment. This literature review focuses on interaction in ODL as a theoretical framework to describe students' success and some research results in predicting it.

Dzakiria, Kasim, Mohamed, and Christopher (2013) asserted that the structure of ODL provides learners with the greatest flexibility and provides control over time, place, and pace of learning, and that "one important element, in accordance with the flexibility, that tends to define success factors for students attending an ODL program is the level of interactivity within the student-tutor-content dyads" (p. 1). It has thus become highly essential that to improve the ODL experience, decreasing attrition rates and maintaining long-term good standing along with equitable provision of such interaction and interactivity should be non-negotiable priorities for tutors and the all-important stakeholders in ODL. Similarly, research regarding the importance of interaction in ODL conducted by Choi, Lee, Jung, and Latchem (2013) specified that, "a lack of feedback from the instructors, heavy workload, and difficulties in studying at a distance were directive subjects to non re-enrollment" (p. 1). The learners' perceptions about the value of the degrees and their ages, gender, and educational backgrounds were also found to have generally stirred up decisions not to re-enroll. Although the factors of non-reenrollment vary, Choi, Lee, Jung, and Latchem (2013) offered some solutions:

> A decreased number of required credit hours per semester; a provision of upstanding social support; an introduction of a more flexible enrollment option; and better use of available technology and infrastructure to help both students and instructors build stronger learning communities. (p. 1)

Describing why interaction in ODL is extremely important. Smart, Feldman, and Ethington (2006) provided a theoretical linkage between variations in patterns of students' success and students' learning experiences as well as their interactions with different academic environments. First, students' success embodies a function of the fit or congruence between their personality types and their chosen academic environments. Second, students' success is determined by the extent to which students learn the distinctive patterns of attitudes, interests, and abilities that are required, reinforced, and rewarded by their chosen academic environments, irrespective of the fit or congruence between their personality types and their chosen academic environments. This study principally refers to open and distance learning in terms of an academic environment, students' academic attainment (GPA and credits earned) and participating in face-to-face or online learning support services as students' learning experiences, and students' re-enrollment as students' success.

The aforesaid study results highlighted the importance of interaction in a learning environment to prevent students from academic failure at an early stage, and correspondingly for educators to strive to expand essential support for meaningful interaction to such an extent that they stimulate and encourage students' success that fits their learning objectives in the ODL environment.

A myriad of studies have extensively delved into the prediction of students' success in ODL higher education, and, ultimately, in face-to-face universities. Using an expanded person-environment fit (P-E fit) model for college students of science, technology, engineering, and mathematics (STEM), Le, Robbins, and Westrick (2014) found that persistent learning behavior was affected by individual difference factors, including ability and interest. They also pointed out that the relationship between ability and persistence is stronger for females than it is for males.

Godfrey and Matos-Elefonte (2010), on the prediction of students' success in college based on various student-level backgrounds and academic variables as well as school-level social and academic characteristics, demonstrated that characteristics at both levels play a role in the likelihood of reaching these goals.

Stephan, Davis, Lindsay, and Miller (2015) described the early college success of students, identifying measures in the state longitudinal data system that predicts early college success, and examining the usefulness of those predictors. The study found that half of the students achieved early college success by the composite of all three indicators (i.e., enrolling in only non-remedial courses in the first semester, completing all attempted credits in the first semester, and persisting to the second year of college). The study also identified variables for student demographic characteristics, high school academic achievement, and behavior that might be related to (or predict) whether a student achieved success in the early college years.

Researchers at the University of Maryland University College (2015) showcased an analysis of predictive models of students' success in college that identified factors associated with the students' success based on students' GPAs and retention rates. The results showed that students' performance in their first semester at UMUC remained crucial in predicting re-enrollment, retention, and graduation. The first term GPA might be an indicator of factors contributing to students' success, beyond academic abilities.

Predicting students' success is particularly important for students in the first year, as this is when most withdrawals occur. However, to complicate matters, information available is incomplete and often inaccurate. In such cases, statistical methods involving logistic regression analysis are more useful than questionnaires or tutors' opinions. Identifying students at high risk of academic failure allows educators to focus on assisting such students and achieving equal, if not greater, overall retention rates as a result.

2 Method

On the basis of the aforementioned literature review, this quantitative study aims to predict the student re-enrollment of UT in the next semester, which is dependent on student participation in learning support services (face-to-face-tutorial, online tutorial, etc.), academic achievement (GPA, credits earned), and personal characteristics (age, gender, and marital status). These factors have been identified as potential predictor variables of re-enrollment in retention literature. These variables have generated a dichotomous outcome that categorizes whether or not a student would re-enroll for the following semester, in this case semester 2. The data analysis was conducted using binary logistic regression, which was designed as a statistical technique in the late 1960s and early 1970s, and became routinely available in statistical packages in the early 1980s (Peng, Lee, & Ingersoll, 2002).

Such logistic regression requires only the dependent variable to be binary, while the independent variables could be interval, ordinal, or categorical. However, to

Table 9.1 The independent variables

Variables	Variable description	Variable values
X_1	Marital status	=1, married =0, unmarried
X_2	Gender	=1, male =0, female
X_3	Age	=1, 25 years old or less =0, above 25
X_4	GPA	=1, above 2.5 =0, 2.5 or less
X_5	Credits earned	=1, more than 12 =0, 12 or less
X_6	Participation in face-to-face tutorial	=1, participating =0, not participating
X_7	Participation in online tutorial	=1, participating =0, not participating

avoid too many blank cells and to generate convenient interpretable output, the variables GPA, credits earned, and ages were treated as categorical, as shown in Table 9.1.

This study relied on simple random sampling (Borg & Gall, 1989), which covered 1195 new students in the first semester of 2015. The regression model, applied to predict the student re-enrollment in the second semester of 2015, took on logistic regression represented by the formula below:

$$\log\left[\frac{p}{(1-p)}\right] = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7$$

where

p = the probability of student's re-enrollment
a = a constant
b_i = coefficient of logistic regression for the variables ith respectively

3 Results and Discussion

Table 9.2 begins with the student proportions based on marital status and gender, which sums up that the re-enrollment percentage of unmarried female students significantly outnumbered that of the married male students, at around 70% and 20% respectively. When it comes to age, the re-enrolment percentage of students aged 25 or less was significantly lower than that of students aged above 25, which was 28.07% and 71.93% respectively. Based on the credits earned, students with 12 credits or less had 18.62% re-enrolment, remarkably lower than the 81.38% of

Table 9.2 Description of non re-enrolled and re-enrolled groups

Predictors	Non re-enrolled		Re-enrolled	
	N	%	*N*	%
Marital status				
Unmarried	109	64.50	749	73.00
Married	60	35.50	277	27.00
Gender				
Female	103	60.95	793	77.29
Male	66	39.05	233	22.71
Age				
25 or less	60	35.50	288	28.07
Over 25	109	64.50	738	71.93
Grade point average (GPA)				
2.5 or Less	152	89.94	459	44.74
Above 2.5	17	10.06	567	55.26
Credits earned				
12 or less	108	63.91	191	18.62
More than 12	61	36.09	835	81.38
Participation in face-to-face tutorial				
Yes	56	33.14	821	80.02
No	113	66.86	205	19.98
Participation in online tutorial				
Yes	83	49.11	206	20.08
No	86	50.89	820	79.92

students with more than 12 credits. However, while the percentage of students who attended face-to-face tutorials presented a much greater rate of re-enrollment (80.02%), those who attended online tutorials suffered from a very low percentage (20.08%).

The difference between the two groups in Table 9.2 could be tested by chi-square test to confirm whether the differences were significant or not and to conclude which of the variables led a student to re-enroll or not in the subsequent semester 2. The purpose of this study, however, was to predict rather than to compare the two groups. To that end, binary logistic regression was to estimate the probability of the present students' characteristics within the re-enrolled group or the non re-enrolled group. The results are presented in Table 9.3.

Table 9.3 presents the statistical significance of the individual regression coefficients (βs) tested with the Wald Chi-square statistic. The test of the intercept was significant ($p < 0.05$), suggesting that the intercept should be included in the logistic regression equation model. The Hosmer & Lemeshow test of the goodness of fit suggested that the model was a good fit to the data as $p = 0.841$ (>0.05). Nagelkerke's R2 suggested that the model explained roughly 37% of the variation in the outcome, correctly classifying 96.5% of the re-enrolled students and 40.8% of the non re-enrolled students, for an overall success rate of 88.6%.

Table 9.3 The coefficients of regression

Variables	*B*	S.E	Wald	Df	Sig.	Exp(*B*)
Marital Status	0.433	0.223	3.778	1	0.052	1.543
Gender	0.309	0.221	1.962	1	0.161	1.362
Age	−0.032	0.013	6.401	1	0.011	0.968
Grade Point Average (GPA)	1.038	0.310	11.185	1	0.001	2.823
Credits Earned	1.429	0.213	45.130	1	0.000	4.176
F2F Tutorial	1.414	0.270	27.489	1	0.000	4.113
Online Tutorial	−0.148	0.252	0.343	1	0.558	0.863
Constant	1.250	0.547	5.232	1	0.022	3.491

According to Table 9.3, age, grade point average, credits earned, and participation in face-to-face tutorials made significant contributions to the prediction of student re-enrollment ($p < 0.05$). The last column, Exp(B), presents the odds ratio for each of the predictors. Such odds represent the likelihood that one outcome will occur to the likelihood that the outcome will not occur (Park, 2013), which in this case, referred to the likelihood of the event of re-enrollment or non-re-enrollment. The odds ratio (OR) is a comparative measure of two odds relative to different events (Park, 2013), which is calculated by dividing the odds by other odds, which in this case, referred to the odds of the outcome in students who were re-enrolled by the odds of the same outcome in students who were not re-enrolled. As seen in Table 9.3, the odds ratio of the age variables was 0.968 (<1), implying that the odds of the students aged 25 or less were lower than the students aged over 25 (see Table 9.1) to re-enroll in the subsequent semester by 0.968 times, thereby denoting lower likelihood of re-enrollment in the younger students. This finding was quite consistent with the result from a research conducted by University of Maryland University College (2015) which found that age and marital status were associated with success at UMUC.

When it comes to GPA, students who scored GPA 2.5 or above were 2.82 times more likely to re-enroll in the subsequent semester than those scoring below 2.5. High-achieving students might very well end up re-enrolling given that GPA is most commonly and strongly associated with academic ability and previous academic success. As "Le, Robbins and Westrick (2014) noted, academic ability is indeed related to persistence in college. This finding aligns with the result of Stephan, Davis, Lindsay, and Miller (2015) that stresses that having higher test scores and taking advanced coursework in the previous school pointed to and predicted early college success.

Similar to GPA, the number of credits earned in one semester heavily defines academic ability and success. Table 9.3 exhibits the higher probability of students with 12 or more credits to re-enroll, which was 4.17 times more likely than students with <12 credits. Credit units were contributing factors to academic ability which was related, as previously cited, to persistence in college (Le, Robbins & Westrick, 2014; Stephan, Davis, Lindsay, & Miller, 2015).

As for face-to-face tutorials, students who actively participated in them were found to be 4.11 times more likely to re-enroll than those who were not. Given that face-to-face tutorials are theoretically related to interaction in ODL, it is consistent with Choi, Lee, Jung, and Latchem (2013) who suggested that interaction with instructors, peers' sharing support for heavy workload and difficulties in studying at a distance were the main reasons for re-enrollment. Tutor feedback and less academic workload were inherently linked to the tutorials from which the students can benefit in self-directed learning in an ODL environment. Unlike participating in face-to-face tutorials (which positively affect re-enrollment), the students' choice of whether or not to join an online tutorial had no effect on their decision to re-enroll. This showed that the online tutorials currently provided by UT are perceived differently than face-to-face tutorials. The students did not perceive the online tutorials as a learning provision that facilitated interaction with content, instructor, and peers.

Face-to-face tutorials are an aspect learning support provided by UT to increase students' learning. Therefore, the variable of students' taking part in face-to-face tutorials was supposed to correlate with the other academic predictor variables, in this case, with GPA and credits earned. The correlation among predictor variables is called collinearity, and collinearity is commonly problematic for statistical modeling. In a linear regression model, the collinearity may lead to the generation of unstable parameter estimates (Haque, Jawad, Cnaan, & Shabbout, 2002). The calculation of Pearson correlation between students taking part in face-to-face tutorial and GPA and Credits earned was 0.423 and 0.519 respectively and significant at the 0.01 level. However, the relationship did not appear strong enough (Pearson's $r < 0.60$) to detect a problem, where values of $r = 0.8$ or more are oftentimes causes for concern (Strand, Cardwallader, & Firth, 2011).

4 Conclusions and Recommendations

4.1 Conclusions

The core of ODL is access and success. ODL's abundance of wide-ranging student accesses and experiences, both on and off-campus, reflects the key element of continued success in an ODL environment. However, ODL's success in delivering these hallmarks is due, in no small part, to student re-enrollment. While what predicted the next-semester re-enrollment was obvious, the results varied: variables of age, GPA, credits earned, and face-to-face tutorial participation were found to be significant predictors while the variables of marital status, gender, and online tutorial participation were not. The conclusions include the following:

- The re-enrollment of students attending face-to-face tutorials is four times greater than those who did not.

- The re-enrollment of students earning more than 12 credits rated four times is greater than those earning 12 credits or less.
- The re-enrollment of students achieving GPA above 2.5 is almost three times greater than those who did not.

This research considers that enrollment from one semester to the next semester is part of the student's success or a step forward to the student's success. Ultimately, graduation with a credential degree is the final success. In general, students' success in an ODL environment, as indicated by their re-enrollment in each semester, is due to various factors. This research specifically predicted that the students' success related to the three factors. First, the individual characteristics related to maturity, as specified by age and marital status, i.e., the more mature the students are, the more chance the students for being success. Second, the level of success in previous semesters, as shown by GPA and credits earned, i.e., the more GPA and credits earned in the previous semester the more chance for the students to re-enrol in this semester. Third, the availability learning support services that are perceived by the students to enable them to interact with content, instructors, and peers, i.e., when the students joining a learning support that give them a feeling of interaction with content, instructors, and peers in previous semester, then the chance for the students to re-enrol in this semester is increased.

4.2 Recommendations

Predicting a student's re-enrollment is an attempt to diagnose the student's likelihood for success. This research used the following model and equation for predicting the probability of a student's re-enrollment (p):

$$\log\left[\frac{p}{(1-p)}\right] = 1.250 + +1.038X_4 + 1.429X_5 + 1.414X_6$$

or

$$p = \frac{e^{1.250++1.038X_4+1.429X_5+1.414X_6}}{1+e^{1.250++1.038X_4+1.429X_5+1.414X_6}}$$

where

p = the probability of student's re-enrollment
X_4 = GPA (1 = more than 2.5, 0 = 2.5 or less)
X_5 = Credits earned (1 = more than 12, 0 = 12 or less)
X_6 = Participation in F2F Tutorial (1 = participating, 0 = not participating)

The equation of the model can be applied to compute the probability of students to re-enroll in the upcoming semester based on academic record in the current semester. Extra support should be given to students during the semester and after the semester grades have been published so that the re-enrollment rate increases. Students who are not attending the face-to-face tutorials during the semester should be contacted and encouraged to do so. Students who achieve a GPA of <2.5 and/or earned <12 credits should be given extra motivation to re-enroll. The probability of those students to re-enroll in the next semester is 0.777. Meanwhile, the re-enrollment probability of the students who attained a GPA above 2.5, earned more than 12 credits, and participated in face-to-face tutorials is 0.994.

It is recommended to compute the probability of re-enrollment for each student using the equation model at the end of each semester. A number of measures are suggested to support learning success among the students who remain at 0.777, and who are at risk of disengagement study. Among them are:

- The students should be encouraged to take 12–15 credits in the next semester to gain a GPA above 2.5.
- The students should be urged to participate in face-to-face tutorials, which is the best platform for the students to actively engage with peers, instructors, and institution.

This research shows that online tutorials did not positively affect re-enrollment. Further research is required to explain how the students perceive the online tutorials and what the weaknesses of the online tutorials are currently provided by UT, especially in relation to facilitating interaction among students, content, and instructors. Furthermore, the future research of re-enrollment in an ODL environment should be focused on the effectiveness of a particular measure to improve student persistence. The results of this research have given a light to implement and evaluate the impact of such measure, for instances:

- Research and development of a mechanism to guide students for academic workload, for example by providing an academic counselling forum within an online environment that allows taking a number of credits and courses in every semester suitable to their academic ability.
- Discussions with students about some risks of failure (to not re-enroll in the upcoming semester) based on academic records in the current semester.
- A variety of learning support should be provided so that students can choose which learning support is best suited to their academic needs. An ODL institution is essential to provide a face-to-face tutorial, especially for the new students. Since the students used to learn by a face-to-face learning in their past level of education, for the new students, a face-to-face tutorial is a kind of bridge for them between conventional learning environment and ODL environment.

Further research is also recommended to compare factors affecting re-enrollment in ODL institutions in other nations to better understand those factors.

Acknowledgments This paper was presented in the Educational Technology World Conference in Denpasar, Bali, in August 1st, 2016. I would like to offer my special thanks to the rector of Universitas Terbuka for facilitating me to attend the conference.

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Chapter 10
Problem-Solving Strategies Among Science Teachers in the State of Selangor, Malaysia

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Abstract Problem-solving is the highest level of learning in the cognitive domain. However, studies have shown that Malaysian students seem to lack problem-solving skills. This may be due to the lack of understanding of thinking skills and problem solving among teachers and the inability to apply appropriate teaching strategies for teaching problem solving. In this study, science teachers in Selangor, one of the most highly populated states in Malaysia, were sampled. The aim of the study was to investigate the problem-solving strategies teachers used for instruction. The findings indicated that teachers preferred giving factual explanations and asking students to listen to these explanations. As for problem-solving modes, argumentation was the dominant mode, followed by analogizing and reasoning causally. Participants were less inclined to use modeling for students to develop and test their own mental models. Hence, there is a need for instructional models for problem solving which would assist teachers in developing instructional strategies to inculcate problem solving and higher order thinking skills among students.

1 Introduction

In the twenty-first century, problem solving is an important skill required in almost every field from judicial, corporate management, engineering design, and even in government agencies (Spector & Kinshuk, 2011). In today's economies, potential employers want their staff to be creative and innovative problem solvers (Organisation for Economic Co-operation and Development (OECD), 2014). Problem solving is a higher order thinking skill, and is positioned at the highest level of cognitive knowledge in Bloom's taxonomy (Dick, Carey, & Carey, 2014). The problem-solving process, however, requires more than just cognitive knowledge. Skills such as

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K.A. Persichitte et al. (eds.), *Educational Technology to Improve Quality and Access on a Global Scale*, Educational Communications and Technology: Issues and Innovations, https://doi.org/10.1007/978-3-319-66227-5_10

flexibility, creativity, critically evaluating arguments, and supporting arguments are required (Barak, 2013; Bassham, Irwin, Nardone, & Wallace, 2012; Jonassen, 2012; Palraj, DeWitt, & Alias, 2016).

In the Malaysian context, problem solving has been regarded as an important skill for employability (Hamid, Islam, & Manaf, 2013). Employers have ranked the ability to identify problems, apply problem-solving strategies, and formulate solutions as the three most important skills (Bassham et al., 2012; Saad, & Majid, 2014). This is because employees who acquired higher order thinking skills had more diverse views, could reason logically and critically to evaluate situations in order to make decisions and solve problems, and hence were assets to the organization (Ministry of Education (MOE), 2013, 2015; Saad & Majid, 2014).

However, it has been noted that Malaysian graduates lacked problem-solving skills. In general, graduates did not seem capable of transferring knowledge and thinking critically in new situations (MOE, 2012). Employers have also reported that graduates seemed to lack problem-solving skills in the workplace (Bassham et al., 2012; MOE, 2015).

The lack of problem-solving skills among graduates may be attributed to the lack of skills in implementing problem-solving instruction among teachers. Teachers were confused on the definition of thinking skills and could not distinguish between the different levels of thinking (Marzano et al., 1988; Nagappan, 2002). In addition, Malaysian teachers seemed to prefer a teacher-centered approach for teaching facts and concepts (DeWitt, Alias, & Siraj, 2014, 2016). The culture of teaching for passing the standardized examinations may have contributed to this preference. Hence, teachers in secondary schools perceived that they lacked sufficient time to complete the syllabus, and this had led to instructional strategies focused on delivering factual knowledge rather than cultivating thinking processes such as problem solving (Chong, 2005; Ling, 2002).

Hence, there is a need to improve the existing teacher training program so that teachers are able to teach higher order thinking and problem solving. Teachers may have acquired some knowledge of problem solving but they did not seem to have acquired sufficient skills and may have misconceptions in teaching problem solving. Furthermore, teachers believed that having more courses on how to teach problem solving would improve their performance (Marzano et al., 1988; Nagappan, 2002). It was also not known what instructional strategies were being used by teachers in Malaysia for teaching problem solving and developing higher order thinking.

The findings of this study are significant as they could help address the gaps in teacher training. Specifically, the study sought to determine which strategies and modes were employed for problem solving during instruction, whether analogizing, modeling, reasoning causally, or arguing.

2 Literature Review

Thinking skills are not a new concept in Malaysia. Critical and creative thinking skills have been incorporated in the Malaysian school syllabus since 1990. Teachers have been trained in implementing strategies for teaching critical and creative thinking in pre-service courses since 1994 (Nagappan, 2001). The infusion approach, or the *Boston Model*, was adopted for training pre-service teachers to teach thinking skills (Kuldas, Hashim, & Ismail, 2015; Nagappan, 2001). The *Boston Model* prescribes an introduction to content and process, thinking about thinking, active thinking, and thinking application, and allows the teaching of thinking skills in different subjects at all grade levels (Swartz & Parks, 1994). An additional component, consolidation and enrichment activities, was added to the model to cater specifically to the Malaysian context (Kuldas et al., 2015).

However, in 1996, after the Malaysian Smart School concept was launched, the focus of teacher training was on integrating information and communications technology (ICT) skills. Thereafter, there seemed to be less emphasis on integrating thinking skills in teacher training programs, as ICT skills were deemed more important.

The recent emphasis on thinking skills in the Malaysia Education Blueprint 2013–2025 has brought changes in the school curriculum. The current version of the standardized curriculum for primary and secondary schools, *Kurikulum Standard Sekolah Rendah* (*KSSR*) and *Kurikulum Standard Sekolah Menengah* (*KSSM*), integrates higher order thinking skills within the curriculum. As for instructional strategies, teacher training was conducted through the i-THINK program for teachers to use thinking maps to organize the thinking processes (Agensi Inovasi Malaysia (AIM), 2014).

The i-THINK program seemed to be useful as it was reported that students improved in their content mastery and higher order thinking (Mazmin, 2013; Suhaili, 2014; Yusop & Mahamod, 2016). Training during the i-THINK program included: knowing the different forms of thinking maps, the characteristics of these maps and how these maps were used, while focusing on the content of instruction. However, as the focus was still on content knowledge, the processes of thinking may have been neglected. The teachers who were trained would most probably employ a similar instructional strategy with their students, focusing on content knowledge presentation rather than the thinking process (Mazmin, 2013; Suhaili, 2014; Yusop & Mahamod, 2016).

Teachers' beliefs and practice on how they teach are influenced by the teacher education program they attended (Zheng, 2009). Teachers tend to teach the way they were taught. In the Lera and Piquet (2014) case study of Spanish primary and secondary mathematics school teachers and students, the willingness to use problem solving for instruction was closely related to the teachers' training and teaching experience. Hence, it is possible that the teacher training programs did not adequately address the teachers' needs for the appropriate skills and instructional strategies for teaching higher order thinking and problem solving (Nagappan, 2010; Suhaili, 2014).

Previous thinking skills training programs showed that teachers were confused on the definition of thinking skills and could not distinguish between the different levels of thinking (Marzano et al., 1988; Nagappan, 2002). This lack of understanding resulted in a reluctance in teaching using the problem-solving approach (Roberts, 2010). In addition, teachers had difficulties applying thinking skills strategies during instruction as they lacked the knowledge and skill (Jones, 2008; Nagappan, 1998, 2001). As teachers were more comfortable teaching facts and content knowledge in a subject, they focused less on higher order thinking and problem solving (MOE, 2012).

2.1 Problem-Solving Strategies

Solving problems related to real life provides a meaningful context and the reason for learning. Many problem types can be used to challenge students. On a continuum from well-structured to ill-structured problems, there are several types of problems: logical problems, algorithmic problems, story problems, rule-using problems, decision making, trouble-shooting, diagnosis-solution problems and strategic performance, case analysis problems, design problems, and dilemmas (Jonassen, 2012; Jonassen, Howland, Moore, & Marra, 2003). Teachers should consider using the different types of problems which are suitable for different contexts in learning.

Problem solving can involve either productive or reproductive thinking processes. Productive thinking uses meaningful understanding of relations and structure to produce a new organization using creative processes, while reproductive thinking uses senseless drill and rote memory, both from prior knowledge and applications of past solutions to solve problems (Katona, 1940; Wertheimer, 1959).

Productive thinking requires higher order thinking. This thinking process contributes to developing new knowledge and innovative processes. For effective productive thinking processes during problem solving, methods of instruction emphasizing discovery learning and expository learning should be employed (Bruner, 1961; Mayer, 1983).

Instead, teachers seemed to focus on reproductive thinking processes. Their tendency was to reproduce solutions based on previous problem-solving techniques, from memory. This aligned with teachers' preferred strategy of instruction, which is using memorization for teaching factual knowledge. The focus of instruction was on content mastery (DeWitt, Alias, & Siraj, 2014, 2016; Mazmin, 2013; Suhaili, 2014; Yusop & Mahamod, 2016). Hence, productive problem solving was used less often. The tendency was for teachers to ask students to recall prior knowledge from experience and memory for reproductive problem solving (DeWitt & Alias, 2015).

In order to promote higher order thinking, teachers should emphasize productive problem solving. Teaching strategies that encourage productive problem solving are learner-centered inquiry learning. Learners can be provided with specific facts during instruction. However, to solve problems and generate new knowledge requires more than factual knowledge. The processes and techniques for problem solving are required. An experienced learner with more experience and practice in problem solving will be better equipped to deal with problem solving. Experience in solving a variety of problems can enable learners to develop general strategies to respond to a problem (Dick, Carey, & Carey, 2014). Since having experience in problem solving can assist learners in transferring learning to other problem situations, teachers should provide opportunities for problem solving to enable learners to develop their skills and gain experience in both general and specific productive strategies for problem solving.

Strategies such as asking questions, debates, and giving feedback during the problem-solving process can enable productive problem solving. Suitable questioning techniques can engage learners with the task, while participation in debates will enable them to use skills for argumentation and reasoning, and thus develop problem-solving skills (Blosser, 1991; Zare & Othman, 2015). These strategies provide opportunities for displaying productive thinking processes. Feedback given to monitor student progress during problem solving assists learners in developing higher order thinking skills (Osman & Kassim, 2015; Toledo & Dubas, 2016). These strategies have been analyzed and classified into the four principles, which Jonassen (2013) calls principles of learning.

2.2 Principles of Learning

In order for meaningful problem solving to occur, productive thinking processes for understanding relationships and developing new structures of knowledge need to be activated. The principles of learning encourage meaningful problem solving and have been classified into four modes of thinking: analogizing, modeling, reasoning causally, and arguing (Jonassen, 2013).

2.2.1 Analogizing

Analogizing is the process of transferring information from a particular situation to another. Analogy is a very important aspect of problem solving. This is because only when we make an analogy to our past experience can we form an understanding of a new phenomenon (Henriksen, Cain, Mishra, and the Deep-Play Research Group 2014b). When comparisons are made with the existing schemas based on experience and prior knowledge, robust schemas are built (Jonassen, 2013; Mayer, 1983). These schemas enable learners to retrieve previously encountered problems that are believed to be similar, using analogical reasoning to solve a problem (Dick, Carey, & Carey, 2014; Luchins, 1942).

As learners observed more cases, they built their prior knowledge which assisted them in making analogies using case-based reasoning processes. First, learners need to build their prior knowledge based on what they have learnt. The facts and concepts, as previously acquired knowledge, help in this initial problem-solving process. This may also explain why teachers emphasize teaching factual content as this is the initial process, which aids problem solving. However, stopping the analogy process at this stage may make problem solving a reproductive thinking process.

Hence, in order to undergo productive problem-solving processes, learners need to progress to the next stage and be able to identify patterns and to abstract main ideas (Henriksen et al., 2014a). Patterning is a cognitive tool used to make sense out of vast amounts of data so as to form structures. In order to form structures, learners need to recognize, select, and form meaningful patterns (Henriksen et al., 2014a). Patterns are recognized as regularities within objects, and meaningful patterns are selected to discover structures and relationships to improve understanding, before new patterns can be formed (Henriksen et al., 2014a). The learners' existing prior knowledge is used to identify these patterns.

Abstraction is the next process. First, the main points are defined and irrelevant details are eliminated, before any new connections can be built and analogies between items are found for deeper understanding (Henriksen et al., 2014b). This means that similarities or differences are discovered using comparisons and contrast between objects in order to make analogies (Henriksen et al., 2014b).

As learners make comparisons, and form new structures and relationships, productive thinking processes occur. However, if these similarities and differences are pointed out as facts to memorize rather than going through the process of abstraction to seek new alternatives and approaches, making analogies may just be a reproductive problem-solving process (Henriksen et al., 2014b). Hence, when incorrectly applied, making analogies may impede productive thinking processes.

Visual tools, whether static models or computer-animated models, when accompanied by oral and written discourse, have been shown to be useful for enabling analogies for building scientific concepts (Doymus, Karacop, & Simsek, 2010). In Malaysia, thinking maps and concept maps have been used for making analogies for developing new ideas (DeWitt & Alias, 2015). Visualization using technology tools can contribute to conceptual understanding when appropriately used. Animations can be used for concept development of dynamic processes while interactive simulations make learning active and enable learners to control the pace of their learning (Doymus et al., 2010). Although visual tools can be used for analogies, it is unknown to what extent these tools are used for teaching problem solving.

2.2.2 Modeling

Modeling is the process involving the building of mental models for testing. Mental models when used for problem solving represent how knowledge is structured in the human mind, as well as how learning evolves and progresses during instruction (Kim, 2012). Models show relations between the elements in a system, and can be represented using databases, images, hypermedia, and other tools (Dick, Carey, & Carey, 2014). Mental models of learners' understanding can be represented formally using tools such as thinking maps. As teachers have been trained in using thinking maps to brainstorm and represent ideas during the i-THINK project, there is a possibility of using these maps to develop mental models.

During challenging problem situations, mental models can be created to reduce cognitive demands (Spector, 2010). A mental model can then increase the capacity of working knowledge, making knowledge more accessible (Bogard, Liu, & Chiang, 2013). Mental models, if well-structured, can enable an expert learner to identify patterns and make predictions (Bogard et al., 2013). For productive thinking processes, these mental models should be tested, manipulated, and changed for deeper understanding of the processes. This will enable processes of making predictions, inferences, and experimentation to occur during modeling and testing. Teachers may make use of thinking maps to visualize their mental models. However, there is a tendency for teachers to use these thinking maps to display their own mental models, and for learners to imitate or memorize these models. Hence, it is unknown if learners were able to transfer and develop their personal mental models into visual images and coherent representations (Doymus et al., 2010).

While cognitive tools such as thinking maps can help learners develop and represent their mental models to assist the cognitive processes of developing new and more sophisticated models, it is not known if these models were memorized models or developed personally by the students (Bogard, Liu & Chiang, 2013).

Technology tools can assist in building models. Graphic organizers, such as thinking maps and simulation software, can assist in building visual and logical models. In addition, computational models can be developed using statistical applications such as SPSS and AMOS for model building (Dick, Carey, & Carey, 2014; Soloway, Krajcik, and Finkel 1995).

2.2.3 Causal Reasoning

Causal reasoning enables learners to make predictions, implications and inferences, and articulate explanations. During the reasoning process, linguistics and logical reasoning play a part in deriving concepts. A set of conditions are initially given and predictions of the possible effects, or hypotheses, can be made based on these conditions to be tested.

In the classroom, it is common for a set of conditions to be given before a problem can be solved. During the process of solution finding, representations of the problem are made before solutions are developed. With appropriate justifications, correct solutions would be selected, monitored, and evaluated (Bulu & Pedersen, 2010). However, learners seem to face difficulties in applying the reasoning process in solving ill-structured problems as they have limited metacognitive and poor regulation skills (Bulu & Pedersen, 2010).

Technology can make the reasoning processes visible. Tools such as thinking maps, hyper media, and question prompts can help learners focus while simulations and modeling tools support causal reasoning. Visual causal maps, such as some forms of thinking maps, have been used for causal reasoning and understanding (Jeong & Lee, 2012). Causal maps can be integrated with technology and designed with support provided in the form of virtual agent feedback (Segedy, Kinnebrew, & Biswas, 2013).

Technology can be used for scripting problem-solving behavior for learners to undergo the processes as they make inferences and reason logically thorough the problem-solving process (Slof, Erkens, Kirschner, & Jaspers, 2010). In one designed learning environment, a text processor was provided for students to formulate and revise answers to tasks, and a notes tool was provided which could be used as an individual note pad to store information and structure learners' own personal knowledge and ideas before making them explicit (Slof et al., 2010). Hence, learners could manipulate values in certain concepts and the simulation model would automatically compute the values of other variables.

However in the Malaysian scenario, only the two-dimensional visual causal maps seem to have been used. Further, it is not known to what extent teachers use thinking maps to support the causal reasoning process.

2.2.4 Argumentation

Argumentation is the means of rationally solving problems using theories to support claims with evidence. When required, alternative theories with counter-arguments and rebuttals are used to support the claims. Argumentation encourages productive thinking for conceptual change (Jonassen & Kim, 2010; Mayer, 1983). Producing coherent arguments to justify solutions and actions is more important when solving ill-structured problems (Jonassen & Kim, 2010). This is important for scientific thinking as argumentation on scientific and societal issues during debates enables scientific knowledge to be articulated and hence, to be refined (Jonassen & Kim, 2010).

However, in order to be able to debate and form strong arguments, learners need the following skills: the ability to generate causal theories to support claims, the skill to offer evidence to support theories, the ability to generate alternative theories, the skill to envision conditions that would undermine the theories or counter-arguments, and the skill to rebut alternative theories (Jonassen, 2012; Jonassen & Kim, 2010). To create opportunities for argumentation in the classroom, teachers should provide meaningful tasks using project-based or problem-based learning (Jonassen & Kim, 2010).

Technology can provide opportunities for argumentation. Collaborative argumentation can be conducted on online discussion forums. In a discussion forum, questions that stimulate arguments can enable learners to be actively constructing arguments and counter-arguments (Jonassen & Kim, 2010). At the same time, scaffolding can be given when the arguments are incoherent (Jonassen & Kim, 2010). Collaborative learning can be used to support learners in the tasks as the group carries out cognitive activities to define the problem and find and evaluate solutions to develop their own knowledge and understanding (Slof et al., 2010).

Graphic organizers such as thinking maps can aid visualization. When arguments are made visible, learners can identify important ideas, and then construct arguments and question relevant relationships (Jonassen & Kim, 2010). However, it is unknown to what extent thinking maps are used. In the Malaysian context, didactic argumentation occurs in the classroom. Teachers pose questions on concepts and request learners to support and give evidence for their arguments; this happens naturally in the classroom. However, it is not known if teachers provided opportunities for rebuttal in the classroom. Project-based and problem-based learning would assist in the argumentation process as learners need to support arguments and provide justification.

In conclusion, although problem solving is an important skill for graduates in the twenty-first century, in order to be relevant, it needs to be taught in authentic and meaningful situations. Problem solving should be taught from a holistic perspective, and include not only factual knowledge, but also procedural, strategic, and content knowledge. Cognitive tools can assist the problem-solving process through visualization of the problem to reduce the cognitive load and support learners in generating knowledge (Bogard et al., 2013). Hence, abstract concepts can be represented and models can be created for enabling metacognitive and self-regulation processes (Bogard et al., 2013). The principles of learning provide a starting point for investigating the processes involved in teaching problem solving. They provide a framework for exploring the instructional strategies currently being used by teachers in Malaysia for teaching problem solving and developing higher order thinking.

3 Method

The study involved a survey of a selected sample of the population of teachers in Malaysia to determine their perspectives on the problem-solving strategies that they use when teaching.

3.1 Sample

Malaysia has 13 states and three federal territories. A total of 10,180 schools are spread across the country, comprising of 7772 primary schools and 2408 secondary schools. The sample for this study consisted of science teachers from the state of Selangor, which is one of the states with the highest density of schools. There are 935 schools (9.2% of the total number of schools in Malaysia) in the ten districts in Selangor: 659 secondary schools and 276 primary schools. All government schools use the same standard curriculum, the KSSR and KSSM. There are several types of government schools: national schools, national-type Chinese schools, national-type Tamil schools, technical and vocational schools, and religious schools. The majority of schools are national schools where the medium of instruction is the national language, Bahasa Melayu.

In this study, the different types of secondary schools in each district were sampled. Technical and vocational schools, religious schools, and vernacular schools (national-type Chinese schools, national-type Tamil schools), where possible, were included in the sample. The sample involved science teachers in secondary schools as it was believed that science teachers were more exposed to problem-solving strategies, scientific inquiry, and technology use. This was because science was a subject included in several government initiatives since 1999 which promoted the use of thinking skills and technology, such as the Smart School and the Teaching of Mathematics and Science in English (Alias, DeWitt, & Siraj, 2013).

Table 10.1 Reliability analysis of constructs in the Learning Skills Questionnaire

Construct	Number of items		Cronbach's alpha	Minimum CITC
	Initial	Final		
General	5	5	0.718	0.260
Modeling	5	5	0.862	0.589
Analogizing	5	5	0.804	0.458
Causal reasoning	10	10	0.928	0.579
Arguing	5	5	0.913	0.721

A total of 40 science teachers from each of the ten districts were requested to take part in the survey. A total of 301 relevant and completed questionnaires were collected (a return rate of 75.25%).

3.2 Instrument

The Learning Skills Questionnaire was used for data collection. This instrument was developed based on literature on the strategies for teaching problem solving and comprised items related to the modes of thinking or principles of learning: analogizing, modeling, reasoning causally, and arguing (Jonassen, 2013; Palraj et al., 2016).

The internal consistency of the Learning Skills Questionnaire was high with a Cronbach's alpha coefficient of 0.962 (>0.7) indicating good item reliability in the items of the Learning Skills Questionnaire (Cronbach, 1951). The reliability for each construct was measured and indicated high reliability (see Table 10.1). This instrument was validated by two experts in instructional technology.

The instrument employed a 5-point Likert-type scale to measure the frequency of using a particular instructional strategy. On the Likert scale, 1 indicated never using the strategy; 2 as almost never, or <20% of the time; 3 as sometimes, which was about 40% of the time; 4 as frequently, which was about 60% of the time; and 5 as always, which was more than 80% of the time or almost every lesson. The data were then analyzed using descriptive statistics using percentages, means, and standard deviation.

3.3 Procedure

A total of 400 printed paper-based questionnaires were distributed through the ten district education offices in the state. The questionnaires were accompanied with a cover letter stating the purpose and the ethical procedures undertaken for the research, and were distributed to the different schools in the districts. The choice to respond to the questionnaire was entirely voluntary. The questionnaire was given to the head of the science department in the school, who was asked to distribute them to teachers who volunteered to respond. The completed questionnaire would then be returned to the district education offices for collection.

3.4 Limitations of the Study

Schools selected for the sample may have been influenced by distance from the district education offices. For practical reasons, the questionnaire may have been distributed to schools nearest or most convenient to the district education offices and this may have limited the generalizability of the study. Data were collected from teachers who volunteered to respond to the questionnaires. This again may have limited the generalization of the findings as only the more extrovert or skilled teacher might have volunteered. Teachers who were less confident of their teaching might not have been willing to volunteer. Finally, school selection for questionnaire distribution may not necessarily be representative for the country as the central zone may be unique in the student and teacher population.

4 Findings and Discussion

4.1 Demographics

Only respondents who were science teachers were selected for this study. Although the procedures outlined that only science teachers were required as respondents, in reality there were also questionnaires answered by teachers of other subjects, such as Mathematics. This could be because there were insufficient voluntary respondents among the science teachers and the department head had to request that other teachers assist. Respondents teaching subjects other than science were, however, excluded from the study.

The Malaysian secondary school structure consists of lower secondary and upper secondary levels. Lower secondary education is from Form 1 to Form 3 and is for 13–15 year old students, while upper secondary, for Form 4 and 5, is for 16 and 17 year old students. The highest level taught by the sample of this study was upper secondary (87.38%), followed by lower secondary (11.63%). This might indicate most of the teachers taught at the upper secondary level. Teachers who taught the upper secondary level could also be teaching at the lower secondary level. A minimum of 5 years teaching would constitute the definition for an experienced teacher. Hence, most of the teachers who responded in the study were experienced teachers. A reasonable proportion had 6–10 years' experience (33.22%), and 11–20 years' experience (39.87%), while a smaller percentage had more than 20 years' experience (19.27%).

Table 10.2 Frequency of use of ICT use among teachers

Frequency of use	Frequency	Percentage
One a week	174	57.8
Once in 2 weeks	68	22.6
Once a month	39	13.0
Once in 6 months	15	5.0
Almost never	5	1.6
	301	100.0

Table 10.3 Frequency of use of instructional strategies

Items	1	2	3	4	5	Mean	Std. deviation
Read notes and books to learn the facts	1	6	47	142	105	4.3754	0.6648
Listen to the teachers' explanation to learn concepts	0	1	28	129	143	3.6312	0.7350
Listen to the explanation on video/audio/other media to learn concepts	1	9	124	133	34	3.9136	0.6727
Recall similar problems or cases that have been done in class	1	1	73	174	52	3.8439	0.6872
Consider only one best solution when solving problems	2	42	137	98	22	3.6013	0.6835

Note: (1) Never, (2) <20% of the teaching time, (3) Sometimes: 40% of the teaching time, (4) Frequently: 60% of the teaching time, (5) Always: More than 80% of the teaching time

With regard to ICT skills and usage, a large proportion of the teachers considered themselves as skilled (61.5%) and averagely skilled (31.9%) in information and communications technology (ICT). A few teachers perceived themselves as being highly skilled (5.3%). However, although almost all teachers were skilled in ICT, it was surprising that the frequency of ICT usage did not commensurate with their skills. Only about half the teachers (57.8%) used ICT at least once a week, and even less used ICT once in 2 weeks (22.6%) and once a month (13.0%) (see Table 10.2). The rationale for including ICT skills and frequency in the study was that the frequency of tool use might indicate the use of thinking tools for problem solving.

4.2 *Instructional Strategies for Problem Solving*

Teachers seemed to prefer a teacher-centered approach for instruction. This was because teachers preferred students to learn facts, and listen to the teachers' explanation, or explanation on video and other media to learn concepts (Mean = 4.3754, *SD* = 0.6648; Mean = 3.6312, *SD* = 0.7350 and Mean = 3.9136, *SD* = 0.6727 respectively) (see Table 10.3). The instructional strategies for direct instruction seemed to be favored.

Teachers did attempt problem solving. However, problem solving seemed to be confined to the recall of similar problems (Mean = 3.8439, *SD* = 0.6872). This indicated that teachers preferred reproductive thinking processes to recall similar problems that were solved, and would favor drills and rote learning for solving problems (Katona, 1940; Wertheimer, 1959).

The preference for direct instruction strategies for students to learn facts from notes and books over learner-centered instructional strategies might have arisen from a lack of understanding and skills. As shown in previous studies, teachers were confused regarding the definition and concept of thinking skills and were unsure about their application for learning (Nagappan, 2001). The perceived lack of time for completing the syllabus may have led teachers to believe that teacher-centered instruction was time-saving (DeWitt, Alias, & Siraj, 2016; Nagappan, 2001, 2010).

Teachers do not seem to place importance on using technology for instruction. Although they perceived themselves to be average to highly skilled in ICT (98.67 %), they do not use ICT frequently. When only a little more than half the teachers (57.8%) used ICT once a week, this indicated little need to employ these tools. This implied that teachers may not have sufficient competency and skills in ICT to use ICT tools for problem solving. Visual and mind maps, simulations, and modeling tools would encourage the modes of thinking: analogies, modeling, and causal reasoning. However, when ICT was hardly used, it was doubtful whether productive problem-solving processes took place.

When the different modes of thinking for problem solving were investigated, however, it was found that teachers seemed to be using these modes (see Table 10.4). The dominant problem-solving strategy used was argumentation (Mean = 3.7090, *SD* = 0.7201) followed by making analogies (Mean = 3.6993, *SD* = 0.7160) and reasoning causally (Mean = 3.6065, *SD* = 0.7729).

As shown in Table 10.4, Malaysian teachers were more confident at solving problems by argumentation. This could be because during teacher-centered instruction, teachers frequently asked questions. Asking questions encouraged teacher-learner interaction and the learner needed to justify and explain the answers. In science, scientific thinking would require learners to justify the solution to the problem and their actions (Jonassen & Kim, 2010). Hence, the questions that teachers asked would be for justification of arguments, to elaborate the steps taken, and to consider alternative methods and solutions. As teachers were more concerned in

Table 10.4 Strategies for problem solving

Domain	Mean	Std. Deviation
Analogizing	3.6993	.7160
Modeling	3.3209	.8573
Reasoning causally	3.6065	.7729
Arguing	3.7090	.7201

Note: (1) Never, (2) <20% of the teaching time, (3) Sometimes: 40% of the teaching time, (4) Frequently: 60% of the teaching time, (5) Always: More than 80% of the teaching time teaching factual knowledge, it is doubtful that productive thinking processes were used by teachers. It was more likely that the argumentation processes were based on memory of previous processes and part of the reproductive thinking process.

Making analogies was frequently employed. Teachers asked learners to recall similar situations and questions solved so that they were proficient in answering examination questions. However, it was not known whether the learners were trained in skills of patterning and abstracting required for making analogies. Teachers seemed to make comparisons: finding similarities and differences when answering questions. Again, the process of thinking might be for reproductive problem solving rather that productive if the focus is on acquiring factual knowledge.

Causal reasoning required learners to make logical arguments and inferences to elaborate theories (Jonassen, 2013). In science, the scientific process required students to make predictions, inferences, and hypotheses for testing. However, the reasoning processes for solving ill-structured problems involve representation of the problem, developing solutions, making justifications, and selecting the solutions, and finally monitoring and evaluating the solutions (Bulu & Pedersen, 2010). When teachers focus on teaching factual knowledge, learners might be memorizing the causal relationships without undergoing productive processes for problem solving.

The teachers involved in this study seemed to use modeling the least frequently. Modeling is required for representing relationships between concepts for understanding and developing thinking processes. Mental models can assist in visualization and reduce the cognitive load for learning during instruction. The modeling process required productive processes which cannot be memorized as the learner needed to find relationships and construct models. More time would be required for modeling, making this the least frequent mode of thinking.

5 Conclusions

The teacher training programs for innovation and higher order thinking may not have been well implemented. Programs using thinking maps had been implemented in the state but the teachers were still using reproductive thinking processes for problem solving. Although teachers seemed to use the modes of problem solving in the principles of learning, it is unknown to what extent the productive thinking processes were employed as it was noted that teachers focused on teaching factual and conceptual knowledge. Further investigation could be done to determine to what extent productive thinking processes were being used in instruction for higher order thinking.

Teachers needed to understand the concept of problem solving. The knowledge, skills, and beliefs in problem solving for instruction are required for efficient training. Trainers need to ensure that pre-service and in-service teachers training programs focus on the productive thinking processes, and not on content knowledge; this would assist teachers in developing their own practice based on the training they received. Hence, training programs must be designed to cater to this need.

Productive thinking processes would require a student-centered approach. This would mean that more time is needed to be spent on the modes of problem solving. School-based assessment approaches, project-based, and problem-based learning enable students to spend time exploring content and developing mental models to be tested as they make hypotheses and conduct experiments to test them. Additional research could be done to design strategies for enabling productive thinking processes for problem solving. To develop creative and innovative problem-solving graduates, suitable instructional models to encourage productive thinking processes need to be applied in instruction for science as well as for other subjects.

Acknowledgments The authors wish to thank the Ministry of Education Malaysia as this work was supported in part by a grant FP011-2014B from the Fundamental Research Grant Scheme, Ministry of Education Malaysia.

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Chapter 11
Exploration of Students' Online Discussion Engagement in Statistics Collaborative Learning

Yi-Chun Hong and Ming-Hung Kao

Abstract Asynchronous Internet-based technology is the most widely used technology for the instructional delivery of both online and hybrid courses. For online courses in particular, students have expressed feeling isolated and undernourished academically and emotionally within online learning communities. To rectify the situation, an increasing number of educators and scholars recognize the importance of implementing collaborative learning to increase interactions among learners, to heighten their engagement in learning events, and to create opportunities for them to provide mutual support. Educators utilize group learning activities for learners in a variety of fields, such as education, arts, and engineering, but such an approach is seldom seen in statistics education. Most statistics students rely primarily on teachers' demonstrations and explanations when acquiring statistical concepts. Yet, students can also benefit from group work because interactions with peers allow them to explain processes to reach the solutions and therefore enable them to realize different ways of approaching statistical problems. In this study, we implemented an online collaborative activity in a graduate-level Applied Analysis of Variance course. Two sources of data, students' discussion posts within their group work and their responses to perception surveys, were collected. This research uncovers students' perceived benefits and challenges of engaging in online asynchronous collaborative learning activities for learning statistics. It also identifies and demonstrates three varying patterns of interactions from students' online group work: interacting for completing tasks, interacting for exchanging answers, and interacting for co-constructing knowledge.

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K.A. Persichitte et al. (eds.), *Educational Technology to Improve Quality and Access on a Global Scale*, Educational Communications and Technology: Issues and Innovations, https://doi.org/10.1007/978-3-319-66227-5_11

1 Introduction

1.1 Background

The increased acceptance of online learning by students, administrators, and faculty members has somewhat changed the current system of higher education. To meet the growing demand of students for pursuing higher academic degrees with flexibility and convenience, more and more universities and colleges offer not only online learning activities and online courses but also fully online degree programs. According to the Survey of Online Learning, the number of higher education institutions offering fully online degree programs is more than double what it was 11 years ago—70.7% of higher education institutions offered fully online programs in 2013, compared with 32.5% in 2002 (Allen & Seaman, 2015).

Online learning is attractive to post-secondary students for a number of reasons. It allows them to fulfill course requirements with flexible scheduling and easier access to learning materials while juggling other responsibilities in their personal and professional lives (Chizmar & Walbert, 1999; Petrides, 2002; Poole, 2000). While it provides better accessibility, continuing doubts about the effectiveness of online learning still remain. In Allen and Seaman's survey report (2013), nearly one-fourth of participating academic leaders believed that the outcomes for online learning were inferior to those of traditional face-to-face instruction. On the contrary, a study using a meta-analysis method conducted by the Department of Education (2012) found that online and face-to-face learning were similarly effective as to students' achievements. While the result strongly supports the efficacy of online learning, a number of drawbacks are recognized. Students who engage in online learning activities often feel isolated and experience a lack of social interactions (Vonderwell, 2003). To provide necessary support for students learning online, an increasing number of educators and scholars recognize the importance of implementing collaborative learning to increase interactions among students, to heighten their of engagement in learning events, and to create opportunities for them to provide mutual peer support.

1.2 Review of Literature

Asynchronous Internet-based technologies are touted as the most widely used technology for online course instructional delivery (Parsad & Lewis, 2008). Common activities that use asynchronous Internet-based technologies are online discussions and online group projects (Ben-Zvi, 2007). Ocker and Yaverbaum (1999) reported that asynchronous collaboration is as effective as face-to-face collaboration with regard to students' learning, quality of solutions, solution content, and satisfaction with the solution quality. Along the same line, Johnson and Johnson (1989, 2005) summarized that collaboration can promote students' higher achievement, greater productivity, high quality of relationships among class members, and greater psychological adjustment. Collaborative learning allows learners to engage in joint dialogues, defined as the mutual exchanges generated by participants where they make substantive and meaningful contribution to a topic by interpreting, arguing, justifying, and elaborating their stances and understandings (Chi & Wiley, 2014; Kleinsasser & Hong, 2017). While the strength of collaborative learning has been consistently confirmed, online learners were significantly less content with the group interaction process and the quality of group discussions in the asynchronous online learning environments. Several reasons may contribute to the negative impressions and experience of collaborating with peers in online courses, including difficulties of completing tasks efficiently in an asynchronous environment, limitations inherent with text only messages, and lack of group members' contributions (Curtis & Lawson, 2001; Swan, Shen, & Hiltz, 2006; Zack, 1993). These factors may reduce students' willingness to engage in collaborative learning activities and decrease their levels of engagement in the learning. Fung (2004) admonished instructional designers and instructors to carefully design instruction that stimulates students' interests in participation of group work. Several studies have shown the majority of collaboration efforts succeed when conscientious management and adequate support are provided (Johnson & Johnson, 2008; Rummel and Spada 2005; Swan et al., 2006). Such efforts and the increasingly perceived need for peer interactions in an online learning context have driven the wider implementation of collaborative learning in many fields such as education, arts, and engineering (Du, Ge, & Xu, 2015; Wegmann & McCauley, 2014).

Recognizing the promise of online collaborative learning, educators in statistics also are interested in the possibilities of involving students in online group work activities. The nature of statistics work in real-world practices demands statisticians to possess strong communication skills and the ability to collaborate with others (Deming, 2016; GAISE College Report ASA Revision Committee, 2016). However, lecturing is the predominant method of instruction in statistics courses. Students are accustomed to relying on instructors' demonstrations of statistical concepts and explanations for solving statistical problems. In addition, students' assessments hinge on individual student's exam scores. To some degree, statistics education in general emphasizes more individualistic learning than collaborative efforts. Such an approach deviates from preparing students with the skills they need to perform statistics related jobs in a real-world setting (Deming, 2016). As such, some alterations should be made to incorporate different statistics instructional approaches by involving students in small group work activities, which bring about opportunities to not only transform students' approaches to learning statistics but also facilitate the development of critical skills for professional statisticians (Kalaian & Kasim, 2014). Through collaborative learning activities, students can benefit from the interactions by explaining to peers their processes to reach the solutions, which provides opportunities for peers to share different ways of solving statistical problems. All in all, the educators in statistics recognize the usefulness of collaborative learning approaches and some have already applied the concept of group work in their teaching (Garfield, 1993; Roseth, Garfield, & Ben-Zvi, 2008). Yet, with the increasing offerings of online courses, research is needed to inform educators as to students' views toward online collaborative learning and how they interact with peers in online collaborative activities.

1.3 Objectives of the Study

The goal of this study was to investigate statistics students' involvement in an online group work activity with the use of asynchronous online discussion boards for exchanging their understandings of statistics concepts as well as their process to solve statistical problems. Two research questions were identified to guide the study: (1) How do statistics students perceive the online group work to assist their learning in statistics with the use of asynchronous discussion boards? (2) How do statistics students interact with their peers in an online collaborative learning activity to assist their acquisition of statistics knowledge and skills?

2 Method

2.1 Research Context and Participants

The participants were graduate students enrolled in an Applied Analysis of Variance course offered by a statistics graduate program in a southwestern university in the United States. The course requires students to complete four major assignments including individual homework, online group homework, online group discussions, and a final project to earn three credit hours (one credit hour = 45 "contact" hours). Among 27 students, 23 students (85%) consented to share all their course assignments and their responses to the survey with the researchers. After the recruitment, students were asked to identify their own group members with each group comprising two to three members. Since part of our data analysis involved students' group discussion exchanges, we were not able to use the group discussion posts from those who did not express their willingness to participate. As such, based on the collected consent forms and group identification information, the data from 18 participants who themselves and their group members agreed to participant in the study were kept for our analysis. The data used for this study include students' pre- and post-activity perception surveys and their group's discussion board posts. Before participants began the first online group homework and online group discussions, they completed a perception survey about online collaborative learning. Throughout the semester, they engaged in four online discussion assignments and two online group homework assignments. All of the online discussions and online group homework assignments were submitted to the Course Management System (Blackboard Learn). Each group had its own group discussion boards with a total of six discussion forums for respective assignments. After completing all online exchanges in the discussion boards, students completed the post-activity perception survey.

2.2 Data Collection and Analysis

We collected two types of qualitative data from 18 participants: (1) participants' responses to an open-ended survey of their perceptions toward online small group work activities using asynchronous discussion boards, and (2) participants' contributing posts to their online group homework assignments and their online group discussion assignments. The online group homework assignments are the statistical problems directly related to what the instructor had introduced in the lectures. These are the practice questions in the required course textbooks. The questions in the group homework assignments usually have right or wrong answers. On the other hand, online group discussion assignments provide opportunities for students to explore topics or concepts relevant to the course topics and most of the information is not directly available in the course textbook and is not provided by the instructor. Students were asked to explore the information and rely on each other as they co-constructed knowledge for the new topics. After data collection was complete, the research team replaced participants' names with randomly assigned pseudonyms for the following data analysis. We used thematic analysis (Corbin & Strauss, 2008) to uncover students' perceptions toward online small group work in the statistics course as well as to reveal students' interaction patterns for their online collaborative learning experience. We first reviewed the data to familiarize ourselves with the student-generated posts and surveys. Then, we went back to the data set to identify common themes across participants. Next, we checked the data once again to confirm whether these themes stood out among other issues observed. We have triangulated students' responses to the surveys and their exchanges in the discussion boards to cross-check and broaden each theme to surface participants' perceptions and interactions patterns to ensure the credibility of the findings (Maxwell, 2013).

3 Results

The following section presents the results for the two research questions. The first research question is answered using the data collected from the open-ended perception surveys. The second research question used the students' actual discussion posts to determine their interaction patterns when learning statistical concepts.

3.1 Participants' Perceptions Toward Online Group Work

3.1.1 Perceived Benefits of Online Group Work

Based on the responses to the perception survey, 18 participants identified a number of benefits for using online asynchronous discussion forums for exchanges, including easy and unlimited access to the online discussion boards; no need to schedule meeting with group members, which leaves no burden on their personal and professional life; increasing opportunities to share ideas with peers at the convenience of individual member's time; easy use of the discussion boards; and access to the group's track of records. One of our participants, Hanna, responded to the question regarding the benefits of online group work, stating that, "I did not need to make appointment(s) with my teammates as we were all busy." Another participant, Jessica, shared in her pre-activity perception survey that, "It [using Blackboard] will record everything in the discussion." Jonassen shared his positive comment toward the asynchronous communication tool in his post-survey, "I can re-check the problems anytime instead of looking for the homework from a big box in the future." These perceived benefits are associated with the accessibility of the tools and they are similar to those commonly identified by students who participated in collaborative learning in other disciplines (Curtis & Lawson, 2001; Swan, Shen, & Hiltz, 2006; Zack, 1993).

In addition to these, our participants perceived other benefits pertaining to learning statistics and believed that the use of discussion boards for group work revealed their peers' thoughts and approaches to the problems. Ryan reported that, "One benefit might be the opportunity to see someone else's thoughts or approach to a problem." Along the same line, Courtney shared that, "It is nice not to be alone and get other perspectives and sometimes other catch your errors. We had different stats classes in our background and that was useful." Another benefit observed by our participants was that interacting with peers enabled them to identify their possible misunderstandings of statistics concepts long before they took the statistics tests. The identification of this theme particularly stood out in their responses to the post-activity perception survey. Allison wrote in her post-survey that, "Two brains are better than one and you can catch your partner's mistake and they catch yours." Moreover, such a pedagogical approach promotes learners to think more deeply and encourages them to explain ideas better in writing. Tobi was one of the participants commenting on the activity that, "I was able to understand statistics in a better way and also learned how to express an idea or concept in words while having a discussion."

The last category of participants' perceived benefits is associated with the instructor's monitoring of students' learning. Participants believed that with asynchronous discussions boards, instructors were able to monitor each student's contributions to their group discussions so the instructor could identify students when they failed to assume their individual responsibilities. Another advantage was that students made their understandings of the learned statistical concepts visible to the instructor in their discussion posts, which provided the instructor opportunities to correct students' misunderstandings of the concepts and offer necessary guidance during students' acquisition of knowledge. For instance, Yolanda commented that using such an approach, "Let[s] the teacher know more about how everything's going with the study of the students, so that he/she can make the students understand better." The opportunity like this is less likely to take place with the traditional face-to-face lecture format because in that setting most students primarily act as a listener rather than an information giver or speaker and therein they are not able to consciously reflect on and fully reveal their understanding and interpretations of the statistical concepts.

3.1.2 Perceived Challenges of Online Group Work

The biggest concerns about online group work shared by several participants were the issues related to time management and group members' delayed responses or lack of contributions. Many participants expressed that working in a group is time consuming because their schedules (e.g., task completion timeline) depends on other member's schedules. Furthermore, the nature of an online asynchronous collaboration project offers limited spontaneous communication opportunities, which makes it more difficult to hold individuals accountable, especially when some individuals do not carry their share of the workload. Hanna expressed her concern based on her previous group work experience, "It took more time to discuss because my team may not respond in time." Similarly, Ryan stated, "A challenge might be that other group members may be slow to post work." A few participants expressed that they prefer face-to-face interactions to the online interactions in that it is easier for them to build relationships in person with their peers than in the online context. Moreover, a number of participants worried about some communication barriers collaborating with peers in an online asynchronous context. First, some indicated that it was difficult to express themselves in writing, especially when the individual had unclear thoughts on the topic. Our participant, Amanda, explained that, "Verbal communication comes more naturally than text communication. There are more opportunities to discuss partially complete thoughts." Second, a few participants, such as Sarah, pointed out that it is actually difficult to type mathematical symbols in discussion forums. The third issue related to communications brought up by our participants was the challenge of drawing graphs with the use of discussion boards for group work. Based on the comment from Carlo, he indicated that, "[It is] hard to draw a graph to explain ideas in an online setting." When students learn statistics, often times they rely heavily on illustrations. Using drawings to illustrate their understanding of statistical concepts or to explain their processes to reach the solutions is an integral element in learning statistics; however, the online environments, especially with the use of text-heavy discussion boards, could restrict or prevent them from effective communications. Taken all together, these various concerns pose challenges for group members to manage their progress toward accomplishing the goal.

3.1.3 Feelings Toward Participating in Online Group Work for Learning Statistics

Our participants expressed positive, negative, and mixed feelings toward online group work activities. Many of them explicitly shared that they prefer face-to-face interactions to online interactions for various reasons. Some participants indicated that they feel uneasy or scared to collaborate with peers online. Furthermore, some thought that collaborating in person allowed them to use different ways of communications beyond texts. On the other hand, there were some participants who liked online group work because it was easy to access and all exchanges were documented. For example, a response from Brian shows his positive attitude toward online collaborative learning, stating that, "[I feel] good because you can do things alone but also have other people to help when you need it." Additionally, these documented records allow the instructor to be aware of each individual's contributions.

Overall, learners in statistics are like learners in other disciplines. When they are provided with group work opportunities, some learners like one modality over the other and their distinct perceptions toward online collaborative learning can be affected by their previous learning experiences. Most of the benefits and the challenges recognized are also similar to what has been perceived by learners in other disciplines; however, the participants in our study raised some additional aspects that should be considered when designing the online collaborative learning environments and activities in the context of statistics education.

3.2 Interaction Patterns of Online Collaborative Learning in Statistics

We used and analyzed participants' interactions of the online group discussion assignments and the online group homework assignments collected from nine groups of participants (18 participants in total). Our analysis revealed three types of interaction patterns: interacting for completing tasks, interacting for exchanging answers, and interacting for co-constructing knowledge.

The first type of interaction pattern encompasses very limited exchanges between the participating group members. The number of posts made by each individual group member was minimal. Most of the required online assignments, both group discussion and group homework, consisted of multiple sub-questions. Students were encouraged to take turns serving as the leader of respective sub-questions but how students proceeded to engage in the assignment was not prescribed. The strategy for some groups was to split up the work (i.e., sub-questions) between the group members. Accordingly, one group member started off by providing initial answers with non-exhaustive explanations, and the major task for the other group member would be simply to check whether or not they accepted their group members' answers. Such a pattern was followed by another group member for completing another sub-question. These group members were task-oriented. There were few interactions beyond completing the tasks and these students seemed to overlook opportunities to learn from and to provide support to each other.

The second type of interaction involved more effort from the group members, who primarily regarded the group work as a way to exchange answers with their group members before submitting the assignments for grading. When the participant served as the leader for a specific sub-question, he or she shared the initial answer with another group member. Immediately after the first member's post, another group member posted his or her answer to examine whether any discrepancies between the two discussion posts (i.e., answers to the sub-question) existed. When there was no discrepancy, they moved on to the next sub-question by repeating the same pattern. When a situation with different answers existed, they discussed the answers with each other until they reached an agreement. Although more exchanges were observed between these group members, it was obvious that the goal of their interactions remained to fulfill the course requirements rather than to see the interactions with their peers as opportunities to increase their intellectual capacity.

The third type of interactions illustrates students' dialogues that went beyond merely exchanging answers with their group members. Students who interacted in this manner achieved the instructor's intention for implementing collaborative learning activities. Their interactions were to support each other as they co-constructed knowledge of the topics that required their own exploration and enhanced their understanding of the statistical concepts presented by the instructor. Students interacted this way truly used online discussion boards and online group work activities to carry on joint intellectual dialogues rather than see the discussion boards as a space for submitting the assignments. Their interactions revealed a variety of exchange types, including proposing initial answers to share with their groups, providing feedback to group members' answers, clarifying the questions provided by the instructor, clarifying the statistics concepts, sharing resources with group members, identifying their misunderstandings of statistical concepts or the questions posed, demonstrating their processes of applying statistical concepts to solve the given problems, providing examples to enhance their understandings of statistical concepts, discovering new concepts or new terms, etc. An example of the third type of interactions (see Fig. 11.1) began with a discussion post that contained

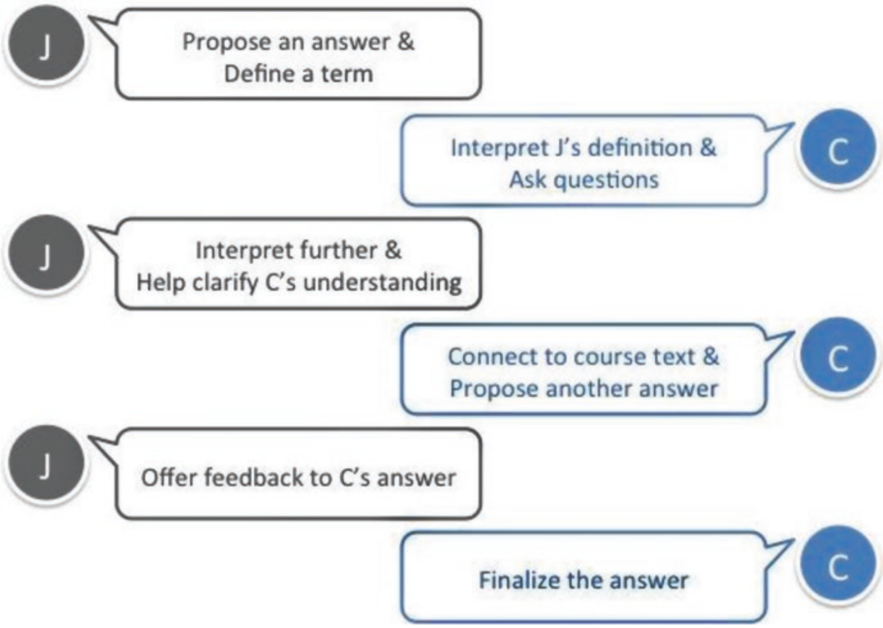

Fig. 11.1 An example of co-constructing knowledge interaction pattern

an initial answer along with a definition of a term from the leading participant, Jonassen. Then, the other participant, Carl, offered his interpretation of the term and asked related questions of Jonassen. Jonassen then offered his own interpretation of the information shared earlier and provided further clarifications to assist Carl to understand better. Carl then attempted to connect the information in the textbook with the information provided by Jonassen and proposed another round of answers. Then, Jonassen offered feedback to Carl's revised answer. With that, Carl finalized the answer and concluded the thread of discussions for the given sub-question. Based on this example, we observed that both participants not only attempted to solve the statistical problem and to complete the required task but also provided mutual support by proffering terms, definitions, and follow-up questions to support their grasp of the concepts. Students who demonstrated such a pattern of interactions regarded their group member as a learning companion and resource rather than a colleague that divvied up the course workload.

4 Conclusions

The purpose of this study was twofold. The first goal was to understand learners' perceptions toward the implementation of online collaborative activities in learning statistics. The second focus of the study was to uncover learners' interaction patterns as they engaged in discourse in an online collaborative learning space. With regard to the perceptions toward online group work, participants in our study shared some similar perceived benefits (e.g., easy accessibility of discussion boards, flexible scheduling, and the capability of documenting all exchanges) and perceived challenges (e.g., the free rider issue, requiring longer wait times, difficulty expressing their opinions in writing) with learners in other disciplines (e.g., Petrides, 2002; Poole, 2000). In addition to the benefits and challenges, our participants identified other benefits (e.g., making the process of solving statistical problems visible to both group members and the instructor, the ability to detect misunderstandings of the statistical concepts at an earlier time) and challenges (e.g., difficulty typing mathematical symbols in discussion boards and the need to draw graphs as they explained their thinking process to their group members) that are specific to the context of learning statistics in an online group work setting. To increase learners' willingness and enhance the effectiveness of online collaborative learning activities, it is critical for educators to identify solutions that provide reliable technological tools and learning space for different types of communications (e.g., audio, video, or text) to take place. Nonetheless, as Fung (2004) cautioned, providing learners with technological support does not guarantee the occurrences of joint dialogues.

As we observed in this study, not all students demonstrated high levels of interaction when provided with the learning space and opportunities. In actuality, most students were inclined to be task-oriented. Their attention focused more on completing the given task and less on gaining knowledge. Only a small number of students regarded group work as an opportunity to co-construct knowledge with peers and advance their understanding of statistical concepts. Kleinsasser and Hong (2016) had observed a similar phenomenon during their implementation of online collaborative learning in a graduate-level literacy and bi-literacy course. These similar observations across different studies support the conclusion that there is much we can do to better understand supporting learners' development of collaborative learning dispositions and guiding them to carry on joint dialogues where they embrace the constructive learning process while interacting with peers. The findings of this current study reveal that when engaged in online statistics coursework collaborative learning tasks, students demonstrated different interaction patterns. Yet, it is not clear to us what leads to different patterns of interactions and what makes students task-oriented or learning-oriented when they are involved in online group work. For future research, it is worthwhile investigating further as to whether or not students demonstrating meaningful joint dialogues with peers are equipped with better communication skills, stronger collaborative skills, and/or more knowledge and skills in statistics. Continued research in this area will help researchers and educators to identify appropriate pedagogical approaches to support statistics students' processes of co-constructing knowledge and skills in an online collaborative learning milieu.

Acknowledgments The research of Kao was in part supported by the National Science Foundation grant DMS-13-52213.

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Chapter 12
The Effect of Listening to Radio News in Developing Students' Listening Comprehension Skills

Lies Budyana, Ismet Basuki, Luthfiyah Nurlaela, Maya Ariesta Umboh, and Kusuma Nagari

Abstract The listening comprehension of elementary-level students in Indonesia has been decreasing, since they prefer to listen and watch the objects at the same time by audio-visual appliances rather than only listening. This study investigated the use of radio in promoting the scrutinize skill that would improve their listening comprehension. For the purpose of the study, fifth-grade students were randomly selected and divided into two groups. The research design used was a quasi-experiment of two-group post-test design, with one group as the experimental group and the other group as the control group. Although some radio news as audio files were presented to the experimental group, both the experimental and control groups were taught by using the same style. According to the results of a post listening test and the related comparisons, the findings showed that listening to the news on the radio as audio media had a positive and meaningful effect on improving their listening comprehension skills even without the visual exposures supporting the content. However, it also indicated that learners' language proficiency played a fairly important role in their listening comprehension.

1 Introduction

There is a definite decline in listening comprehension these days. For some time we have been aware of the decline in students' ability to comprehend what they hear. The authors have a theory about what happened. Our young generation's listening

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K.A. Persichitte et al. (eds.), *Educational Technology to Improve Quality and Access on a Global Scale*, Educational Communications and Technology: Issues and Innovations, https://doi.org/10.1007/978-3-319-66227-5_12

skills are getting worse due to the excessive use of audio visual appliances such as television, video games, computer usage, etc. Those modern appliances have contributed to the decline of listening comprehension skills.

It is such a strange phenomenon to us, especially issues related to listening comprehension. In the past, it was important to learn listening comprehension in schools. It is an extremely important skill to have and this is even true in lower levels of elementary classes with scrutinizing capabilities.

2 Literature Review

Audio media that processes the elements of listening according to Munadi (2013) is the media that involves the senses of hearing and is only able to manipulate voice capabilities. Radio has been used in education ever since it became available. In one study, Peterson (2001) found that the average student has used 53% of their time awake to listening to radio.

2.1 Radio

Radio waves were discovered in 1887 by Heinrich Hertz and paved the way for Guglielmo Marconi to conduct wireless communications in 1895. The definition of radio is the delivery of information with the use of electromagnetic waves that have a free frequency of less than 300 GHz (wavelengths greater than 1 mm). Munadi (2013) argued that the characteristics of audio media are based on the ability of the media to stimulate the sense of hearing. Its main characteristic is that the message is delivered through audio media conveyed in additive symbols, both verbal and nonverbal.

The term “radio broadcast” or “radio” comes from the word “radio broadcast” (English) or “radio Omroep” (Netherlands), which means the delivery of information to the public in the form of sound that goes in one direction with use of the radio waves as a medium. Radio is synonymous with music, songs, commercials, and news. Radio encourages the listener’s imagination through words and sounds. Listeners can only imagine what is proposed. Usually, people listen to the radio in the bedroom, in the kitchen, or in the car.

The news description is information about an event or events. An event is referred to as news when it concerns the society or supports the spread of news through the media, both print and electronic. To capture the news content, we must know the main points of it. As for listening to the news spread through electronic media requires a variety of capabilities. There are three capabilities required to listen to the news content: concentration, understanding content, and precipitator information. The ability to concentrate is used to prevent someone from easily missing the news that followed. The ability to understand the content is needed to capture and digest the contents of the news. The ability to precipitate information must be owned by someone so that the meaning of the news can be understood.

2.2 The Process of Listening

The listening itself is a complex process involving the following three elements:

1. Listen—The definition of listening is a selective process to observe, listen, understand, and remember the listening symbols. Hearing is a psychological process of automatically receiving auditory stimuli (aural stimuli). In other words, hearing is a process whereby sound waves enter through the outer ear canal connected to the eardrum in the middle ear and cause vibrations that then stimulate nerve impulses to the brain. We are capturing and storing our auditory hearing information at any time, even without us knowing. When we use our own voice by talking, some important areas of our brain become active.
2. Attention—Paying attention to stimuli in our environment means focusing our awareness on certain stimuli. The receiver senses are constantly bombarded with lots of stimulation that do not allow us to respond at the same time. Special cells in our nervous system (nerves inhibitors) function to remove a number of sensations that occur and keep those sensations in our consciousness. Although we have helpful cell blocks, we still often have problems focusing on one event more than a few seconds at a time. This is because other stimuli are also competing to attract our attention. This phenomenon that accepts certain stimuli while throwing other stimuli is called selective attention.
3. Understand—Understand is the most difficult element in listening. The definition of understanding is the process of giving meaning to the words we hear, in accordance with the meaning intended by the sender of the message. The process of understanding involves linking messages with our past experiences that results in a tendency to judge (accept or reject) messages as we try to understand them.

2.3 Scrutinizing Capability

Scrutinizing is a process of listening to verbal symbols attentively, with understanding, appreciation, and interpretation to obtain information, capture the content or message, and understand the meaning of communication that has been delivered by the speaker through spoken language (Rost, 1994).

People can do scrutinizing activities through the sounds of language or symbols of verbal sounds. Scrutinizing human activities can be done when there are a speaker and a listener. Paul (2003) argued that listening is a process that involves listening to the language, identifying, interpreting, assessing, and reacting to the meaning it contains. Thus, scrutinizing is not just listening to the sounds of the language and verbal symbols.

Scrutinizing requires the listener's understanding so that the message or intentions conveyed by the speaker can be well understood. It requires the attention of a listener. It has meaning to listen with understanding, attention, and appreciation. According to Mendelson (1994), *hearing* means capturing sound or noise in the ears, while *listening* means hearing something in earnest.

The word listening, according to Mendelson (1994), means to listen or pay close attention to what is said or read by others. From that sense we can see the difference between the meanings of the word hear, listen, and listening. Conscious or not, when there is a sound, human hearing will surely catch it. Thus, the person hears a noise without a deliberate reaction, because the sound is heard without any prejudice in the actions performed by the listener. The listening will occur if the sound attracts the attention of the listener so that he wants to know what he hears and wants to understand more.

At the beginning of its development, the listening skills in language learning are considered not as important as other skills. In fact, most people assume that having the language skills means having the ability to speak and write. In 1960, some researchers began to see the importance of listening skills in language teaching. Theories about the importance of listening skills flourished in the 1980s, when Brown (1980) indicated that the development of listening and speaking (orally) is as important as the ability to read and write (literacy).

Brown (2001) stated that listening skills play an important role in the process of learning language as it can provide meaningful input to those learning the language. He then stressed that without understanding the inputs at the right level then the learning process cannot be implemented. Therefore, he believed that listening is as important as the ability to speak.

The challenges that are faced in teaching listening skills are how to give students the opportunity to control the content of the material to be discussed in classes (in some degree) and personalize these materials so they can engage with the topic being discussed, which in turn can create activities that will be held in the classroom that is varied and meaningful. For example, the teacher can ask students to listen to an audio recording of a person who is discussing a topic, then they are asked to develop some questions to interview their classmates on the same topic.

Scrutinizing skills mean a lot for a person, especially for students. Their listening skills can determine their success in learning. Scrutinizing is the beginning phase for humans in acquiring language. Whether they are with their families at home, at school, or in society, everyone is required to have effective scrutinizing skills as a means to interact and communicate. In listening, the listener not only understands but also manages the interpretation and tries to understand what is meant by the speaker.

Scrutinizing activities include several types that correspond to the activities undertaken by learners:

1. *Intensive listening*, aims to enable learners to know about components in any language, including discussion of phoneme, word, intonation, and so on.
2. *Responsive listening*, activities in the form of short greetings, questions, commands, etc. which aims to allow students to provide a brief response.
3. *Selective listening*. In this type of listening, the activities place emphasis on the activities of listening so that learners can scan the submitted material and are able to collect information relating to specific topics derived from teacher instruction, radio news, or stories. At certain times, students will be asked to listen and find information about names, numbers, directions, or events that match the records presented.

4. *Extensive listening*. This type of listening activity is presenting material longer than other types, such as recording when a teacher gives lectures to students and conversations involving multiple people. Learners are expected to capture the global understanding of the recording. In order for learners to achieve a comprehensive understanding, it is advisable to use interactive skills, such as recording important information, creating a series of questions, and engaging in discussions related to the topics presented.

3 Research Question and Methodology

This study was conducted to explore the presumed belief that listening comprehension skills of elementary students has been decreasing, due to the habit of listening and watching audio-visual appliances rather than only listening. The following research question will be answered: Is the use of radio significantly promoting the improvement of students' listening comprehension?

This study was quasi-experimental, non-equivalent group. And a pretest and posttest design was utilized. A quasi-experimental method is used when it is not possible for the researcher to randomly assign subjects to groups. With this design, both the control group and the intervention group were compared. However, the groups were chosen and assigned out of convenience rather than through randomization. The study was conducted at the fifth grade of Mawar Sharon Christian School, Surabaya, which is considered one of the best independent schools in Indonesia. The data were analyzed using SPSS version 16 software. All reported p values were compared to a significant level of 5%. Differences were considered statistically significant at $p \leq 0.05$ (Sudjana, 2005).

The following study tools were used. The researcher structured them after reviewing related literature and the others were adopted, tested, and piloted:

1. Structured interviewing questionnaire designed and developed by the researcher.
2. The pretest and posttest were used to examine the students' knowledge, vocabulary acquisition, and scrutinize capabilities related to listening comprehension skills before and after listening to the news in radio as audio media for listening practice program, which was constructed by the researcher based on the revised articles, books, related literature.

The instrument of this research was a short answer test, answered by the teacher. It consists of four items, which are:

1. Main Idea:
   - The main idea after listening to the news.
   - The students are able to recall his or her background knowledge of the news topic by predicting the main ideas and process the overall meaning of the news by getting the keywords that came up in each news.

2. Details:
   - The students are able to record the detail of the news by answering the questions.
   - The students rely on grammar, vocabulary, and the semantics of the news to comprehend the details.
3. Vocabulary:
   - The students are able to choose several vocabulary words that are essential to understanding the news and give a one-word synonym or a descriptive definition for those vocabulary words heard in the news.
4. Understanding messages:
   - The students are able to understand the news message and able to answer at least two questions about it.

4 Results

On the first day of classroom learning, the teacher performed a test as the pretest. The results of this pretest were obtained from an independent sample T-test. The pretest in this study aimed to determine the initial ability of the control class and experimental class before being treated. Therefore, it was possible to determine whether there is a significant difference between the two groups of participants at the alpha level of 0.05. The pretest results show the significance level was higher than 0.05 ($T = 0.457$; df = 36; $p = 0.160$) and thus made a conclusion that there were no significant differences between the two groups before the implementation of the study.

The experiment was done in the following way. During 20 school days in a row, a group of students as the control group practiced to improve their listening comprehension skills by using a television as their learning aid. The television was displaying the news in audio-visual mode. That means the students in the control group listened to the news being displayed simultaneously with its visualization (sound and images).

While the other group, as the experimental group, practiced to improve their listening comprehension skills by using a radio as their learning aid. The radio was displaying the news in audio mode only. That means the students in the experimental group listened to the news without seeing its visualization. This treatment was also done for 20 school days in a row, just like the control group. The treatment for both the groups was conducted by the same teacher.

On the twenty-first day after the treatment ended, the researchers conducted posttests for both the groups to analyze the results of their research. The scores obtained by pretest and posttest were statistically analyzed to see whether there was a statistically significant difference between these two groups.

The posttest scores obtained by the experimental and control groups were analyzed using the SPSS software package using the independent sample T-test to establish whether there were significant differences between two groups of participants at the 0.05 alpha level.

This analysis was carried out to determine whether listening comprehension can be improved through listening to the news on radio (without seeing its visualization) compared to listening to television news (with seeing its visualization). In addition, the analysis of this study was used to answer the research question whether radio usage significantly enhanced the students' listening comprehension.

The significance level was lower than 0.05 ($t = -3.114$; df = 36; $p = 0.004$), which led to the conclusion that there was a statistically significant difference between the two groups. In other words, the students in the experimental group who practiced to improve their listening comprehension skills through listening to the news on the radio are significantly able to develop their scrutinizing skills more than the students in the control group who were listening to the news while simultaneously viewing its visualization on the television.

5 Conclusion

This study attempted to prove that listening to news on radio has a positive and meaningful effect on improving the students' listening comprehension skills. More importantly, as this research shows that the listening comprehension development of the experiments group was developed significantly after 20 days or four weeks in a row practicing their listening comprehension skills by listening to the news on the radio as audio files only. There was a significant difference in the development of listening comprehension skills of the control group that listened to the news with its visualization at the same time on the television audio-visual appliances. It is the conclusion that listening to the news on the radio has a positive and meaningful effect on improving the students' scrutinizing skills which lead to the listening comprehension skills development, especially without the vision exposures supporting the content.

6 Suggestions

The researchers would like to give some suggestions for the process of teaching and learning and also for the further research. As we discovered, the scrutinizing skills of the group of students who often listen to the news on the radio are good. The teacher can use several techniques with variations of tasks and activities using radio appliances in the scrutinizing practice task such as guessing, completing sentences, and paraphrasing. We also suggest that other researchers may conduct the research for a longer period of time since the treatment in this research was conducted in only 20 meetings. The impact of listening to the news on radio on the students' listening comprehension development in the long run is also thought-provoking to discover.

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Chapter 13
Instructional Design for the Computer Network Subject: A Balinese Culture-Based Learning Using Subak

Ketut Agustini and Gede Indrawan

Abstract Indonesian culture is very diverse and many of its indigenous concepts and values can potentially be applied in modern education and daily life. Subak is a Balinese irrigation system, which is known widely in the world. The Subak system with its unique resources management is similar to the concept of a computer network system. The Subak concept can be applied to an innovative learning model to improve students' understanding and mastery of certain concepts. This is a needs analysis study to produce an instructional design manual based on Subak concepts, for the subject of computer networking. The subjects for this study were students majoring in Informatics Engineering Education while taking a course in computer networks. The data were collected through the use of questionnaires, observation, and interviews and analyzed through a descriptive qualitative method. The instructional design manual being developed consists of 11 chapters with 23 specific instructional objectives where each chapter illustrates two important points. However, there are still three chapters having material which is still difficult to be analogically linked to Subak concepts, such as Internet Protocol, internetworking, and directory of naming. The computer network concepts are associated with the analogy of a Subak network system. The aspect that does not seem to be covered with the analogy is the commercialization of computer networks/Internet and the involvement of large corporations.

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K.A. Persichitte et al. (eds.), *Educational Technology to Improve Quality and Access on a Global Scale*, Educational Communications and Technology: Issues and Innovations, https://doi.org/10.1007/978-3-319-66227-5_13

1 Introduction

In the era of globalization and the ASEAN Economic Community (AEC), mastering science and technology is very important to keep competitive. Human resources in Indonesia have the challenge of being reliable, qualified, and able to master science and technology but Indonesians also have typical national characteristics based on indigenous culture. Gardner (2007) claimed that future challenges require five characteristics: a disciplined, synthesized, creative, ethical, and respectful mind. Miarso & Hadi (2007) and Tilaar (2012) stated that globalization should be encountered by fostering creativity and entrepreneurship through transformative critical pedagogy in national education.

Educators have to prepare students with good technological skills, critical thinking, creativity, and the ability to adapt to changes and developments. Accordingly, there is a need to reorient education in these changing times so as to facilitate pedagogical transformation and to raise self-awareness.

ICT knowledge, particularly in relationship to current computer material networks, tends to have weaknesses such as: (a) the learning concepts are not connected to real life; (b) students complain that it is too difficult to learn the materials; (c) the material does not encourage students to think creatively and critically; and (d) the materials do not support concrete understanding of concepts and lack relevance to existing cultural values. This is confirmed by Suastra (2008) who argued that nowadays education tends to be a means of social stratification and the education system simply attempts to transfer knowledge to students, which is unrealistic He adds *dead knowledge* is achieved through rote learning (text books).

Attempts have been made to improve student learning outcomes, by (a) applying the cooperative learning model, (b) holding workshops, and (c) reproducing tasks. Although these efforts achieved some success, the results were not optimal because students had difficulties understanding concepts and problem analysis. Learning outcomes do not only depend on the experience in the classroom, but also depend on culture and the environment.

2 Literature Review

Cultural values can be included in the instructional design and learning process. Morrison, Ross, and Kemp (2007) argued that cultural and social differences, as well as other differences, should be recognized and addressed in an instructional design because they can affect student performance and the ability to take responsibility for individual work or to engage in creative and collaborative activities. Paul and David (Ardana, 2008) argued that several approaches might be taken to investigate individual differences that are a result of cultural diversity. Philosophically and practically, in daily life, environmental circumstances strongly influence students in developing their knowledge. One environmental influence on the learning process is a cultural aspect because the learning process should not be separate from the learners' culture and environment.

According to Subagia and Wiratma (2006), life values adopted by the community have an effect on the educational process. They state that there is potential for local wisdom to be relevant to modern instructional and educational theory. Local wisdom can potentially play a part at the level of the (1) learning concept, (2) learning discipline concept, (3) teachers as leaners concept, (4) how to teach concept, and (5) how to learn concept. Based on these findings, Subagia and Wiratma (2006) suggested that local wisdom should be taken into account in developing the concepts of a culturally based education. This opinion is emphasized by Kesiman and Agustini (2012) who claimed that by studying and analyzing Indonesian culture, one may find many concepts of local wisdom that have been practiced in daily life that can be beneficial for the study of information technology. Ardana (2008) indicated that a local wisdom-oriented learning model can be effectively used to improve learning quality, learner participation, student achievement, and student responses in the learning activity.

Character development is very important and can positively affect people, good manners, positive behavior, and national spirit. Indonesian people characteristically tend to value all, aiming to have a superior and noble civilization. It is time to rebuild awareness of the importance of positive character development for the Indonesian people through quality education based on local wisdom.

Thus, it seems necessary for a transformation of ICT education, from learning by rote to learning through higher-level thinking, from studying superficially to studying in depth, from the transfer of knowledge to the development of knowledge, skills, and positive character traits to improve the nation. It is therefore the responsibility of all ICT education experts to develop an ICT curriculum and testing system which is focused on this new orientation, as well as knowledge disseminating on ICT learning methods, and to develop techniques that are effective and meaningful. All these efforts, however, would be less than effective without considering innovative learning in class.

Developing an instructional design that is focused on developing students' creative thinking and national character based on local wisdom may provide a valuable contribution to support human resource development and improve the quality of learning, especially ICT through innovative learning. There will be a balance and harmony between the knowledge of the technology itself with the development of scientific attitudes, as well as national character-based values of local wisdom and growth in the community. Accordingly, ICT education will be beneficial to the students themselves, the wider community, and the Indonesian nation.

Based on the above rationale, this study aims to: (1) identify and analyze the instructional qualities of the local wisdom using the concept of Subak in managing water resources; Subak's basic concepts are similar to the concepts of managing a computer network system; and (2) define the learning goals that are tailored to the syllabus for the networking course. Through the identification and analysis of the similarity between the two concepts, instructors can assist students in learning concepts in a more concrete way by using this analogy.

In the Indonesian island of Bali, rice farmers form cooperative associations called "Subak" (which is also used to refer to the irrigation system used by Subak associations), averaging 100 farmers working on less than 50 hectares of irrigated rice fields (Falvo, 2000). Subak is a socio-religious organization responsible for irrigation management and religious activities within a defined geographical area. Every Subak has rules that have developed over a long period of time. The rules have been codified into a set of laws called *awig-awig*. These laws regulate the rights and duties among the members of the Subak. Such rights and duties include public obligations, regulations concerning land and water use, legal transactions for land transfer, and collective religious ceremonies (Lorenzen, 2006).

As an irrigation system, Subak owns and manages a network of irrigation from the same water source. Like a computer, Subak is mostly supported by three main components: the *hardware* (facilities and irrigation infrastructure), the *software* (the processes undertaken from planting the seed to harvest, along with a series of religious ceremonies performed), and the *users* (the members of Subak). The three main computer parts, such as the input devices, the processing devices, and the output devices are also contained in the concept of the system of Subak. Subak as a physical unit has a subsystem of artifacts that also serve as input, process, and output devices. Control of access to resources is also done within a Subak system. The basic services of a network operating system can be found commonly in each Subak, such as: Activity Management, Resource Management, Input and Output Management, Protection System, and Distributing System.

Subak members do not have direct access to the resources of Subak. The Subak rules provide a mechanism to access resources on behalf of Subak members. In this case, Subak acts as a resource allocator, for allocating resources to some of its members or to regulate jobs that are running simultaneously. The *Pekaseh* or the head of Subak is responsible for managing the distribution of water fairly and equitably for all Subak members. For a larger Subak (usually called *Subak Gede*), the *Sedahan* is responsible for synchronization when there is a conflict over water usage among Subak members. The flow of water from the dam is governed by the gate controller, in accordance with the agreements made by all members. Interruption is an important part of computer architecture. This mechanism is also applied in the process of water distribution in the Subak system.

From the period of the growing season to the harvest season, the water distribution process is conducted in accordance with earlier agreements of all Subak members. In actual practice, however, some members may complain to Subak about problems in the distribution of water. Like a networking operating system, the Subak system is also responsible for activities related to collective management of resources such as keeping track of and distributing water, selecting cropping activities and religious ceremonies, and also arranging the process of the borrowing/transfer of land and water among Subak members.

Two or more Subak organizations may cooperate to form a larger Subak. In this distributed system of several Subaks lie concepts of local wisdom as a quite complex operating system. A number of ceremonies are for instance conducted in the planting period or to anticipate extraordinary events such as pest attacks. In a distributed system, Subak attempts to maintain the coherence and consistency of water flow that may become more complex. A rice field area may receive water input from several sources originating from different regions of Subak. The *Sedahan* of each Subak region are involved in the process of negotiations and compromising over water distribution. In addition to the need to calculate the debit of water received from the Subak's own irrigation channels, the quantity of water received from other surrounding Subaks must also be taken into account.

The Subak system also provides irrigation facilities and infrastructures within its region. The services provided by Subak in an irrigation system are outlined below. The first service is the planting program (program execution). The Subak should be able to implement the entire planting program that has been planned, including conducting a whole series of religious ceremonies. The second is the setting and maintenance of irrigation facilities and infrastructure (I/O operations). The Subak must organize everything involved in the usage of facilities and irrigation infrastructure. Farmers themselves cannot manipulate the use of irrigation facilities, without any agreement between all Subak members, in accordance with the rules stipulated in the *awig-awig* of the Subak. The third service of the Subak is as a medium of communication among its members. The Subak serves as a bridge of communication among its members for all activities that will be run by Subak members. The fourth one is anticipating conflict and searching for solutions (error detection). The Subak should be able to provide solutions for conflicts arising within its territory. The fifth service is allocating the irrigation of water resources (resource allocation). The last one, the sixth service, is to protect the distribution process and the use of irrigation water resources (a protection system).

Similar to an operating system, the Subak's main objectives are to provide comfort for all members in the use of limited resources. Common to all includes the efficient use and utilization of Subak resources. Evolving systems and organizing of the Subak should be built to enable and to facilitate the development, testing, and filing of the new systems. These objectives are obvious from the characteristics of *awig-awig* of Subak, which is highly flexible; sometimes non-formal agreements among Subak members are needed.

Subak provides services for the proper use of all resources in the operation of an irrigation system. Subak is not only a religious and socially based cultural heritage, but it is also a deep and complex, living system for sharing limited resources, much like a modern computer (Kesiman, 2011).

3 Study Design

This chapter details the results of a two-year research and development study, based on an adoption of the instructional development model referred to as MPI (Suparman, 2012). The MPI contains these important stages: identification, development, evaluation, and revision. This study is focused on the identification stage, which has two main objectives: (1) to assess and analyze the instructional needs in the form of descriptive research, and (2) to define and establish the conditions and requirements of the empirical development of instructional design of computer networks based on local wisdom, namely the Subak concept of Bali.

The subjects were students majoring in informatics education, who take courses in computer networks. The data were collected through questionnaires, observation, and interviews. The data were analyzed using qualitative descriptive analysis.

The identification and analysis stages were completed through examining the sources of relevant literature, such as relevant aspects and indicators. The identification and analysis were then included in the questionnaire, which was distributed to students. The questionnaire gathered information relating to preferred instructional design. The needs analysis stage of the learning concept was done through a literature review on the concept of Subak, which is analogically linked to the concept of a computer network. This has been adapted in the syllabus and made explicit and clear to students.

3.1 Discussion

The needs analysis of instructional design identifies eleven clusters of computer network concepts which are analogically linked to concepts of Subak system. Those eleven clusters (which could be treated as chapters in an instructional sequence) consist of 23 specific instructional objectives. Some other results of the analysis are:

1. The time-sharing system in the computer network concepts is similar to the concepts of water resources sharing. For example, the specific objectives of emotional and physical well-being (*moksartham jagadhita*) are applied in the Subak system. While networks do not have emotions, the notion of balancing tasks and being equitable with time demands does apply.
2. The broadcasting network with its transmission technology is similar to the Subak irrigation system. The rice fields' distribution scope that enters into the territory of a particular Subak is determined by factors of geographical location of the rice fields. Subak is an indigenous concept of Balinese, who are socio-agrarian, economical, and dynamic in regulating the use of irrigation for paddy fields. Subak members are farmers, including tenant farmers. They utilize the irrigation network, which could include one or more rural areas. Thus, membership-based Subak irrigation (canal based) is not limited to the area of the village (village based). For a small water control system, the area to be managed is not too extensive. It is probably only about 10 % of total area. However, when a Subak involves a larger area (rice fields), which is usually a combination of several small water control systems, the geographical area can be as much as one region or district. Bandwidth issues in a computer network exhibit similar characteristics.
3. The concept of wide area network exists in a larger Subak network, known as *Subak Gede*. The *Subak Gede* consists of several dams and water control systems that use irrigation infrastructure collaboratively. At the *Subak Gede,* communication

must be established between the heads of all the Subaks. The process of water distribution and utilization of irrigation channels will become increasingly complex. Conflicts, which may arise, will also be more complex, because they may involve members of Subak from different regions. Similarities in computer networks include coordination of shared resources among multiple users and user communities.
4. Looking at the function of an irrigation or water control system as a network of irrigation facilities, needed to organize and distribute irrigation water from the source to the rice fields of individual farmers has similarity with how one may view a computer network. The irrigation facilities consist of irrigation channels, along with irrigation and buildings, *awig-awig* (rules/protocols for the management of Subak) and Subak meetings (the interaction and communication between Subak members), which together form an integrated system of irrigation networks. Alternative channels and protocols similar to those in a Subak can be found in a computer network.
5. The structure and functions of the layers in the OSI (Open System Interconnection) are similar to the concept of Subak. Although it is better known as the setting of irrigation systems, the water control system is also a complex organization. Therefore, we need a protocol structure of the network model that can simplify highly complex tasks into smaller units (layers). The Subak system recognizes the existence of four layers that have their respective functions and form one unit. This is somewhat analogous to the notion of protocols and priorities in a computer network.

3.2 Limitations of These Studies

The Subak irrigation system is one example of the culture of Bali, which has only been studied as a socio-cultural organization. Other researchers have studied it in terms of its economic value (Kesiman & Agustini, 2012). Instructional design and development seeks to provide alternative sources and resources in support of learning so that students can build new knowledge from their own experiences. The ability of students to construct knowledge is in line with the opinion of Saekhan (2008) and many others who argue that learning is a process of building knowledge through real experience in the field.

3.3 Content Limitations

There are eleven aspects of computer networks that have been identified and analyzed in the existing syllabus. Among these are three topics that the researcher could not analogically link to the concept of Subak. These are: (1) Internet Protocol; (2) internetworking; and (3) directory of naming. There is no suggestion that such an analogical approach based on Subak will work outside Bali or outside Indonesia. It might be interesting to find other analogies embedded in local culture that might inform how one thinks and learns about information and communications technologies.

3.4 Demographic Limitations

Indonesian culture is diverse and has developed from a variety of local wisdom to regulate the life of local communities. Every region in Indonesia has a unique culture and local wisdom respectively. If someone comes from a certain area and then settles in other areas, they need to adjust to the local environment. There is a saying that "when in Rome, do as the Romans do." When in Bali, stay in tune with Subak.

A limitation in this research for developing instructional design is that it is specifically appropriate for students who were born, grew up, and lived in Bali. They already know and understand the concept of Subak, so they can easily learn from the material provided. For students, who come from outside of Bali, however, they have to first understand the concept and terminology of the Subak system before applying it to computer network systems.

4 Conclusion and Future Study

In examining the syllabus and lecture material used for computer network systems, eleven chapters with twenty-three specific instructional objectives can use the concept of Subak as an analogy. Three chapters were not analogous: Internet protocol, internetworking, and naming in a directory. Researchers and teachers should continue to explore the nation's local wisdom, as there are still many untapped resources, which could be optimized and used as a reference in the development of education in schools, based on a national character using elements of Indonesian culture.

Acknowledgments The authors thank Prof. Dr. Atwi Suparman for his support and sharing his experience. This has helped us to improve our knowledge. Also thanks to our Institution, Universitas Pendidikan Ganesha, for the permission to conduct this research.

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Chapter 14
A Scientific Approach for the Accelerated Preparation of Indonesian Senior High School Students: Development of Economics Tools and Teaching Materials

Siti Nurjanah

Abstract Indonesia's educational system is becoming a concern, especially with regard to the 2013 curriculum, at the time of this study. Curriculum-based and student-centered approaches are a focus but its implementation is not ready in all aspects. Much has been considered on the pros and cons, revisions have been made, and those ready to apply the 2013 curriculum are welcome to implement this approach. Those not ready will continue to apply the 2006 curriculum. Indonesia has been using the Dual System (2006 and 2013) curriculum to include both strategies. The purpose of this study is to help map out tools and teaching materials in support of the 2013 curriculum, especially for the subject of economics for senior high schools in Indonesia. The development of tools and instructional materials in accordance with the principles of 2013 curriculum is very exciting for teachers and students. The results of this study found the current economics tools and teaching materials in high schools are ineffective for students. Second, the development of tools and teaching materials for economics in Senior high schools to help the stakeholders to improve the educational activities was very interesting in preparing students in the context of the ASEAN Economic Community (AEC). The developed product is called E-conosmart and Econo-SmartCard (dual languages) which is displayed in every classroom in the 10–12th grades on the subject of economics, which students can read anytime they want as a mobile application without using economics textbooks.

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K.A. Persichitte et al. (eds.), *Educational Technology to Improve Quality and Access on a Global Scale*, Educational Communications and Technology: Issues and Innovations, https://doi.org/10.1007/978-3-319-66227-5_14

1 Introduction

Indonesia is a member of the ASEAN Economic Community (AEC) which was implemented at the end of 2015. The impact of the AEC includes the creation of a free market in capital, goods and services, and labor. Thus, Indonesia will compete not only with domestic labor, but also with other workers from the countries in Southeast Asia.

With AEC, the Indonesian people are expected to be creative and of a high quality to be able to compete with ASEAN countries. But looking at the reality of today, Indonesia apparently is still not ready to face the challenges. There are still many workers in Indonesia who need to be equipped with effective education and training to improve their skills and quality of work.

Given the importance of the role of education to produce qualified human resources, the government needs to put the development of the educational sector as a top priority. Various efforts have been done in order to support government development in education: locating primary schools in remote areas, launching a program of compulsory education, providing assistance in the form of financing, increasing the number of graduation requirements, and tightening the accreditation of schools to enhance the qualification of human resources. However, those efforts have not shown satisfactory results.

The real problems include inequitable educational opportunities to all corners of the archipelago. In the era of intense development, educational inequality still exists in various regions of Indonesia. There are still many school-age children who are not able to get a quality education and this leads to high dropout rates. Meanwhile, the Ministry of Education and Culture reports reveal that in every minute there are four Indonesian children who are forced to drop out of school.

The education budget reached IDR 345.3 trillion in 2013 but has not solved the problems of education in Indonesia. Ironically, the government, through the Education Ministry, certifies the quality of education in Indonesia as being far behind the other developed countries of ASEAN. The survey was based on the Political and Economic Risk Consultant (PERC). The quality of education in Indonesia was ranked 12th out of 12 countries in Asia.

The low quality of education in Indonesia cannot be separated from the low quality of the facilities and infrastructure of the schools. Many buildings are damaged, instructional media does not support instruction, there is a lack of library collections, there exists inadequate information technology, as well as the low quality of teachers.

Teachers are an important key in improving the quality of education. Overall, the quality of education starts with the quality of the teachers and instructional strategies. According to data from the Ministry of National Education in 2010, there were more than 54% of teachers with standard qualifications which needed improvement and 13.19% of school buildings needed to be repaired.

National education should guarantee to improve the quality of Indonesian society in order to be competitive to face the challenges of globalization which is characterized by the ASEAN Economic Community. There are still many things that need to be addressed by Indonesia to support quality improvement and the quality of education to be able to produce competent human resources.

Indonesia has the opportunity to take advantage of the country as a base to make a profit in the face of the ASEAN Economic Community (AEC). However, Indonesia still has many challenges to be faced. Therefore, improvement of competitiveness of Indonesian workers through education is a fundamental element that is very important for improving the quality of labor, so that Indonesia can survive and compete with other workers.

Given the important role of education, the development of the education sector should be a priority in the development of quality human resources. Every citizen has the right to an education and the government is obliged to provide quality education. As stated in the Preamble to the Constitution of 1945, which protects all the people and the country of Indonesia, the intellectual life of the nation promotes the general welfare and participates in implementing world order based on freedom, lasting peace, and social justice. In line with the Article 28 paragraph (1) of the 1945 Constitution mandates, every person has the right to develop themselves through the fulfillment of basic needs, the right to education, and the benefits of science and technology, plus arts and culture for improving the quality of life for the welfare of mankind.

Various efforts are being made by the government in accelerating the improvement of education by spreading the development of elementary schools to the whole country through a program of elementary instruction. The National Movement for Parents Foster (GNOTA) launched a movement for compulsory 6 years (elementary level) in May 1984, followed by a program of compulsory 9 years (level Junior High School) in the mid-1990s. At the high school level education program, it was proclaimed and studied in 2008 (Education Statistics, 2009). There are also various other support programs in an attempt to accelerate and improve the quality of education.

The curriculum also has changed several times. The most recent is the curriculum in 2013 (K-13) that is focused on being curriculum based and student centered. Although the curriculum in 2013 (K-13) is curriculum based and student centered, there is some doubt as to its effectiveness. There are some important things that should be noted. First, teachers are not prepared to teach this curriculum. Second, the curriculum infrastructure is not fully available. Another thing that will potentially affect the implementation of this curriculum is a regime change in the Ministry of Education and Culture after the elections (presidential elections) in 2014. The curriculum is to be simultaneously put into effect from the academic year 2014/2015 at all school levels, from elementary to middle.

Various problems arose when many schools complained because of the unavailability of textbooks for students and teachers. Another issue is the lack of readiness of teachers in implementing the curriculum because many teachers have not received the necessary training.

Based on the data, the researcher conducted a study related to the Provision and Instructional Materials for Economics at the level of Senior high school in Indonesia, so that hopefully the results can help the Government in accelerating the overall education of its citizens.

2 Research

The problems addressed by this study included:

1. What are the tools and teaching materials used in teaching Economics in Senior high school in Indonesia?
2. How to create easy tools and teaching materials that are interesting and involve active learning in the subject of Economics in Senior high school?
3. How to implement and simulate tools and teaching materials appropriate for the acceleration of Curriculum 2013; curriculum based and student centered to meet the needs of the Asean Economics Community (AEC)?

2.1 Research Objectives

The purposes of this study are as follows:

1. Knowing the manufacture of tools and instructional materials used in the learning process for Economics in Senior high school in Indonesia.
2. Developing the tools and teaching materials of Economics Subject in Senior high school in order to create effective learning that is interesting and involves active learning in Indonesia.
3. Developing a model to simulate the learning tools and teaching materials appropriate for the acceleration of Curriculum 2013: curriculum based and student centered and competitiveness within the ASEAN Economic Community (AEC).

2.2 Benefits of Research

The following are the benefits for each of the stake holders to be gained from the research results:

1. For the Central Government and Local Government: this research may help in the planning of education in the regions and Indonesia in general.
2. For the society (Learners and Teachers of Economics): this research is expected to help reduce the level of saturation in learning especially the Economics subject for Senior high school in Indonesia.
3. For the academic: this research is expected to be a reference in the field of education, particularly in terms of development, simulation tools, and learning materials.

3 Theoretical Framework

3.1 Education

The quality of human resources depends on the quality of education. Education is a very important element of strategic national development, because it is one of the determinants for a nation's progress. Education is the most effective means to improve the quality of life and the degree of public welfare, as well as to improve the nation's prosperity (Ali, 2009).

In etymological terms, education is derived from the Greek "paedagogie." It is a compound word consisting of the word "pais" meaning "child" and the word "ago" means "I lead." So paedagogike means I guide children. People who work with the intention of guiding children to a place of learning, in Greek is called "paedagogos." So education is an attempt to guide the children.

Education as disclosed in the Indonesian Dictionary is defined as the process of changing attitudes and code of conduct of a person or group of people through teaching and training efforts. Other education definitions proposed by Tilaar states that "the essence of education is to humanize humans, a process which sees humans as a whole in its existence" (Tilaar, 2002). Tilaar's description includes the educational process, where there is the process of teaching and learning to become more human. The process of educating and being educated is a fundamental act, because there is a process and actions that change and determine a course of human life.

3.2 Teaching and Creating Learning Experiences

The main task of a teacher is to facilitate the learning of students. To fulfill this task, the teacher must not only be able to provide an interesting and harmonious learning atmosphere, but they also need to create a memorable teaching environment. It means teachers need to create an atmosphere of learning that can stimulate students' interests in addition to thinking about the virtues and needs of students.

In a study session, teachers often deal with students who differ in terms of their skill levels. This requires the expertise of teachers in defining teaching and learning strategies. This means, the teacher should determine the approach, choose the rules, and select specific techniques appropriate to the development and the ability of students. The chosen strategy potentially stimulates students to learn actively by being able to help analyze the concept or idea and attract the hearts of students while producing meaningful learning.

It is important that teachers engage students by choosing activities that are interesting and have a high potential where the materials presented to students are appropriate. Those activities should be memorable and be able to influence the intellect, emotions, and interests of students.

In designing the instructional strategies, teachers should choose relevant activities in the correct order. It needs to be aligned with the content and objectives of teaching proficiency. Generally, the selected activities should be able to gain the student's attention; seek to enhance the intellect, memory, emotions, interests, and trends; and be able to help the teacher to explain the lessons being taught.

In designing memorable and meaningful teaching activities for students, teachers should think in advance about the techniques to be used. Select the strategy wisely in order to be able to ensure a smooth and successful delivery of the subject or module. Among the tools and techniques that may be used by teachers are (Hamalik, 2009):

- Brainstorming methods
- Shows how (demonstration)
- Simulation or teaching collection
- Methods conversation or problem solving
- Audiolingual rule
- Cognitive code rule
- Methods of project

In teaching and learning, there are some rules and techniques that can be used by teachers. The use of rules and techniques can help make teaching activities interesting and will give space to allow students to explore and strive to be actively involved throughout the teaching session without getting bored. However, the selection of rules and techniques must be done carefully so that it does not prevent teachers from successfully implementing the process of forming concepts in an easy and memorable way.

A methods project proposed by John Dewey encouraged students to learn something through experience, observation, and experimentation. Generally, this way provides an opportunity for students to use the tools at their convenience to make observations and responsiveness impressive. In terms of the use of the technique, the teacher may use any technique in accordance with: the technique assessing, reviewing techniques, easily solving techniques, techniques of storytelling, and conversation techniques. Using examples is one of the principles in teaching and learning because it can give clear thoughts and memorable learning experiences.

Usually, a teacher will explain complex ideas to students by providing examples and illustrations. For abstract ideas, new and difficult concepts, it will be easier to understand if the teacher uses examples to illustrate the simple and concrete concepts. An example, in oral form, includes suggesting analogies, storytelling, metaphors, and so on. Examples can also be shown in the form of visual images or illustrations.

3.3 2013 Curriculum

2013 curriculum (K13) is a fixed curriculum implemented by the government to replace the Unit Level Curriculum that has been in effect for more than 6 years. Curriculum 2013 began in 2013 by making some schools into experimental schools.

In 2014, Curriculum 2013 was applied in Classes I, II, IV, and V, while for Classes VII and VIII junior high and high school classes X and XI. It was expected that by 2015 it would be implemented at all levels of education.

2013 curriculum, curriculum based and student centered has three aspects of assessment: the aspect of knowledge, skills aspects, and aspects of attitude and behavior. In the curriculum of 2013, especially in the learning materials, are materials that were downsized and materials are added. The material is visible in the material downsized in Indonesian, Social Science, Civic Education, etc. In contrast, the written material is the material of Mathematics (Permendikbud Nomor 54 tahun 2013).

The subject matter (especially mathematics) learning materials were adapted to International standards so that the government hopes to balance the education in the country to prepare students to study abroad. The Minister of Education and Culture Anies Baswedan stated the need to implement the curriculum for a semester on 5th December 2014 (Baskoro, 2015).

4 Research Methodology

This research study aimed to develop tools and teaching materials for use in Economics in Senior high schools in Indonesia. This study was conducted using the methodology that is a combination of qualitative and quantitative methods.

The term of this research was two years. The focus of the research in the first year was to map out the types of tools and teaching materials used in teaching Economics at Senior high schools in Indonesia and to develop them into tools and teaching materials. While the focus of research in year two was to develop tools and teaching materials for Economics as well as simulating tools and instructional materials in Senior high schools in order to accelerate the process of socialization and the preparation to be competitive in the Asean Economic Community (AEC).

The research in the first year was done in stages as follows:

1. Study literature and research to determine the mapping tools and instructional materials used in the study of economics in Senior high schools in Indonesia.
2. Clarify to do:
   (a) *In-depth interview* (IDI) with representatives of the Association of Teachers of Economics Indonesia (Agei), Ministry of Education and Culture (Kemendikbud), the Regional Office of Education, and Master of Economics as well as high school students in Senior high schools
   (b) *Focus group discussions (FGDs) with related parties in the sample.*
3. Develop tools and learning materials for Economics in Senior high schools by making certain prototypes, by preparing all the materials according to the Economics Curriculum 2013 in two languages (Indonesian and English).
4. Design simulation tools and teaching materials for Economics in the Senior high schools selected as a sample.
5. Perform data analysis to determine the accuracy of the tools and teaching materials developed with the expected goals.

5 Results and Discussion

Research results obtained from the field from the Focus Group Discussion (FGD) on Economics were categorized into two parts:

(a) Results of the instruments were distributed to 100 high school teachers in Jakarta and their students:

No	Indicator	Options	Percentage
1	Is there textbook on Economics that is used in class?	Yes	90
2	Are there tools and teaching materials other than books?	No	90
3	Do students have easy access to the Internet for the material on Economics?	No	90
4	Do the majority of students (>50%) have an HP smartphone?	Yes	98
5	Is student learning fun and enjoyable in Economics?	No	80
6	Are students learning at any time access to Economics?	No	90
7	Is the study of Economics done very often with questions often asked?	No	80

From the results of the above information, it is apparent that the learning of Economics still is limited yet making learning economics at any time, is fun and exciting for students as well as the teacher. There were some reported access difficulties in studying Economics. Economic material closer to student access is a necessity. Presenting the material economically in classrooms, without having to bother to bring textbooks, is another opportunity for researchers to investigate.

(b) Print Media Creative Economy in *"Econo-SmartCard"*

Researchers have developed tools and teaching materials called "Econo-SmartCard" which covers 27 topics for class X, XI, and XII levels in Senior high schools. The following responses are from the Economics teachers and students:

No.	Indicator	Option	Percentage
1	Does the Econo-SmartCard make Economy fun?	Yes	80
2	Is the Econo-SmartCard creative?	Yes	90
3	Does the Econo-SmartCard allow students to study Economics at any time?	Yes	90
4	Is the Econo-SmartCard good for national distribution?	Yes	90
5	Will the Econo-SmartCard be able to improve economic literacy, or the ability/competence of economics students?	Yes	80

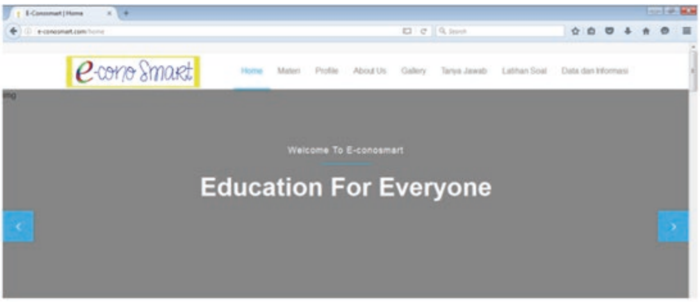
Researchers also developed tools and teaching materials, called "E-conoSmart" which covers 27 topics for class X, XI, and XII levels of Senior high schools in an application for the HP smartphone, which is in the hands of almost all students, especially in Jakarta. This application was accompanied by a question and answer column or an interactive space that was led by Team Economic Education students and Scheduling. Here are the responses of the teachers of Economics:

No.	Indicator	Option	Percentage
1	Is the E-conoSmart fun?	Yes	95
2	Is the E-conoSmart creative?	Yes	96
3	Does the E-conoSmart make Economics easier for students to learn at any time?	Yes	93
4	Is the E-conoSmart appropriate to be distributed Nationally?	Yes	91
5	Will the E-conoSmart be able to improve economic literacy, or the ability/competence of economics students?	Yes	80

E-conoSmart is the result of research and development studies which tried to present a way of learning that is easy, inexpensive, and fun. With a web-based (www.econosmart.com), The PlayStore and appstore (econosmart v5) is easier for students, teachers, and the public to study economics at any time. E-conoSmart version 5 comes with a tutor that helps users with increasingly difficult economic matters. E-conoSmart is organized into 27 topics or chapters. It starts from the introduction of economics, economic systems, micro economics, macro economics, international trade until the accounting services, as well as trade. These materials are then elaborated in such a way to achieve economic materials for college level. Accompanying the application is also present data and information on issues relating to the economy of Indonesia.

Smartphone App "Econosmart" have been copyright from Minister of Law and Human Rights of Republic of Indonesia, Director General of Intellectual Property, with number C00201601645, May, 3rd 2016.

Picture of www.econosmart.com



Picture of smartphone App

6 Conclusions and Recommendations

Based on the findings described above, it can be concluded that the material is still at the early stage of development for the Senior High School of Economics' related equipment and materials in the learning of economics. The products developed by the researchers received a positive response from teachers and students. The results were considered exciting because it was packaged in a fun and enjoyable way for students and teachers.

The researcher's advice based on the study has two items. First, keep exploring, developing interactive learning experiences that are interesting, and continuously focus on the desire for students to learn appropriate in their era. Second, in the context of the AEC, the teachers and students need to continue to elaborate on the ability of Economy skills and knowledge in terms of content material and English skills, so that gradually the human resource capabilities of teachers and students will improve Indonesia, particularly in the area of Economic Literacy.

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Siti Nurjanah In Demak, Central Java Province, the author was born on January 14, 1972 from the late Hj. Bariyah and H. Munawar. Both parents worked as traders. The author is the fifth of six siblings. In 1984, the author completed elementary school at the Reef Elementary School I sari in Demak, with achievements that have been gained as a Student Example. In 1987 the author graduated from Junior High School I Grogol Demak, also entered as the third best students. In 1990 the author graduated from the State High School of Demak, and ever as a champion of mathematics. In 1994 S1 graduated from the Faculty of Economics, Department of Economics and Development Studies Jenderal Soedirman University Purwokerto (received scholarships Supersemar) Cum Laude. Awards: received a Student Achievement Jenderal Soedirman University. Then in 1998 the author graduated from S2 at the Bogor Institute of Agriculture, Magister Science Program Regional and Rural Development Planning (got a scholarship project Urge batch II of Higher Education), with honors. In 2010 she graduated as S3 Education Management Program (received scholarships BPPS Higher Education) at the State University of Jakarta. She began her career as a lecturer in the Faculty of Economics at Trisakti 1995–2004, and from 1998 to the present is a lecturer at the Faculty of Economics, State University of Jakarta. Currently, she is active in education and teaching, research, and community service. The author wrestled from the embryo and is now the managing editor of the *Journal of Econosains* which began in 2003, online edition of 2010 and Media communication Information Econochannel began in 2009 in the neighborhood UNJ, as well as E-conoSmart online and Economic Studies based smartphones in 2016. She attended training of trainers organized by the Council of Economic Education (CEE) USA in 2007–2008 in Mexico City and Egypt. And She continues to elaborate on her knowledge in the education and training of teachers organized in the program PLPG Higher Education, PPG, and also MGMPs Economy under the Ministry of Religious Affairs as an instructor (2007–present), as well as a speaker on interactive broadcast television Education (TVE) on Education IPS (2008–2010).

Chapter 15
Improvement of Distance Learning Experiences and Materials Through Formative Evaluation

Ratna Marta Dhewi and Rini Dwiyani Hadiwidjaja

Abstract Distance education requires a continuous evaluation of distance teaching materials. The consideration for evaluation is essential to continuously improve the quality of distance learning experiences. In addition, the evaluation contributes to promote effective and constructive distance learning. The research objective was to examine learning effectiveness for distance students' understanding of the objectives intended through formative evaluation. This chapter first outlines the issues and challenges faced to understand distance teaching materials effectively and discusses the main variation of learning patterns and diverse understanding to the distance teaching materials. The findings suggest that formative evaluation is considered an integral part of conducting effective learning experiences and students' learning progress. It highlights key contributions of good instructional design to promote effective and constructive distance learning that enable students to learn independently and achieve the required competences from the learning experience. This research conducted a formative evaluation that collected data from a survey, interviews, and academia literature. The assessment had three stages that are one-on-one review, small group reviews, and field trials.

1 Introduction

Distance learning materials have been designed as self-contained teaching materials, meaning that the learning contents were formulated in detail to assist students learn independently. Independent learning expected from distance education is different from autodidact study; instead, it has structured learning materials with paperwork, guidance, and a feedback system. Distance education is expected to

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K.A. Persichitte et al. (eds.), *Educational Technology to Improve Quality and Access on a Global Scale*, Educational Communications and Technology: Issues and Innovations, https://doi.org/10.1007/978-3-319-66227-5_15

provide encouraging learning experience with supporting academic resources and feedback systems.

The distance education tutors and facilities involved in this study were advised to reflect satisfaction aspects of the learning experience as "a guide to the persistence and or retention to uphold its mission of making higher education open to all through flexible quality education" (Sembiring, 2015, p. 9). This was important as distance education has to pay considerable attention to:

> …empathy, responsiveness and reliability as routes to satisfaction which leads to persistence and or retention. While issues related to assurance and tangibility are not problematic at present, nevertheless assuring that procedures are improved and maintaining available facilities will augment the quality of services. (Sembiring, 2015, p. 8)

Improving the quality of distance learning experiences and materials which contribute to satisfaction as well as effective and constructive distance learning can be done through continuous evaluation.

Evaluation and improvement are expected to demonstrate the dynamics of knowledge advancement. Openness to constructive criticism for teaching materials is encouraged to improve the quality of teaching materials. An awareness of regular evaluation needs to be shared among tutors, so that improvement is developed as part of an excellent academic culture. This study was conducted as a call to periodically evaluate teaching materials in the Indonesian Open University/Universitas Terbuka (UT), particularly for a course that was an Introduction to Accounting/EKMA 4115 which is written by Sugiarto (2010).

The teaching materials for the Introduction to Accounting/EKMA 4115 course have been published since 2009 and have been used for all students of Accounting and Management classes in the Indonesian Open University with a heterogeneous background. Students have a wide variety of different characteristics ranging from demographic differences, motivation, learning patterns, and the level of understanding regarding the content of the lessons. The variety of students' preferences and learning experiences should be "incorporated as an integral part of the mechanism for designing and reviewing study programs" (Li, 2014, p. 44). Additionally, Depdiknas (2008) has encouraged that the contents of the distance materials must have an adequate organization of learning contents; use instructional methods; use simple language and be easily understood; and have an organized layout and presentation of good writing, in order to equalize the understanding of learning contents as a foundation reinforcement to take courses and deepening of Accounting understanding in advanced semesters.

However, based on the preliminary study and interviews conducted on students who took the course EKMA4115, students experienced difficulty in understanding EKMA4115 teaching materials, so they decided to join the face-to-face tutorials (FTFT). Face-to-face tutorials with a tutor played an important role in helping students to understand their courses (Mulyasa, 2005).

Students who joined FTFT tended to gain a better understanding of the materials and were able to obtain a score of A or B. However, students who did not join the FTFT tended to earn grades C or D even scored E. Table 15.1 shows the results of students taking courses EKMA 4115 at the time of registration year 2012 semesters 1 and 2.

Table 15.1 Results of students taking subject EKMA4115 in 2012.1–2012.2

Reg period	Total students	Participants of FTFT			Participants of non FTFT		
		Partici-pants	% of grade A or B	% of grade C, D or E	Partici-pants	% of grade A or B	% of grade C, D or E
20121	153	71	77.5% (55 students)	22.5% (16 students)	82	12.2% (10 students)	87.8% (72 students)
20122	172	95	73.7% (70 students)	26.3% (25 students)	77	20.8% (16 students)	79.2% (61 students)

Source**:** Student records system and application FTFT accessed December 10, 2013

Table 15.1 shows that students who attended FTFT have a greater opportunity to earn an A or B (median 75.6%) then the students who did not follow the FTFT (average 16%). The percentage of the students' progress by only learning the teaching material itself without attending face-to-face class was considered low. This might indicate that the teaching materials for EKMA4115 were not fully designed to be self-teaching materials. The teaching materials in both print and non-print forms containing educational content with the theory of pedagogy were expected to facilitate self-learning learners (Suparman, 2012). This became the main reason for conducting this formative evaluation study. In addition, the urgency of this study refers to a system of distance education based on the independence of the students in line with the Rector Decree No. 3747/UN31/2013 dated June 28, 2013, article 3. It stated that the scoring of a subject is based on the accumulation of FTFT and online tutorial scores and the accumulation will contribute to a final score only if the value of a student's final examination result reaches ≥30. The effectiveness of distance learning is measured by examination results, and its satisfaction will be related to greater GPA results (Martirosyan, Saxon, & Wanjohi, 2014).

Accordingly, this research evaluated teaching materials of Introduction to Accounting/EKMA4115 covering the formulation of competencies that must be learned by students, the concept of instructional design through evaluation of the effectiveness of instructional materials, as well as effective contents and methods. This research was conducted as an evaluation of a concern for diverse understanding of students toward the contents of teaching materials. That concern impacted poor students' achievements. Addressing the concern became important because the course of EKMA4115 is a basic concept of accounting that should provide a strong foundation in understanding further accounting subjects. It is essential to explore the key aspects in facilitating students' experiences. To learn requires a learner-centered approach, the role of resource-based learnings as well as delivery methods (Tucker & Morris, 2011) which was demonstrated in this present study.

Therefore, distance learning needs to provide learners with the opportunity to accommodate a learning experience based on students' needs and preferences (Demetriadis & Pombortsis, 2007). In addition, the urgency to conduct continuous quality improvement complies with the formative evaluation criteria from the Indonesian Ministry of Education. This study attempted to compare the old teaching materials with new teaching materials (after revisions) to determine whether the advice and recommendations from experts, tutors of FTFT, and students were applied. Based on the students' backgrounds and pre-study, EKMA4115 teaching materials were considered to be re-designed, revised, and enriched so that it became self-instructional materials. Therefore, the formative evaluation of the teaching materials EKMA4115 was conducted in this study.

The case study of assessment of teaching materials EKMA 4115 aimed to:

1. Evaluate the teaching materials for EKMA4115 through evaluation of individuals or one-to-one evaluations.
2. Evaluate the teaching materials for EKMA4115 through the evaluation group (small group evaluation) that had been revised based on the results of individual evaluations.
3. Test, analyze the efficacy, and validate the EKMA4115 teaching materials that were revised or developed based on the evaluation of individuals and groups and students' results.

This study began with a critical analysis of the teaching materials for Introduction to Accounting/EKMA4115 and identified the learning contents which needed improvements. Critical analysis aimed to understand and assess the contents, case study, paperwork and feedback and systems in delivering clear and direct meanings. Several steps to develop self-learning materials have been done through the formative evaluation.

This research outlined the issues and challenges of distance learning and explored effective distance teaching materials. The research objective was to examine learning effectiveness for distance students. Through this research, formative assessment and feedback from related stakeholders were reinterpreted to show how these processes can help distance students take control of their own learning (Nicol & Dick, 2006). Formative evaluation undertaken in this study included the instruments that consisted of organization and quality content, the use of instructional methods, use of language, organizing grammar, and typographical arrangement. This formative evaluation involved experts, the tutors for FTFT, and students as the users of the teaching materials.

2 Literature Review

2.1 Open and Distance Learning (ODL)

One of the characteristics of ODL is independent study. Students learn unaccompanied by a teacher or tutor, so the presence of the teacher must be replaced by the presence of specifically designed teaching materials.

It is important that "ODL practitioners should not lose sight of the different cognitive styles when designing instructions for distance learners. They should allow both cooperative and individualized learning in the whole class" (Osuji, 2011, p. 12). A particular challenge for ODL is to develop teaching materials that have the learning contents presented as interesting, relevant, motivating, and of high quality.

A transfer of knowledge should be supported by the quality descriptions of content, whether written or oral, equipped with pictures and sound. That is essential for the teaching materials for Introduction to Accounting/EKMA4115 that have accounting formulas and comprehensive case studies. Therefore, if students find a case study is difficult to understand and contains several errors, it might impact students' understandings and learning experiences.

As the role of science and technology in education becomes very important, teaching materials need supporting media such as pictures, charts, and video to illustrate the contents better. Learning materials used in ODL are generally designed using a very tight organization and solid contents with information and knowledge. Teaching materials used in ODL need to be designed using appropriate instructional models with good learning conditions in order to assist students in the learning process effectively and efficiently. Designed learning system is a systematic process used to design learning experiences achieving intended learning objectives. The design of effective teaching materials includes several components such as a structure, a learning content, a presentation of learning strategy and instruction, and a physical appearance of teaching material. Students and tutors are also expected to evaluate and give feedback as well as play an important role in determining the quality of the teaching materials used in ODL programs.

2.2 *Design of ODL Teaching Materials*

Instructional strategies have been suggested to follow the complete cycle of instructional activities as set out in Fig. 15.1 with the following phases.

- Phase I

- Define the problem and the organization (identify instructional needs, formulate general instructional objectives, instructional analysis, identify the behavior and characteristics of early learners, and describe the background/setting)
- Phase II
- Analyze instructional systems development (write specific instructional objectives, write the reference benchmark tests, prepare instructional strategies, and develop a prototype instructional system)
- Phase III

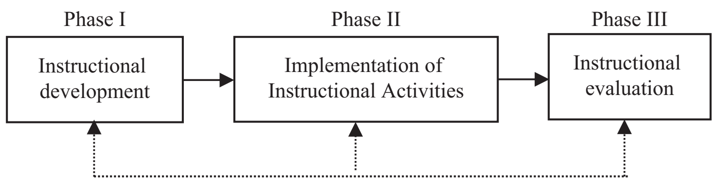


Fig. 15.1 The complete cycle of instructional activities. Source: Suparman (2012)

- Conduct formative evaluation of the prototype instructional system (expert review and revision, small scale trial and revision, and large scale trial involving the user community of graduates and revisions)

This study was considered Research and Development (R&D). It was because R&D is a series of processes or steps in order to develop a new product or enhance existing products in order to be accountable. Such products are not always hardware such as books, modules, learning tools in the classroom or laboratory, but it can also be software such as computer programs for data processing, learning, classroom, library or laboratory, or models of education, learning, training, guidance, evaluation, and management systems.

The procedure of R&D for distance teaching materials was conducted through an evaluation, namely a formative evaluation. Research and development of teaching materials can be done by designing programs or instructional materials according to the problems derived from the results of the needs analysis. Following up the results of the needs analysis was to design, conduct pilot programs or materials, and make revisions to the instructional materials considered ready for use in a real situation. The procedures of the development of teaching materials specifically through formative evaluation were:

1. Individual or one-to-one evaluation on teaching materials and implement revisions based on the results of the evaluation. The first step was to evaluate teaching materials for EKMA 4115 with (a) expert knowledge of accounting and (b) tutors of FTFT. The results of this evaluation provided some inputs and recommendations for the authors to revise the instructional materials.
2. Group evaluation on teaching materials. Evaluation was being conducted by the group of students in one class. Each student filled out a questionnaire that was equipped with a print-out of the old module of EKMA 4115 (before revision). The results of this evaluation then became feedback to authors to immediately respond and revise the module accordingly.
3. Field trials or field try out for the teaching materials that are being developed. This last phase was a step to test the potency of the teaching materials produced. The trial was conducted by 24 students in one class; each student was given a questionnaire and the new module (after revision). The results of this trial were analyzed by comparing the old module (before revisions) and a new module (after revisions). Comparing the results of tests/experiments on these groups assessed the level of efficacy and constructive distance teaching materials.

3 Methodology

Sources of data in this study were primary data. Primary data were obtained from questionnaires and interviews with students in Jakarta and Bogor regional office who took this course EKMA 4115 semester registration period year 2014 semester 1 and 2. The samples of students from Jakarta and Bogor regional offices were considered to represent the complexities of the social, cultural, education, and the variation of UT students. In addition, primary data were also obtained from experts (expert review) through questionnaires and interviews. The criteria of experts in this study were tutors of UT who had the educational background of accounting and taught the course of Introduction to Accounting/EKMA4115 for at least two semesters, and professors and professionals with educational backgrounds in accounting.

In addition, data were collected through observation in the classroom tutorials and distributing questionnaires in Bogor and Jakarta regional offices. The questionnaire used was the Questionnaire User Rating of the Subjects (AJ10-RK03-R02) with Likert scale (1–5) to students who joined FTFT and non FTFT. This research was conducted to develop the teaching materials through formative evaluation of the several modules of teaching materials for Introduction to Accounting/EKMA4115 that was first printed in 2009 and is still used by students until now. Formative evaluation was focused on how to plan, acquire, and analyze data, and information for the improvement of distance teaching materials (Suparman, 2012).

The formative evaluation consisted of several stages involving subject matter, experts, and students. The formative evaluation procedure is described as follows by adopting the procedure (Suparman, 2012) (Fig. 15.2).

1. Participation by three subject matter experts to verify:
   (a) Formulation of learning objectives
   (b) Analysis of instruction
   (c) Accuracy and contemporary of material
   (d) Vocabulary, sequence, and student participation activities
   (e) Clarity and proper test items
2. Participation by students
   (a) Evaluate the quality of initial tests and formative tests
   (b) Sit with students at the time they study the teaching materials
      - Clarity of learning
      - The impact on students

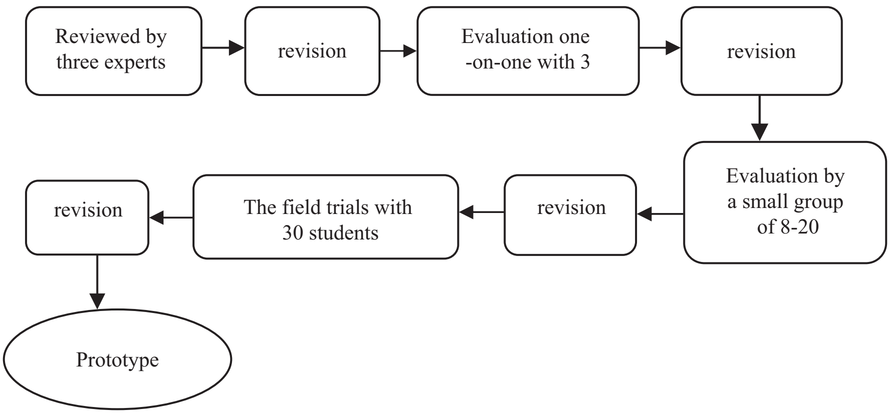


Fig. 15.2 Procedure of formative evaluation

- Appropriateness

3. Evaluation by a small group of 8–20 students to evaluate:
   (a) Effectiveness of learning (initial and final tests)
   (b) Attitudes toward learning (questionnaire and interview)
   (c) Feasibility study (measure the time it takes for students and the attitude of the organizers)
   (d) Carry out a questionnaire to students about their attitudes:

   - Does the earlier lesson attract your attention?
   - Is the earlier lesson too long or short?
   - Whether learning was too difficult or too easy?
   - Do illustrations aid or hinder?
   - Whether the test was to measure the materials that had been presented

4. The field trials with 30 students
   (a) Effectiveness was measured by the final test for students
   (b) The attitude of students and tutors in learning process
   (c) Feasibility study in terms of relevance/benefits, time, and cost
   (d) Design of learning materials (compliance with the principles of learning, learning, and motivation)
   (e) Availability of other learning resources if necessary

The paradigm framework (Fig. 15.3) of this study is as follows:

This framework (Fig. 15.3) outlines the notion of a preliminary study resulting in problems through critical analysis of teaching materials, researchers' understanding, students' perceptions of learning materials including student complaints about the difficulty in understanding the content of the materials, as well as learning progress, and outcomes of students who took the course EKMA4115. The preliminary study presented that most of the learning results (grades) of students who did not join the FTFT received scores of C and D, while the majority of students who attended FTFT obtained A or B.

After problems had been identified through critical analysis, the next step researchers conducted was the formative evaluation of teaching materials through three evaluation phases. This study evaluated whether independent distance teaching materials met the standard and requirements of the concept of distance learning. It began with a critical analysis of teaching materials EKMA4115 by identifying the things that had been going well at every stage of the planning and development of teaching materials, and then evaluating the parts that needed to be improved. The formative evaluation steps (Table 15.2) were conducted as follows.

This study was also a combination of descriptive, evaluative, and experimental. A descriptive method was used in a pilot study to collect data on existing conditions. Existing conditions included: (1) the condition of the products that already existed as the comparison material or base material (embryo) product to be developed, (2) the condition of the part of users (students), (3) the condition of the factors supporting and inhibiting the development and use of the product to be produced.

Evaluative methods were aimed to evaluate the product in the process of testing the development of a product. Product research was developed through a series of

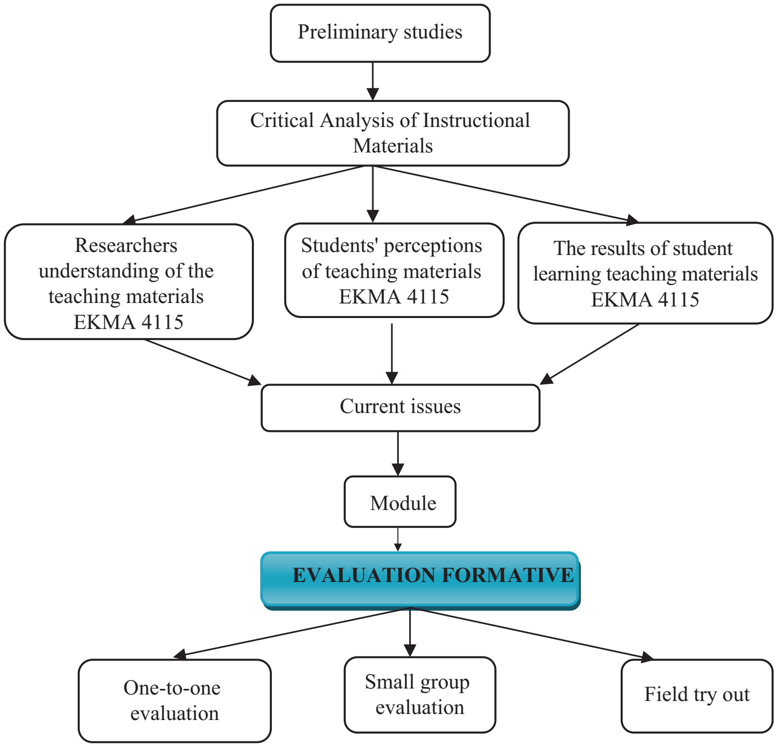


Fig. 15.3 The framework research

tests and trials on each activity of an evaluation, whether for the evaluation results and the evaluation process. Based on the findings of this, evaluation was used to revise the current teaching materials. The experimental method was aimed to test the efficacy of the resulting product. Comparing the experimental results in groups assessed the level of efficacy and the resulting product.

Formative evaluation undertaken in this study included instruments comprising:

1. Organizing the material, reviewing the contents of the theory, quality of presentation, explanation of the formula and practice questions, illustrations, and case studies of teaching materials of Introduction to Accounting/EKMA4115.
2. Using instructional methods and feedback for the course of Introduction to Accounting/EKMA4115.
3. Using language teaching materials for the course of Introduction to Accounting/EKMA4115.
4. Organizing board layout and appearance for Introduction to Accounting module/EKMA4115.

The results from formative evaluation suggested to:

1. Improve material substance more effectively with the enrichment of case studies and paperwork. It had been suggested that the paperwork and case studies were

Table 15.2 Evaluations steps by using formative evaluation for teaching materials

#	Stage of evaluation	Objective evaluation	Data analysis	Respondents	Results
1	Evaluation of an individual (one-to-one)	Identify and eliminate mistakes and obtain indications and initial reactions from experts and instructional designers	Descriptive using the instrument (AJ10-RK03-R02)	1 experts + 1 tutor	Revised Draft Design and Instructional Materials
2	Small group evaluation	Determine the effectiveness of the changes that have been made after an individual evaluation and identify when learners have learning problems	Descriptive evaluative	ten students	Revised draft subjects
3	Field try out	Determine whether changes have been made after the evaluation of the group had been effective and tested. Teaching materials developed were in accordance with the substance and the concept of instructional design	Descriptive qualitative	30 students	Revised final BA

designed to motivate students to learn more and stimulate their curiosity to implement the theory into practice

2. Improve the organizational and instructional design to be clearer and more easily understood.

4 Results and Discussion

4.1 One-to-One Evaluation

According to the survey from 20 students who studied 12 modules of Introduction to Accounting (EKMA 4115) module 1 and 2 needed to be revised due to its contents and organizational/instructional design. As seen in Tables 15.3 and 15.4, students with a diverse educational background, particularly in natural science, needed a better and detailed explanation of accounting theories and implementations.

Table 15.3 Comparison of participants FTFT) based on educational background at the time of registration 20141

Registration Period	Participants of FTFT			Participants of Non FTFT		
	Participants	Educational background		Participants	Educational background	
		Social sciences	Natural sciences		Social sciences	Natural sciences
20141	28	12	16	77	33	44

Table 15.4 Comparison FTFT participants based on the educational background of education at the time of registration 20142

Registration Period	Participants of FTFT			Participants of Non FTFT		
	Participants	Educational background		Participants	Educational background	
		Social sciences	Natural sciences		Social sciences	Natural sciences
20142	31	17	14	95	45	50

Source: Data SRS processed

They were also aware of the importance of understanding an Introduction to Accounting course as a foundation to learn advanced accounting courses.

This study found that in order to improve the quality and the organization of learning content, it was expected to improve logical structure, order, and understanding of the teaching materials as well as the distinct competence expected from each module. Expert opinions gathered from tutors reviewed that the illustrations in the modules should be updated with the current theory development and practice. It was also important to develop interesting discussions among students with relevant case studies. The Introduction to Accounting course materials had also been suggested to meet the requirements of the Financial Accounting Standards (GAAP).

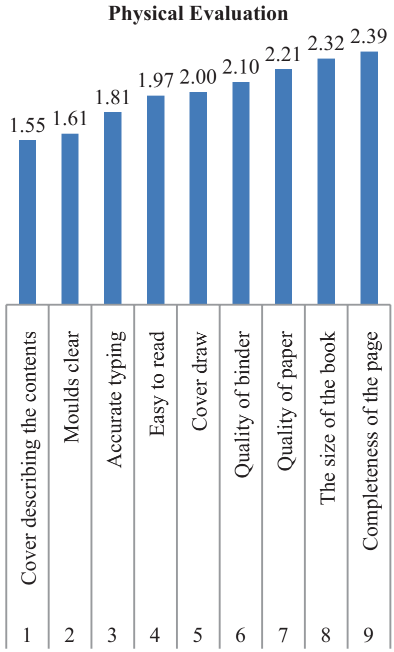
Expert reviews provided suggestions for the improvement of modules 1 and 2:

1. Consider meeting the requirements of the International Financial Accounting Standards (IFASs)
2. Consider using accounting terms both in Bahasa Indonesia and English
3. Review the formulations and calculation results
4. Review the accuracy of the questions and answers
5. Review the quality and consistency of worksheets in formative tests
6. Review the structure of content

In addition to these criteria, the experts also revealed an overall assessment of learning contents:

1. The learning content should be clear, easy to understand, and more focused on the discussions covering the scope of accounting, the accounting cycle, the worksheet and the closing of bookkeeping, financial statements, the company's legal and specialized journals, accounting for fellowship, for the company's Accounting I and Accounting II for the company

Fig. 15.4 Physical evaluation. Source: Data processed



2. Grammatical errors, typos, and errors in arithmetic should be minimized
3. Price of the modules and books were too expensive so that students rarely bought them

To view the overall quality of teaching materials for Introduction to Accounting (EKMA 4115), the evaluation of individuals in this study used the instrument evaluation form AJ10-RK03-R02 which was developed by the Centre for Quality Assurance—known as Pusmintas. This evaluation included physical, layout, language and material, and non-print instructional materials (BANC). Individual evaluations using evaluation form AJ10-RK03-R02 was conducted on ten students in the Bogor regional office and eight students in the Jakarta regional office in 20142 registration period as a random sample. The results of the evaluations can be seen in Fig. 15.4 for physical evaluation, Fig. 15.5 for image layout evaluation, Fig. 15.6 for language evaluation, and Fig. 15.7 for image evaluation materials. The BANC evaluations could not be performed because the students did not have the original teaching materials. Students only had a copy of teaching materials, so it did not include BANC inside the teaching materials.

Based on the results of physical and layout evaluation, the most critical things to be minimized were grammatical errors, typos, and errors in arithmetic. The accuracy was important as some formulas in the teaching materials were found in error and caused confusion among students and tutors. Additionally, it had been suggested that the teaching materials needed further improvements to make the materials more systematic, interesting, and interactive.

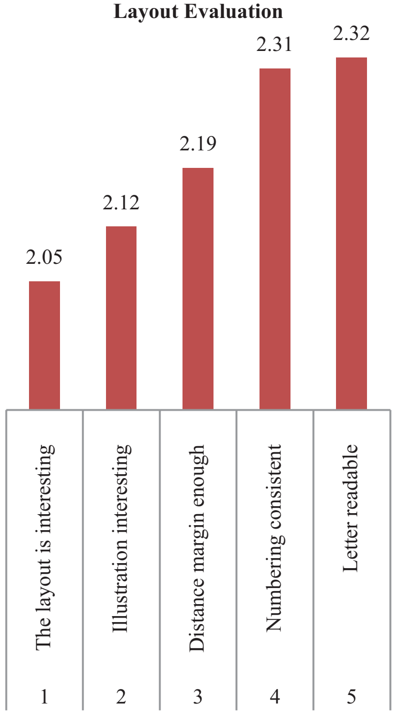


Fig. 15.5 Layout evaluation. Source: Data processed

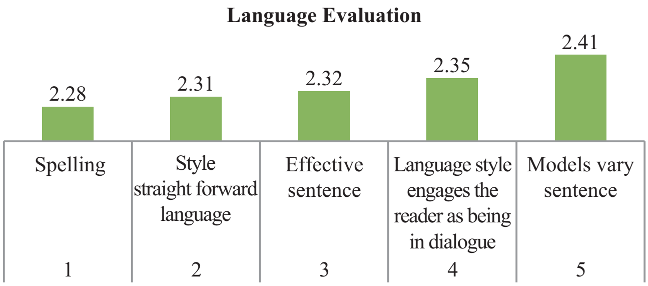


Fig. 15.6 Language Evaluation. Source: Data processed

Based on the results of individual evaluations, it can be concluded that modules 1 and 2 of the EKMA4115 teaching materials needed to be revised. Table 15.5 has shown that the number of students who attended FTFT and whose grades were C, D, or E had a very significant increase when compared to Data Table 15.1 that was 20.36% (22.5% vs. 42.86%). This percentage was dominated by students who had a background in natural science of 11 people (Table 15.5). While on the contrary, students who received grades of A or B experienced a significant decrease when compared to Table 15.1 at 20.41% (77.55% vs. 57.14%), it was dominated by students who had the educational background in social science (Table 15.5).

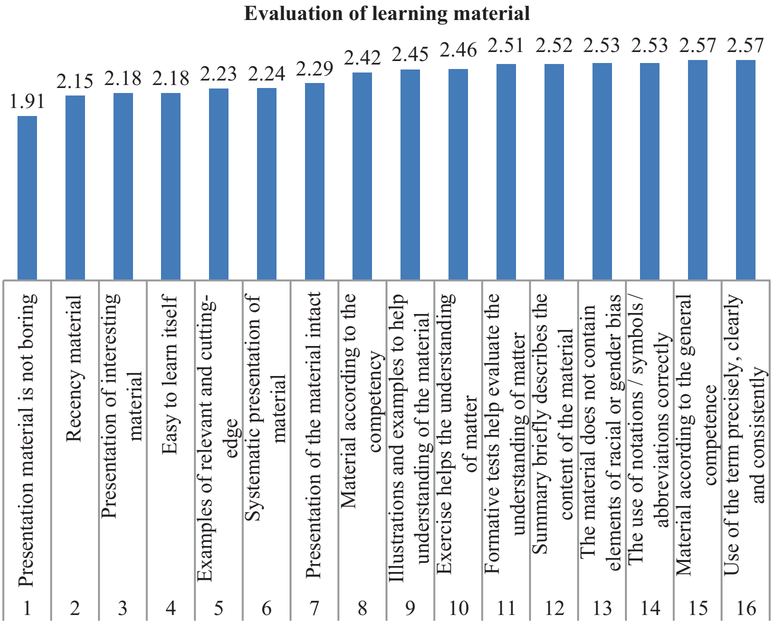


Fig. 15.7 Evaluation of learning material. Source: Data processed

Table 15.5 Comparison of participants) and non face-to-face tutorial (FTFT)-based educational background

Registration period	Participants of FTFT					Participants of Non FTFT				
	Participants	% of grade A or B		% of grade C, D or E		Participants	% of grade A & B		% of grade C, D, and E	
20141	28	57.14 (16 Vs 28)		42.86 (12 Vs 28)		77	10.39 (8 Vs 77)		89.61 (69 Vs 77)	
		Educational background		Educational background			Educational background		Educational background	
		Soc sci	Nat sci	Soc sci	Nat sci		Soc sci	Nat sci	Soc sci	Nat sci
		11	5	1	11		6	2	27	42

Source: Data SRS processed

While students learned without attending FTFT, grades of C, D, and E were increased by 1.81% (87.8% vs. 89.61%). It also affected scoring A and B decreased by 1.81% (12.2% vs. 10.39%). Based on these data, this study found that a face to-face tutorial is essential for students, particularly to those with the educational background in natural science. With the Rector Decree No. 3747/UN31/2013 Article 3 students are required to be independent in learning. Therefore, this research suggested that UT needs to improve the quality of distance materials.

4.2 Evaluation Groups (Small Group Evaluation)

Evaluation of the groups only involved students participating in FTFT On Demand course Introduction to Accounting/EKMA4115 at the time of registration 20142. Samples of students who attended the group evaluation were being conducted with a random sample of 42 students consisting of 21 students at the Jakarta regional office and 21 students at the Bogor regional office. The evaluation was conducted in the second meeting that was at the end of the tutorial schedule when the students had finished discussing modules 1 and 2 in their tutorial classes.

The majority of respondents in FTFT were women (64.29%). They were relatively young or a fresh graduate and single. Students who worked as private employees ranked the largest (76.19%) as compared to other jobs. The educational background of participants for social and natural science was 54.76% and 45.24% respectively. The samples taken were considered to represent the entire participants of FTFT.

The findings of this study from the perspective of experts and students suggested that practical questions, illustrations, and case studies needed to be clearer and updated with the dynamics of knowledge advancement and best practices. This was because the level of students' understanding of the modules did not reach the intended objectives of the course, especially for students with a natural science background.

4.3 Field Trials (Field Try Out) Against the Revised Teaching Materials

After the students filled out the questionnaires in the group evaluation and gave explanations of what should have been carried out as improvements on module 1 and 2, both modules then were revised accordingly. The revised modules then were evaluated once again to check whether the improvements had addressed the issues. The researchers and tutors then evaluated the students’ understanding again from the revised modules 1 and 2 and asked them to work on some assignments from the modules. The results then showed that:

(a) The Bogor regional office: 81.25% (26 of 32) of students reached a better score of >90.
(b) The Jakarta regional office, from the two classes: Class A. 76.92% (20 of 26) and class B. 69.70% (23 of 33) students reached a better score of >90.

These results indicated that the majority of students had understood the materials from revised modules 1 and 2 without attending a face-to-face tutorial.

5 Implications

Implications from the results of this study are:

1. Results of the evaluation of individual or one-to-one evaluations suggested that the most critical elements to be improved were the introductory modules. The introductory modules provide a fundamental understanding to study advanced modules, especially for students with heterogenous backgrounds.
2. The most critical modules to be improved are modules 1 and 2 as suggested by the results of the individual evaluations of experts. In addition, based on the results of the evaluation form instrument ISO 9001-2008 AJ10-RK03-R02 learning contents that needed to be improved was the module cover, EYD spelling, layout of the material that was less attractive, and presentation of the material that was considered less interactive.
3. The learning contents should be more compacted, more focused on discussions covering the scope of accounting, the accounting cycle, the work-sheet and the closing of bookkeeping, financial statements, the company's legal and specialized journals, and accounting for fellowship, to the company's Accounting I and Accounting II for the company. Those were important as the foundation for the fundamental understanding of the basics of accounting theories.
4. The focus of the revision should be carried out on the work-sheet and formative tests, mainly the work that is related to the calculation and the accuracy of key answers for the work-sheet and formative tests.
5. This study requires further research on the framework to evaluate the teaching materials from the students' understanding through the examination mechanism.

6 Conclusion

This research outlines the issues and challenges faced in understanding distance teaching materials effectively. The evaluation process contributes to promoting effective and constructive distance learning.

Distance students have diverse educational backgrounds and wide range of ages. In addition, the variations of learning patterns and diverse understandings of the distance teaching materials were also identified in this research. The mechanism of reviewing distance teaching materials needs to be conducted periodically, reviewed by peer reviewers, and updated with the dynamics of knowledge advancement and best practices as suggested in this research. The participants considered the teaching materials as less interactive and less instructional for stimulating the curiosity of students. The teaching materials were expected to help students to learn independently and achieve competence and expertise from the learning experience.

This research examined learning effectiveness for distance students to understand the objectives intended through formative evaluation. This research suggested that formative evaluation is considered an integral part of effective learning experiences and students' learning progress. Effective evaluation needs to be conducted periodically to cope with knowledge advancement and best practices.

Acknowledgments We are grateful to both Professor Tian Belawati, the Rector of Universitas Terbuka, Indonesia for her continuous support and Kristanti A. Puspitasari Ph.D., the Director of the Research and Community Services Institute of Universitas Terbuka for her permission for this research to be finally made possible.

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Chapter 16
Developing a Project-Based Early Childhood Assessment Textbook

Desak Putu Parmiti

Abstract This study was aimed at developing an instructional product in the form of project-based early childhood assessment textbook at the Department of Early Child Education Teachers (PG-PAUD) Faculty of Science of Education (FIP), Ganesha University of Education. This study was a developmental study. The development of project-based early child assessment used the Dick, Carey, and Carey model with ten steps. The respondents who reviewed the textbook consisted of three experts, three students at the time of individual testing, 12 students at the time of small group testing, and 30 students at the time of field testing. The results showed that the validity of the textbook viewed from the content, media, and instructional design aspects fell into good category. The individual and small group testing stages showed that the textbook fell into good category. The t-test showed that there was a significant difference in learning achievement between before and after the use of project-based assessment textbook. The level of effectiveness reached was high. The high category achieved was due to the development of learning theory, theory of instruction, theory of instruction message design, and because it contains a number of authentic projects. The same thing can be said about the implementation of the textbook that used project-based instructional setting.

1 Introduction

Graduate competency standards in Early Childhood Assessment course at the Department of Childhood Teachers Education (PG-PAUD) of the Faculty of Educational Science of Ganesha University of Education state that the students are expected to have knowledge, attitude and skills in assessing the process and outcome of children at early ages. By acquiring the competency the students are expected to be able to measure the process and outcome of learning of the

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children at early ages appropriately, fairly, accurately and objectively. Meaningful learning experience becomes the requirement of the students who are developing the competency.

However, the students have difficulty in applying assessment theory in practicum activities. The less optimum application of the assessment theory is due to different fields, variations in situations and students' characteristics; the condition of the physical and social environment often becomes another problem. This practicum activity that is less than optimum has a negative effect on the less than optimum students' learning achievement, especially in the area of assessing progress of learning in children.

Some factors that cause the less than optimum achievement are the following. First, the unavailability of relevant course books that suit the students' characteristics and context. The course books and other materials used do not have enough good examples and contextual cases that relate assessment theory and its implementation in the real world (school). The local course book has some advantages over the textbook. The former is written systematically in accordance with the characteristics of the target while the latter tends to be used as a reference and is oriented toward general objectives. The result of a study showed that the instruction that only uses textbooks (not local course books) can cause a low student's learning achievement (Bas, 2011). The study shows that a course book as a component in the instructional system significantly influences the quality of the instructional process. Secondly, the students have not optimally worked together in doing the group tasks or projects. The tendency is that the more able students dominate in doing the tasks or projects. The effect is that the students are not able to solve problems in group and collaboratively through sharing ideas, opinions and to give an innovative solution. Thirdly, the students do not know what they learn. The most important thing is not collecting the tasks but the correctness and the authenticity of the tasks collected. The nonexistence attraction of the tasks, the tasks that are less challenging, and the students have not felt the real effect of the tasks become things that need to be corrected in the lecture.

There are some weaknesses in the instructional process and we need to find a solution to these. The solution offered is by developing a course book based on authentic project. The element of project in the course book provides an opportunity for the students to develop knowledge through interaction with peers and community members during the project. The development of project-based course book was based on some advantages: (1) it facilitates the students in learning in group in solving a problem, (2) it facilitates the students in learning systematically and punctually since they have to finish the project whose deadline has been determined, (3) It provides real experience for the students since the project they are doing is an authentic project that is obtained through observation in the field in the institution of early childhood education, (4) it increases the ability to think critically on the part of the students.

The importance of course book development starts from the function of course book development. According to the Depdiknas (2010) the double functions of course book development are (a) that which is based on the users, and (b) that which is based on the strategy of instruction used. The development of a course book follows instructional product development models. The thing that makes this development differ from other developments is that in the use phase or in the implementation phase, the course book in the classroom was done through project-based instructional model. Project-based instructional model is relevant to and suitable for the characteristics of the course. The integration of a course book into media and instructional models is supported by Kozma (1994) who states that media and methods make students interact in the cognitive and social processes to develop knowledge. Both are parts of the instructional design. This indicates that the use of a course book cannot be separated from methods and models of instruction as parts of an instructional design.

The project-based instruction was chosen based on some study results. The study done by Memisoglu (2011) showed that project-based instruction can help students access the information, improve understanding, and improve practical ability better than the traditional instruction. Hence, the choice of project-based instruction in implementing a course book is relevant to the effort at improving the students' learning achievement.

The aims of this study were to: (1) describe the procedure of a project-based course book development for early childhood assessment course, (2) describe the responses of some experts and students to the course book developed, (3) explain the effectiveness of project-based course book developed in improving the students' learning achievement.

2 Literature Review

A book is written material that presents knowledge or ideas of the author. The author gets the contents of his or her book using various methods such as taking them from results of studies, from observation, actualization of experience, or personal imagination called fiction. On the other hand, book as instructional material is defined as something that contains knowledge from analysis of a curriculum in writing. A course book in general is instructional material written by an author or a team of authors who write it based on a curriculum or an interpretation of a curriculum that is effective with targeted students.

Surahman (in Prastowo, 2011) stated that in general, books are differentiated into four types as follows.

1. Resource book, which is a book that is usually made to be a reference, and resource of a particular study, usually containing a complete study of a discipline.
2. Reading book, which is a book that only functions as reading material, for example, a novel
3. Handbook, which is a book that can be used as a guide for a teacher in teaching.

4. Course book, which is a book that is written for use in teaching and contains materials to be taught.

A course book is written systematically, and consists of three parts: the first, the core, and the last part. In the first part there are title, preface, table of figures, list of tables, and table of contents. In the core or chapter part, there is a chapter title with some key words following it, then instruction in learning the chapter or material, as well as a content outline, general and specific instructional objectives, materials of the chapter with examples, illustrations, activities and exercises, summary, problems at the end of the chapter, and references at the end. The same is true for subsequent chapters. The last part of the book contains a glossary.

In addition to using the theory of course book development, the developer also used project and assessment based learning theory also known as project-based learning (PBL; not to be confused with problem based learning although the two are related). Thomas (2000) defines project-based learning (PBL) as a model that organizes learning around projects. Blank, Dickinson, and Harwell (in Korkidis, 2009: 4) defines project-based learning as a learning model or authentic strategy in which the students plan, implement, and evaluate projects with real world applications outside the classroom PBL can be applied in all subjects.

Project-based learning has the potential to make learning experiences more interesting and more meaningful for adults, high school students, university students or traditional training participants to develop job skills (Gaer in Santyasa, 2006). According to Santyasa (2011) the implementation of this model follows five main steps: determining a project theme, determining the learning context, planning activities, processing activities, applying activities.

According to Uno and Koni (2012) a project study is an evaluation activity of a task is to relate the evaluation contents and the real world so that the project can measure the implementation of knowledge in the world. To be able to complete a project well, the teacher can give guidance and open the students' mind to complete it. The project should include an assessment textbook, and project evaluation is done to provide feedback and refine the process for future efforts.

3 Methods

This study was a development research project. It used a one group pretest posttest pre-experimental design. The development model used was Dick, Carey, and Carey's (2005) model that consists of ten stages.

The result was a course book that needs to be tried out in the field to obtain a description about its level of validity and effectiveness. This description was obtained by doing a formative evaluation. This evaluation was meant to revise the course book developed. The stages in the formative evaluation were (1) validation by experts including content expert, media expert, and instructional design expert,

(2) individual evaluation which was done by three students, and (4) field try-out that involved 30 students.

The data were collected using questionnaires, tests, and observation methods. The questionnaire was used to obtain data from content, media and instructional design experts, individual try-out and small group try-out. The test was used to measure the acquisition of learning objectives in order to know the effectiveness of the use of the course book in increasing the students' learning achievement. Observation was used to observe the instruction with the project-based course book. The data collected were then analyzed using qualitative descriptive analysis, quantitative descriptive analysis, and inferential statistical analysis. The inferential statistics of t-test was used to analyze the score difference in pretest and posttest in implementation of the course book. The t-test was done by using SPSS software.

4 Results and Discussion

The result of the development was in the form of a project-based course book developed using Dick et al. (2005) model that consists of ten stages. The innovative aspect of the course book is the presence of project element in each chapter of the course book and the final project as the accumulation of knowledge from each chapter. The projects integrated in the course book have authentic themes based on the existing condition or cases in the application of evaluation of early childhood education.

The project-based course book has experienced a series of validations by experts. The validation results show that the course book is effective. This shows that the contents of the course book in the form of facts, concepts, principles, and procedures are suitable to be taught to and learned by the students. The media expert validation result shows that it has a good validation. This shows that the picture media are suitable for explaining concepts, principles, and procedures in the course book. The design expert validation result shows that the course book falls into good category. This result means that the course book has met the feasibility aspects of instructional design, message design, and authenticity of project tasks. The process of expert judgments was followed by an evaluation by the students. The individually, in group, and field evaluation try-out (the students' responses). The results show that the course book has a good level of validity. The result means that the material readability, the ability to motivate, the attraction, and the easiness in understanding the course book are regarded to be feasible that the course book can be used by the students. The course book that has undergone a series of evaluations by the experts and students was then used in the classroom to find out the level of effectiveness in increasing the students' learning achievement. The observed paired sample t-test shows that significance level is 0.0001, which is smaller than the determined level of significance (0.05). This means that there is a significant difference in the students' learning achievement between before and after using the project-based course book. The result is in compliance with Lee and Osman's (2012) result shows that a course book is effective. It is also in compliance with the result of a study on the effect of the project—based instructional model done by Boondee et al., 2011 shows that the mean score for the posttest in an instruction used project-based instructional model was higher than that for the pretest at the 0.05 significance level. The result of this study indicates that the learning achievement of the students improves after they learned through the project-based instructional model. There are some factors that cause the difference in mean scores between learning achievement before and after the use of the project-based course book.

First, it facilitates the students to build knowledge and it gives challenges to learn. The course book was based on learning theory that focuses on the learning process that occurs since the synergy of short term memory and long term memory activated through the creation of external factor, or learning environment (Prawiradilaga, 2008). The course book as a component of the learning environment contains texts, pictures, illustrations, cases, and a number of projects that motivate the students to read, to relate prior knowledge and new knowledge, to discuss, and to implement theories into a real situation. This practice activity conforms to what is stated by Silberman (2013) who says that what I listen, see and do give me knowledge and skills. The students who were involved in implementing theories of early childhood education assessment also learn the principles of cognitive learning theory. They could build knowledge by creating experiences. The aims of the instruction will be achieved with the provision of meaningful experiences for the students. If the experiences experienced by the students were logical, then they would trigger them to understand experiences better. Experiences provided through field investigation task division in group, and performance in completing the project are real efforts that the students make when they enter the work. This encourages them in seeing that experiences that they got are purposeful and meaningful. The course book developed was based on instructional theory. According to Gagné, Briggs, and Wager (1992) the presentation of materials in the course book was based on the events of learning according to Gagné et al., (1992). The aim of using instructional events is to maintain that the presentation in the course book does not follow a direct instruction model. The presentation of materials uses texts and pictures that are not merely the transfer process of knowledge and position the students as the passive receivers of the message. The course book was designed to support constructivist instruction and was aimed to help the students to explore the topics and generalize knowledge. The instructional message design theory has a great effect on the implementation of the principles of motivation, the principle of memory, the principle of perception and the principle of concept learning. The principle of motivation was implemented through attractiveness of the book cover design. The design of the book cover reflects the book contents and gives a positive impression to the students about the book contents. Not only in the book cover, the principles of motivation was also applied in giving examples related to abstract material, readability and relevance of the pictures, and in presenting interesting, challenging topics that make ones wonder. The principle of memory was implemented through presenting concrete messages, repetitions of difficult topics, and practices of implementing materials of concepts, principles and procedures. Principle of perception was implemented through varying a word, phrase shapes like using bold type, and giving a note to pictures to help the reader in perceiving them. The implementation of learning principle was done through presenting easy concepts first and moving to more difficult ones, the use of examples and non-examples, the use of varied examples and the use of examples and opposing non-examples.

The course book was designed based on Gagné, Briggs, and Wager's theories (Gagné et al., 1992). The events are: (1) getting the students' attention, (2) presenting instructional objectives, (3) activating students' prior knowledge, (4) presenting contents, (5) giving direction to learn, (6) giving an opportunity to perform, (7) giving feedbacks, (8) doing an evaluation, and (9) increasing knowledge transfer and retention. The method used to attract the students' attention was to give questions. At the beginning of material explanation, questions were given to stimulate them to think and to relate knowledge that they have to the new knowledge. The illustrations are in the form of texts accompanied by pictures that were also presented to stimulate attention, to stimulate motivation to learn, and that leads the students' thoughts to the topic that the will learn. The instructional objectives are always presented at the beginning of the material. The presentation of the objectives is needed in order that the students are directed and know what they have to achieve. The students have to listen and understand the intention of the instructional objectives before moving to the presentation of contents, or material. The presentation of contents uses text objects and pictures as if they were communicating with the students. The explanation of material is communicative and suitable with the students' cognitive development level. This finding is supported by Mayer and Moreno (2002) who show that it will be easier for the students to understand messages when the contents are communicated using conversational style rather than the formal style. Some materials are accompanied by examples, analogies or illustrations that are relevant, both textually and pictures. The presentation of examples is done to make it easy for the students to understand or to deepen their understanding.

The direction for learning is presented on the first page that leads the students' learning activities. The direction contains learning steps that follow project-based learning model. The students' learning activities in group are led as follow. (1) determining the project title, (2) planning the project including making cost budget, identification of tools, place, and project design, (3) writing the project schedule, (4) implementing the project, (5) checking the project progress, and (6) doing an evaluation of the learning process and product. The direction for learning also contains classification of materials that the students have to learn to complete the project. Deep understanding is optimized through direction to do exercises, and tasks in each chapter. The form of exercises and tasks is adapted to the competency that is stated in the instructional objectives. The exercise are in the form of exploring understanding, practicing procedures, making a design, and creating a product.

The level of mastery can be measured using the provided assessment rubric in the course book. The students can do a self-evaluation to know the level of competency that they have acquired. To consolidate the students' understanding, in each chapter is presented an evaluation in that consists of multiple choice items, essay test, and project. The evaluation section facilitates the students to evaluate regularly the learning process that they have gone through. The feedback at the end of each chapter and for essay items are also accompanied by an assessment rubric and the students are expected to evaluate their answers by themselves. Gee (2005) says that feedback can help the students to know their learning progress. The feedback can strengthen what they have learned and it can also correct misconceptions. The students are provided with ample opportunity to use (transfer knowledge, attitude, and skill that they have acquired in a different situation. Understandings of concepts, principles, and procedures are applied through project work. Project is a laboratory that gives real experiences, requires students to relate knowledge, cooperate to achieve the objectives that they have determined together.

Secondly, the implementation of the course book in the instruction used project-based learning. The effectiveness of the implementation of the course book has to be supported by selecting an appropriate instructional model. Project-based learning model is relevant to and suitable with the characteristics of the course. The integration of the course book into a media and model of instruction is supported by Kozma's point of view (Kozma, 1994). Kozma states that media and method make the students interact in the cognitive and social process to build knowledge. Both are part of instructional design. This indicates that the use of course book cannot be separated from method and model of instruction as part of instructional design. The selection of project-based learning was based on the results of some studies. The study by Memisoglu (2011) shows that project-based learning can help the students to access information, to increase understanding, and practice ability better compared to the traditional instruction. Hence, the selection of project-based instruction in implementing the course book is relevant and can increase the students' learning achievement. Based on the function of the course book and the model of instruction it can be emphasized that course book is a media that presents instructional messages using texts and pictures. The presentation of authentic project tasks encourages meaningful learning process that is facilitated by project—based instructional setting. The instructional model contributes to the effectiveness of the course book and likewise, the reverse, the course book contributes to the effectiveness of the instructional model.

5 Conclusion

In terms of contents, instructional media, and instructional design, the validity of the course book falls into category good. Based on the students' evaluation in the individual try-out, small group tryout, and field try-out, the quality of the course book falls into category good. The implementation of the project-based course book in the instruction turned out to be effective in improving the students' learning achievement.

The findings of this study contribute to the message design aspect of instruction and instructional design aspect as follows: (1) the presentation of instructional messages uses texts and pictures to facilitate and speed up the interpretation, retention, and transfer of knowledge by the students better than if texts alone are used; (2) the instructional design in the course book plays the role in creating a constructivist instruction so that it does not position the students as receivers of the message; (3)

the authentic project element has the role as motivator of the students' learning motivation and creates a meaningful learning process; (4) the combination of course book and project-based learning becomes part of the instructional design to create an effective instruction.

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Chapter 17
Discrepancy of Difficulty Level Based On Item Analysis and Test Developers' Judgment: Department of Biology at Universitas Terbuka, Indonesia

Diki Diki and Eko Yuliastuti

Abstract The chapter discusses a discrepancy of test items by difficulty level between the test developers and students' perceptions. Previous studies showed the difficulty level was critical in multiple choice question tests (Naqvi et al., Procedia—Social and Behavioral Sciences 2:3909–3913, 2010; Sim and Rasiah, Annals Academy of Medicine Singapore 35:67–71, 2006). A high number of invalid test items also reduced the effectiveness of a test (Ratnaningsih & Isfarudi, 2010). The aim of the study was to compare the difficulty level of the test items according to the test developers and the difficulty level based on item analysis. The hypothesis is that if there is a gap between two kinds of difficulty levels, the test is less effective. The study used data from three examination results of BIOL4110 (a General Biology test at Universitas Terbuka, Indonesia) of three consecutive semesters between 2014 and 2015. Participant numbers for of each examination were 469, 536, and 520 students. Analysis of a relationship between difficulty levels used Chi square test. In addition, there was an analysis of relevance of the test to the textbook using KR20 and an analysis of the discriminant index. The analysis showed that in each semester, there were always different difficulty levels between test developer judgment and item analysis results. In addition, the relevance level of the test was greater than 0.5, which was good, while the discriminant index was not good, since some test items had rpbis of <0.3. However the passing rate of each test (62–73%) was satisfactory.

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K.A. Persichitte et al. (eds.), *Educational Technology to Improve Quality and Access on a Global Scale*, Educational Communications and Technology: Issues and Innovations, https://doi.org/10.1007/978-3-319-66227-5_17

1 Introduction

Universitas Terbuka (UT) is the primary distance education provider at the post secondary level in Indonesia. Nowadays, it has more than 300,000 registered students from all over the country with 17,000 islands. The distance education program allows students to study regardless of geographical barriers, family and job responsibilities, and age (Hewindati & Zuhairi, 2009; Holmberg, 2005; Moore & Kearsley, 2012).

The department of biology in the Faculty of Mathematics and Natural Sciences at the university in the study was established in 1998. In 2016, there were more than 500 students in this department. The students live in many areas throughout Indonesia. They do their practicum in laboratories of partner universities in Pangkalpinang, Bogor, Bandung, Purwokerto, Solo, and Ambon.

A significant problem for the department of biology at Universitas Terbuka is low test scores. In 2014, 29.14% of the general biology students who took the final exam received very low scores and failed the examination (Diki, 2015).

Most of the examinations in the department of biology are a multiple choice test. The multiple choice test is conducted as a paper-and-pencil test in various locations. Students do the examination in locations near their domiciles.

One possible cause of the students' failure during examinations is the accuracy of the examination material difficulty levels. Less accuracy of difficulty levels caused students' low levels of success during examinations. Examination material should have accurate difficulty levels. It is important to develop test material with an appropriate balance of difficulty levels in the examination material (Sim & Rasiah, 2006). However, there is lack of research on this subject in the department of biology at Universitas Terbuka.

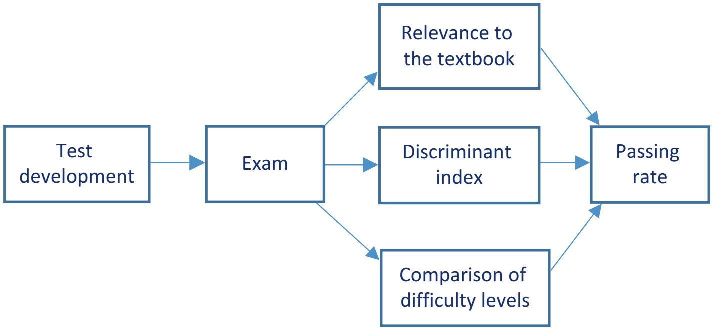
Another suggested possibility for the students' failure is a high number of invalid test items. According to Ratnaningsih and Isfarudi (2010), there were findings of invalid test items in Universitas Terbuka. However, there should be more studies in the department of biology, since the study of Ratnaningsih and Isfarudi did not include biology students.

There are two research questions in this study. The first is to what extent is the match between item test difficulty levels according to the test developer and students' exam scores. The second research question is to what extent are the discriminant index, reliability, and passing rate. Meanwhile, the hypothesis of this study is that there should be a correspondence between difficulty level of test developers and students' perceptions about item test difficulty levels.

2 Theoretical Framework

Ideal testing should distinguish high achiever and low achiever test takers. One criteria of the ideal test is the difficulty levels. However, recent studies showed that test items at UT still allowed test takers to be guessing during the test (Ratnaningsih

& Isfarudi, 2013). Therefore, there should be a study about the level of difficulty in developing the test items. In order to measure difficulty level, the study used a difficulty index (Naqvi, Hashmi, & Hussain, 2010). To measure if the test would discriminate those who and do not study, the researcher used a discrimination index. This study also investigated the relevance of the test with the subject that was evaluated using the point biserial statistic.



3 Literature Study

Multiple choice testing is used at UT. The application of multiple choice tests is to assess students' knowledge. In this most common type of the test, students have to choose one out of four options. The test is usually administered at the end of a semester. Therefore, teachers get feedback about student achievement (Mitra, Nagaraja, Ponnudurai, & Judson, 2009).

Advantages of multiple choices testing are efficiency and reliability. It can cover broad topics of knowledge in a test (Sim & Rasiah, 2006). For example, a multiple choice test with 45 items may cover the material found in a course textbook. However, the material included in the test should be in the test blueprint.

The test may measure higher order thinking, if it is carefully designed. Usually, it is easier to develop a test that requires students to recognize or recall. Therefore, test development should also consider the taxonomy of cognition. Covering various levels of cognition is an important requirement to developing valid and reliable tests (Sim & Rasiah, 2006; Swanson, Holtzman, Allbee, & Clauser, 2006).

A multiple choice test item consists of a statement (stem) and alternatives of answers (option). One of the options is the correct or the best answer. Other options are distractors. The role of a distractor is as an attraction for students who are not sure about the correct answer, while students who are sure about the correct answer are not attracted by the distractors (Mukerjee & Lahiri, 2015).

A good multiple choice test should have relatively homogenous options so that students do not guess the correct answer. A heterogenous option allows students to guess the correct answer. This type of test does not discriminate between students who learn and who do not (Mukerjee & Lahiri, 2015).

Despite its advantages, there are some disadvantages to multiple choice tests. One weakness is that students may do guessing during the examination according to Hotiu (2006) and Sirri and Fredanno (2011). Therefore, according to Hotiu, test developers tend to measure only factual information, rather than higher order thinking.

At Universitas Terbuka, the examinations use multiple choice tests. There are pencil and paper tests as well as online tests. Students do the pencil and paper test in schools or buildings near where they live. Meanwhile, the online tests are only in regional offices of the university.

In order to ensure that students have quality test material, it is important to develop a good test. The requirements for test developers are that they understand the test objectives, they understand the test substance, and they have the required skills for writing the test items (Sirri & Fredanno, 2011).

Item analysis is an assessment of the quality and quantity of test items and the test as a whole based on students' answers and test questions (Sirri & Fredanno, 2011). The analysis is a process to measure quality of a test by means of collection, summary, and the use of information (Mitra et al., 2009). Item analysis may find misleading or ambiguous test items (Mukerjee & Lahiri, 2015).

Item difficulty is the percentage of students' correct answers to the total test items. The greater the number, the easier the test items are (Hotiu, 2006; Sim & Rasiah, 2006). The importance of item difficulty is to avoid a misfit between the level of difficulty of the test and student's ability (Mitra et al., 2009).

There are two approaches for conducting item analysis. The first approach is the Classical Test Theory (CCT). The other approach is the Item Response Theory (IRT) (Baker, 2001; Hambleton & Jones, 1993; Sirri & Fredanno, 2011). One characteristic of the difference is that Classical Test Theory is considered theme based, while IRT is considered item based (Hambleton & Jones, 1993).

Classical Test Theory is a linear model and it works at the test level, instead of at the item level. It is considered weak, since it is easy to meet with test data. The Classical Test Theory consists of item difficulty index and discrimination index. The difficulty index is the proportion of students who correctly answered the item. The discrimination index is the point biserial correlations between students' scores on individual items and overall test scores (Hambleton & Jones, 1993; Sirri & Fredanno, 2011). According to Mitra et al. (2009), CCT focuses on the homogeneity of the test. If the test as a whole has more similar test items, the test is more likely to measure a certain cognitive aspect. Therefore, the test is considered having higher reliability. On the other hand, a less homogenous test, the lower its reliability.

There are some limitations of CCT. For example, the test difficulty index and test discrimination index are group dependent. Both values are influenced by the sample. The value of difficulty and discrimination are higher if the examinees are more heterogenous. Meanwhile, if the examinees are more homogenous, there will be a lower value (Hambleton & Jones, 1993). Another weakness of CTT is that as a test-based measurement, it cannot measure a particular test item. For example, the CCT cannot find if examinees do not respond accurately to a single item (Hambleton & Jones, 1993). Although analysis about the whole test is important, the test developers do not have a clue to find which test item is misleading or unclear for students.

In the Iterm Response Test (IRT) approach, the assumption is that there is a correlation between each test item and the whole test performance (Sirri & Fredanno, 2011). An advantage of IRT is it connects the test ability and test score. As opposed to CCT, IRT may reveal any single test item that needs to be rewritten or to be deleted. However, some weaknesses of IRT is that it requires a larger sample (>500) and the model is too complex (Hambleton & Jones, 1993).

Another critical parameter of good multiple choice test is its relevance to the textbook. The primary learning material at UT is the printed textbook. As a result, all test items are developed according to the UT textbook. All test developers use the same textbook as the students read as the only source for developing test items. So far, there is a lack of studies about relevance of test items and the UT textbook as the source.

A measure of relevance between the test items and textbook is Kuder-Richardson 20 or KR20. KR20 is measuring internal consistency reliability. In other words, KR20 is an indicator of how well a test item measures a certain construct (Kehoe, 1995). For example, in biology, the test items should measure topics in biology, not other topics.

Test development at UT begins with the assignment of test developers. Most all test developers are academic staff at the university. They have to develop a test blueprint for the test. The test blueprint includes difficulty levels and cognitive levels. Each test blueprint is reviewed by other academic staff who has an understanding of the topic. Mostly, the test blueprint developer and the test developer are different persons.

After the test blueprint is ready, the test developers prepare the test using the UT textbook as the source. The test measures students' achievements in the competence levels included in the test blueprint. Every test item will be reviewed by other faculty members at the university. The test developer will do a validation process after the reviews.

The test developers should consider the cognitive levels and difficulty levels. The difficulty level is based on the test developers' judgment. Therefore, common understanding about levels of difficulty is important. Otherwise, each test has different levels of difficulty.

There are previous studies about the difficulty index and other measurements of test quality in multiple choice tests. Naqvi et al. (2010) measured validity of multiple choice tests in Lahore, Pakistan. The study found that the test had poor reliability based on difficulty levels and the discrimination index. Besides, the sample size was only 48 students which was considered too small.

There are two studies that not only observed difficulty level and discrimination index, but also focused on the relationship of the two criteria. Sim and Rasiah (2006) conducted a study about a relationship between the item difficulty index and discrimination index in true/false multiple choice tests in an undergraduate medical programme in Malaysia. They found that a multiple choice test has a good discrimination index correlated with moderate difficulty items. However, the study was about true/false multiple choice question, as opposed to the four-option multiple choice tests used at Universitas Terbuka.

Another study that also studied correlations between the discrimination index and difficulty index was conducted by Mitra et al. (2009). They found a low correlation between the difficulty index and discrimination index. The correlation was negative, indicating that an increase in difficulty level is related to a decrease in the discrimination index.

However, in spite of various studies about difficulty levels of multiple choice tests, there are still a limited number of studies focusing on if there are two different difficulty levels in a multiple choice test. Mitra et al. (2009) suggested a possibility of subjective judgment of the test developer. However, they did not elaborate the possibility further. Therefore, there is a need to study the different difficulty levels according to the test developers and according to the item analysis.

4 Methodology

The researchers acquired the test scores of BIOL4110 General Biology. Then, they did item analysis based on the Item Response Theory (Kubinger & Gottschall, 2007; Ratnaningsih & Isfarudi, 2013). The determination of levels of difficulty used the difficulty index (Naqvi et al., 2010). The analysis of a relationship between the difficulty according to test developers and according to item analysis was done using a Chi square test.

There were four tests that were used in this study. Those tests were item analysis, Chi square, reliability, and the discriminant index. Item analysis was for measuring the difficulty level of the test items according to the test developers.

Meanwhile, Chi square was for measuring if there was a relationship between the difficulty level of the test items according to the test developers and the difficulty level of the test items according to the item analysis.

For measuring the relevance of the exam material to the learning material/textbook, the researcher used KR20 (Kuder-Richardson) for each test. It is a point biserial correlation (rpbis) of each test item. The formula for KR20 from Sabri (2013) is

$$\mathrm{KR20} = \frac{n}{n-1}\left(\frac{\mathrm{SD}^2 - \sum \mathrm{PQ}}{\mathrm{SD}^2}\right)$$

The purpose of using point biserial is to measure if the test measures a single cognitive factor, which is General Biology. The value of rpbis is between −1 and 1(Kehoe, 1995; Sabri, 2013; Sim & Rasiah, 2006).

Discriminant index (DI) is a measurement of how effective a test item differentiates students of high scores and low scores. The formula for discrimination index is

$$D = P_U - P_L$$

where P_U and P_L are the proportions of students in the higher level and the lower level who got the item correct. The range of discrimination index values is between −1 and 1. If the DI index is higher, the test is more effective. A DI value between 0.3 and 0.39 is good, although it needs improvement. A DI value of 0.4 and greater is considered excellent. Items with DI value below 0.19 should not be used (Mukerjee & Lahiri, 2015).

The measurement of difficulty level uses the formula of:

$$P = \frac{c}{N} \times 100$$

where c equals the number of correct answers and n is the total item numbers. An indication of an easy item is if p value is approaching 100%. It means that all students answer the item correctly (Kubinger & Gottschall, 2007).

The study used examination results from three consecutive semesters in 2014 and 2015. Participants of each examination numbered 469, 536, and 520 students. The students who took the examination included students from other departments in the Faculty of Mathematics and Natural Sciences, such as statistics, mathematics, agribusiness, and food technology. The examination was conducted as a paper and pencil test in various locations throughout Indonesia.

5 Results and Discussion

The result of the analysis of BIOL4110 General Biology test in three consecutive semesters between 2014 and 2015 was presented in Table 17.1.

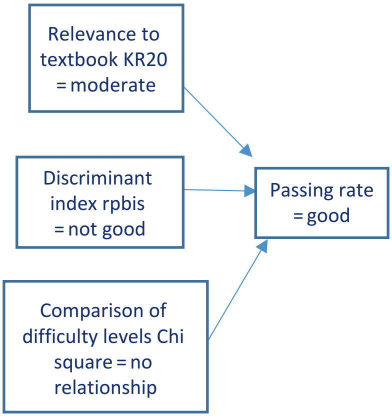
The passing rate of the test was 75, 98%, 62, 60%, and 73, 9% consecutively. Data about difficulty levels according to the students were gained from item analysis. The analysis of a relationship between difficulty according to test developers and according to item analysis used Chi square test. The analysis showed that in each semester, there were significant differences of difficulty levels between a test developer's judgment and item analysis results.

Table 17.1 BIOL4110 general biology results

	2014.2	2015.1	2015.2
Student number	454	524	458
Mean of rpbis	0.23	0.24	0.24
Std of rpbis	0.113	0.13	0.14
Range of rpbis	0.426	0.45	0.78
KR20	0.509	0.525	0.525
Passing rate (%)	75.98	62.60	73.09

- For the 2014.1 semester, the χ^2 was 0.44.
- For the 2014.2 semester, the χ^2 was 0.44.
- For the 2015.1 semester, the χ^2 was 0.33.
- All results were that the were χ^2 > than 0.05.

The analysis showed that in each semester, there is no relationship between difficulty level between the test developer judgment and item analysis results.



The analysis showed that none of the examinations within three consecutive semesters showed a relationship between difficulty levels according to the test developer and according to the item analysis. The judgment of the test developers was not validated by the item analysis, which answered the first research question of this study. This result was supported by the previous research by Mitra et al. (2009) in a study of multiple choice test in the department of human biology in Malaysia. They pointed out that there was a possibility of subjective judgment about item difficulty by test developers as well as the vetting committee.

Despite no relationship between two measurements of difficulty levels, the passing rates of the test were moderate and good (75.98%, 62.60%, and 73.09% in each semester). This passing rate was higher than Abdulghani et al. (2015) who reported a 56.3% passing rate.

Discriminant analysis showed that rpbis for each item varied. Some items had a rpbis <0.3. However, the mean rpbis were <0.3 for each test. This level of discrimination index was not good (Kehoe, 1995; Sabri, 2013; Sim & Rasiah, 2006).

In the 2014.2 test, there are 16 out of 45 items with rpbis below 0.19. Those items should be eliminated, for these items could allow students to guess during the test. The number of the identified items was around 30% of the total items in the test.

The results of the discriminant analysis of the other two tests were almost similar. In the 2015.1 test, there are 13 out of 45 items with rpbis below 0.19. However, the test with the largest number of items that should be eliminated was in the 2015.2 test. In the 2015.2 test, there were 21 out of 45 items with below 0.19.

Discrimination indices are an important measure of test quality. Low or poor discriminatory indices may indicate ambiguous wording, gray areas of meaning, or wrong keys (Sim & Rasiah, 2006). Poor discrimination indices allow guessing practices during the test. Sim and Rasiah also disclosed a possibility for a low discrimination index. The reason is that it is less likely for a student who studies well to make guesses for a difficult multiple choice test item to avoid losing a mark. Meanwhile, a student who does not study well may be more likely to take a risk guessing a difficult item. The student who does not study well may feel that there is still a possibility to gain a mark, or at least a zero mark.

Therefore, these indices may provide feedback for quality improvement. However, there should be more studies for longer periods of time. According to Sim and Rasiah (2006), three consecutive years of studying discrimination index of a test are not sufficient, while this study was conducted on a test during three semesters between 2014 and 2015.

Reliability of the test was moderate. KR20 of each test was 2014.2 = 0.609, 2015.1 = 0.605, and 2015.2 = 0.525. High KR20 indicates a high reliability of the test. High KR20 means that the tests were relevant with what students learned from the textbook. The result was lower than the previous study by Erturk (2015) and Sabri (2013) who reported 0.717 in their respective studies. Another study by Mukherjee and Lahiri showed a high KR20 of 0.9.

The reliability is important at UT. Students learn mostly from the printed textbook. Therefore, test developers should improve the consistency of the test material that they develop. The test material should measure what students learned from the textbook. Any training programs for the test developer (Abdulghani et al., 2015) should include efforts to improve test reliability.

A training program for the test developers, as well as blueprint developers, is not limited to improving reliability. Abdulghani et al. (2015) also pointed out that a passing rate and discrimination index increased after an improvement program was conducted for faculty members of a university in Saudi Arabia. The passing rate increased from 49.2% prior to the training to 56.3% after the training, while the discrimination index increased from 92.1% to 95% after the training.

Finally, there are limitations to the study. A limitation of this study is that the observation is limited to only three consecutive semesters. Sim and Rasiah (2006) even considered that three consecutive years are still not enough to study. Another limitation is that this study did not include a correlation between the discrimination index and difficulty index. Mitra et al. (2009) found a negative and weak correlation between difficulty and discrimination index.

6 Conclusion

This study suggested that the difficulty level of the UT Biology test is rather weak. The test developer's judgment about the level of difficulty did not match the item analysis results. This result is in line with Mitra et al. (2009) findings that subjective judgment may influence test preparation. Therefore, there should be an improvement on the objectivity of test developers in determining item difficulty. For example, future studies should include analysis of the blueprint (Ratnaningsih & Isfarudi, 2013). If the test developers are not the test blueprint developers, it is likely that an unclear blueprint may cause the test developers' judgment about levels of difficulty to be invalid.

The results also answered the second research question about other measurements of test quality. Although the test was not good in terms of the level of difficulty, it had a moderate to high passing rate. This passing rate is higher than a previous study by Abdulghani et al. (2015). In addition, the KR20 was high. This result means that the tests were reliable and relevant with the subject matter. The test measured the content of the textbook that the student used as their learning material.

The discriminant index is not good. The mean discrimination index is <0.3, which is rather low. Almost one third of the test items in each test have a discrimination index below that point and should be eliminated.

In the future, there should be other studies for a longer period, such as the study of Mitra et al. (2009) that covered three consecutive years. The study may include non-functional distractors (NFD) which have been conducted by Abdulghani et al. (2015) and Mukherjee and Lahiri (2015). The study about NFD may indicate options that are not selected by most test takers and should be revised.

The recommendation for the management of Universitas Terbuka is to conduct an improvement training for the test developers, including the test blueprint developers. The focus of the training may include discrimination index and difficulty level considerations.

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Chapter 18
Role of the University Lecturer in an Online Learning Environment: An Analysis of Moodle Features Utilized in a Blended Learning Strategy

Rijanto Purbojo

Abstract Successful implementation of an online blended learning strategy as a framework of learning has been considered an important characteristic of innovative higher education organizations. This is a condition where many higher education institutions must strive for high quality teaching and learning, and also to operate efficiently and effectively in delivering a profound student engagement. Thus, the emphasis must not be based solely on the purchase of a learning management system (LMS) but also on the role of university lecturers in utilizing an LMS and its features, which involves applying instructional design and learning activities to elicit the students' self-regulated learning process. This study was conducted to examine specific roles of university lecturers as instructors in delivering an engaging learning process in both classroom and virtual-class sessions as well as assessing the student's learning outcomes. Moodle logs files and reports, learning outcomes data, and interview data were collected. The quantitative and qualitative statistical analyses reveal that there are several behavioral characteristics of the instructor's role in utilizing Moodle features to design engaging learning activities and to assess student learning outcomes effectively. Having these results, best-practice teaching and learning activities for online blended learning and the competence profile of the university lecturer can now be defined for the purpose of a training and development program.

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K.A. Persichitte et al. (eds.), *Educational Technology to Improve Quality and Access on a Global Scale*, Educational Communications and Technology: Issues and Innovations, https://doi.org/10.1007/978-3-319-66227-5_18

1 Introduction

As many other higher education institutions across the globe, Universitas Pelita Harapan (UPH, www.uph.edu) has been faced with the demand to deliver a high quality teaching and learning process. In addition to that, the university has also been demanded to advance into an innovative higher education institute. However, this process does not come without its own challenges. Rajasingham (2011) and Duderstadt (1999) mentioned that a modern university that is merely centered on infrastructure modernization (i.e., buildings and transportation) has the ability to respond to the national needs of the industrial society. However, it has limited capability in responding to the rapidly changing needs of the knowledge society. The use of Internet-based e-learning and virtual universities is deemed as the answer to this matter. E-learning and virtual universities are able to accommodate the needs for an increasingly interconnected, multicultural, multilingual, and globalized world. Thus, modern universities need to take on a more innovative role in rising to this challenge.

Since 2006, this university has been implementing technologies in their teaching and learning process. These cover the (a) utilization of broadband Internet connection in entire campus buildings, (b) purchase of software packages to support learning, (c) distribution of learning materials through digital media, (d) implementation of an enterprise level academic information system, and (e) utilization of a learning management system (LMS). Through the utilization of these educational technology approaches, the university envisions to deliver a meaningful learning engagement for approximately 12.000 students with the utility of 2 campuses in Jakarta and 2 other sister universities in Surabaya (East Java) and Medan (North Sumatra).

In Indonesia, the tangible challenge of utilizing educational technology in the university does not solely lie on the fulfilment of governmental regulation as reflected in the national standard of higher education. Moreover, it also deals with an efficient resource allocation. The key resource is to deliver an overall scenario for students which aims to create a meaningful learning engagement in each learning process, whether in classroom settings, blended learning strategy, or distance learning mode. Traditionally, the classroom setting is the most preferred teaching and learning method to date. On the other hand, technology-enhanced open and distance learning mode remains a strategic plan for most universities in Indonesia. To illustrate, the Directorate of Higher Education Ministry of Research, Technology and Higher Education has initiated a simulation project to diffuse an open and distance education in Indonesia since 2014. Despite the government's attempt, nearly all Indonesian universities are confronted with the tradeoff among the quality of learning engagement, technological infrastructure, financial sponsorship, the culture of learning of students, and competency of the instructor. The interaction of the last two factors in technological enhanced blended learning strategy is predicted as the key factors in creating student engagement.

The focus of this research is on elaborating the role of the instructor in a technology-enhanced learning environment to deliver a blended learning strategy.

Hence, this will lead to a creation of students' intellectual engagement. This article also aims to emphasize the paradigm shift to a virtual university, if not other technologically enhanced learning environments for higher education. Furthermore, the role and function of the lecturer as an instructor in the learning environment should not rest on the investment of technological infrastructure only, but also applies to students' guidance and evaluation as part of their learning environment.

Part of this article has been presented and published in the International proceeding of Education Technology World Conference 2016 (in Bali, Indonesia, 31 July to 3 August 2016) with the title of "Improving Learning Engagement in Blended Learning Strategy: Role of Learning Management Features" (Purbojo, 2016).

2 Literature Review

Nowadays, distance constraints are no longer the focus of distance education study. The effort to bridge geographical borders through organizational strategies for the mass production and delivery of learning packages is also seen as becoming less constrained in the related topic. The focus has shifted to educational issues that are associated with teaching/ learning/knowledge transaction on the Internet to extend learning opportunities that applies to all individuals with no time and location constraints and with the use of any mode. One of the reasons for this focus shift was mentioned by Waha and Davis (2014) which states that higher education institutions have long recognized that holding onto past learning and teaching practices is not congruent with the needs of our knowledge society. Universities have been challenged to position their institutions for the twenty-first century.

In general, student engagement is defined as the quality of effort that students devote to educationally purposeful activities which contribute directly to desired outcomes. Schlechty (2005) postulated that developing student higher-order thinking skills requires students' work engagement. Students who are engaged and attentive tend to be more committed as they find value in completing the task or activity that needs to be worked on. According to Smith, Sheppard, Johnson, and Johnson (2005), in The National Survey of Student Engagement (NSSE), students indicated that there are five requirements to call learning activities as engaging ones: (1) Level of academic challenge: Schools encourage achievement by setting high expectations and emphasizing importance of student effort; (2) Active and collaborative learning: Students learn more when intensely involved in educational process and are encouraged to apply their knowledge in many situations; (3) Student-faculty interaction: Students are able to learn from experts and faculty when they serve as role models and mentors; (4) Enriching educational experiences: Learning opportunities inside and outside classroom (diversity, technology, collaboration, internships, community service, capstones) enhance learning; (5) Supportive campus environment: Students are motivated and satisfied at schools that actively promote learning and stimulate social interaction. In online learning, as mentioned by William, Julia, and Lisa (2014), the core purpose of integrating technology into the classroom is the engagement itself. Thus, this raised an issue about how to provide student engagement in online learning.

Blended learning (BL) is understood as combining face-to-face and technology-based teaching (Manninen, 2014). Blended learning integrates both on-campus face-to-face teaching and learning and on or off-campus virtual learning environments utilizing the affordances of each environment to enhance the student experience (Keppell & Riddle, 2012). Operationalization of BL in a course may be supported by asynchronous computer-mediated communication or ICT tools. It means that the students have to attend face-to-face meetings in the classroom, but also have access to an asynchronous virtual course to perform other learning activities. The purpose of providing an online or virtual course is to enhance student learning process and outcomes through additional reading, browsing additional materials in websites, watching videos, in combination with self-assessment and assignments and online discussion forum (Al-Qahtani & Higgins, 2013). It has become common that teachers are presented with Internet technologies in various new learning services. Through Internet tools, a wide range of resources and content can be shared easily. Internet is playing a crucial role in delivery of higher education lectures (Bicen, Ozdamli, & Uzunboylu, 2012).

Many practitioners struggle with the attempts to identify the real application of blended learning in practice. Various researchers face problems when using different concepts like open, flexible, distance, or computer- supported learning or computer-mediated communication (Manninen, 2014). Planting BL into practice can involve a variety of approaches, such as: (1) Teachers can grant students access to virtual learning environments (i.e., learning management system—LMS) or “wiki” (an editable website that can be used for collaborative activities); allowing 24/7 access to digital materials that support classroom work: a “dual track” approach; (2) Teacher could set homework assignments based on a digital media. Students use technology to perform specific tasks between face-to-face classes, to prepare or consolidate: an “integrated” approach (Sharma, 2010).

The features of modern LMSs such as Moodle (www.Moodle.org) allow an adjustable and dynamic learning ecosystem that enables the integration of different interactive learning activities and facilitation of the teachers’ ICT acquaintance to foster student intrinsic motivation. Other factors, such as the empowerment and continuous improvement of LMS interactivity, may result in higher levels of students’ satisfaction (Dias & Diniz, 2014). This implies that the pedagogical strategies applied while using Moodle are more emphasized on the teacher, lecturer, or instructor. The instructor’s main responsibility is in the design and provision of resources and activities. They should be aligned with the learning strategy that the instructor wishes to apply in order to achieve the learning objectives. It is obvious that the role and scope of responsibility of the instructor in the design and delivery of a course in Moodle is highly dependent on their technical capabilities and pedagogical competencies. Second, the nature of the course itself might also be predetermined to the instructional strategy applied in Moodle. Thus, during the design and delivery of a course the student learning needs might be less focused.

Although students in Moodle have more freedom and autonomy within the scope of curriculum and courses than the instructor, it will call for a condition where students need a pattern of self-regulation. This implies the need for motivating factors for a continuous learning process. From the student's perspective, student engagement in online learning addresses a cluster of issues surrounding the quality of the student learning experience (Coates, 2006). In the case of technology-enriched spaces, many university teachers feel ill-equipped to re-imagine their teaching practices so they have reservations in relation to the commitment required to capitalize on the affordances enabled by these spaces (Steel & Andrews, 2012). Thus, LMS as a learning environment is supposed to facilitate student engagement in BL strategy, yet it is assumed to have an artificial connotation, as a built, constructed environment by instructors, hinting to a result of a design process in an isolated laboratory (Duveskog, Sutinen, & Cronje, 2014). This has created a gap ("design-gap") that has made the LMS conflicted with the realities of instructor and student.

Role of a lecturer as an instructor in online learning environment has been an interesting issue in BL and distance learning approach. Various articles have attempted to define a number of roles and tasks for online instructor which is believed to elicit student-centered learning and provoke problem-based learning. Maor (2003) proposed a simple metaphor of the "four hats" to describe the role of teacher in online environment as follows: (1) pedagogical; (2) social; (3) managerial; and (4) technical actions. The *social hat* involves affective support, interpersonal communication, setting a positive tone, and keeping the communication flowing. The *managerial hat* involves actions such as designing, coordinating the unit, and overseeing tasks and course structure and requirements. The *technical hat* includes actions such as helping and guiding in the use of technology. Finally, the *pedagogical hat*, which appears to be the most salient in terms of promoting interactive learning, includes actions such as providing feedback and instruction, probing, asking questions, stimulating the discussion, synthesizing students' comments, and referring to outside resources or experts in the field.

Accordingly, Alvarez, Guasch, and Espasa (2009) defined the instructor's role as follows: (1) *Designer/planning role* includes instructor behavior related to course planning, organizing, leading and controlling; (2) *Social role* includes instructor behavior related to influencing students' relationships with the instructor and with other students; (3) *Cognitive role* includes instructor behavior that deals with mental processes pertaining to perception, learning, information storage, memory, thinking, and problem-solving; (4) *Technological domain* relates to knowledge of support services, multimedia knowledge, basic technology knowledge, technological access knowledge and software skills, and data analysis; and (5) *Managerial domain* is connected to a group of competencies that allow the teacher to develop and adapt the planned actions and, in the same way as the technological competencies, also integrate transversally into any of the teacher's roles, such as: responding to expectations, motivation and learning needs; administering the online classroom; managing spaces and channels of communication—in other words, supervising and tailoring the process in progress and online.

Based on the above discussion, it can be concluded that the implementation of technological enhanced blended learning strategy through a LMS could successfully support student's learning process through the maintenance of students' motivation and self-regulated learning—learning engagement. Hence, it will result in better learning outcomes. However, this situation of learning engagement could only be modeled if the instructor has applied his/her role in an appropriate instructional strategy to close "design-gap" within technological enhanced learning.

There are several issues that need to be clarified in this study: (1) whether the roles of the instructor that are represented in the utilization of Moodle in a BL course improve the student engagement, while producing better learning outcomes in test scores; (2) whether there are any differences among student cohorts in parallel classrooms regardless that they are combined into one Moodle course which adopts BL strategy, while presenting differences of instructor roles; and (3) what are the roles that usually performed by instructors in delivering BL course with Moodle.

This study is conducted to investigate and describe instructor's roles and students' behaviors by measuring the correlation between activities in classrooms which are enhanced and integrated with learning activities in Moodle and the learning outcomes in a real course. The author is aware that the result of the study is limited. Therefore, it requires a further thorough research.

3 Method

This study is conducted based on an understanding of applied research that attempts to assess the effectiveness and value of specially design programs. Cozby (2005) defined program evaluation as research on programs that are proposed and implemented to achieve some positive effect on a group of individuals. It places more emphasis on the qualitative and quantitative nature of research methodology in terms of describing association among variables to determine the benefits of implementing the program, to evaluate the program outcomes, and to determine the improvement of the program implementations.

This study uses students' online activities of an existing course "Introduction to Assessment of Personality" in the department of Psychology, undergraduate study program. The data is taken from August 25th until November 30th 2015 in 3 parallel classes, with the total participants of 93 students. These 3 classes are also represented in 3 student cohorts: Cohort A consists of 35 students, Cohort B consists of 25 students, and Cohort C consists of 33 students. The course is delivered in the duration of 15 weeks. This course has one main instructor who teaches 1 class and 1 additional instructor who teaches 2 parallel classes.

These 3 student cohorts are combined in one Moodle course which is designed in a standardized course template. The students are enrolled by using "course metalink" method. The engagement analytic tool and course completion features are also activated. This virtual course generally has the following characteristics: weekly topics, as defined by the classroom syllabus; one file course syllabus; 12 Topics of presentation files; various reading materials (URL links, PDF, and Doc files); video files; two online forum discussion; two online quizzes and two online assignments. Thus, each student has the same learning environment and course schedule.

3.1 Moodle Course as a VLE in Blended Learning

The Moodle virtual learning environment (VLE) is accessible commencing on the second week of the semester. The design of virtual environment follows the sequential structure of the syllabus which consists of: information of the learning objectives, presentation and reading materials, online quizzes, and discussion forums for each topics or classroom sessions.

During the face-to-face classroom sessions, students follow regular lecturing sessions, group discussions, role-play sessions of psychological testing administration procedure, student group presentations, and mid-term and final-term exams. The mid-term exam consists of 15 multiple choice questions and 4 essay questions (assessment rubric is used for essay grading). The final-exam consists of 5 essay questions (grading rubric is also provided during scoring process). The instructor of each class is responsible with the scoring process.

The objective of implementing a VLE for this course is to support student learning process beyond the classroom sessions. This is believed to promote better student's knowledge acquisition, collaborative learning, self-assessment, and extension of student-instructor communication processes as an overall implementation of BL strategy. Therefore, a course policy has been created and agreed by the students commencing on the second week of classroom session. The policy is clearly stated that students must access and follow online learning activities, such as online quizzes and forum discussion in weekly basis.

In this Moodle course, the course completion plugins and engagement analytic tools are used as well. It provides a full monitoring of student online activities. During the first 3 weeks of the classroom sessions, the data from engagement analytic (see Fig. 18.1) and course completion report (see Fig. 18.2) are presented in the classroom to motivate the students and to provide information on how they are being monitored by the instructor. This feedback session is believed to support students during their learning process. This online monitoring mechanism is provided until the end of the semester. However, no academic consequences are given if students fail to access the Moodle course regularly.

3.2 Measurements

The qualitative evidence is collected through Moodle logs data. These data show each student online activities. Later these data are tabulated and presented in timeline bar charts. Gismo, Graphical Interactive Student Monitoring Tool for Moodle (http://gismo.sourceforge.net/), is used to visualize these qualitative data.

Username	Assessment Activity	Forum Activity	Login Activity	Total
[illegible]	3% (14%)	0% (1%)	0% (0%)	4%
[illegible]	3% (13%)	0% (1%)	30% (60%)	33%
[illegible]	3% (13%)	0% (1%)	30% (60%)	33%
[illegible]	3% (13%)	0% (1%)	30% (60%)	34%
[illegible]	3% (13%)	0% (1%)	30% (61%)	34%
[illegible]	3% (13%)	1% (4%)	30% (60%)	34%
[illegible]	3% (13%)	1% (4%)	30% (60%)	34%
[illegible]	3% (13%)	1% (4%)	30% (60%)	34%
[illegible]	3% (13%)	0% (1%)	31% (61%)	34%
[illegible]	3% (13%)	1% (6%)	30% (60%)	34%
[illegible]	3% (13%)	1% (6%)	30% (60%)	34%
[illegible]	3% (14%)	0% (1%)	31% (62%)	35%
[illegible]	3% (13%)	0% (1%)	31% (62%)	35%
[illegible]	3% (13%)	1% (6%)	30% (60%)	35%
[illegible]	3% (13%)	3% (10%)	30% (60%)	36%
[illegible]	3% (13%)	3% (10%)	30% (60%)	36%
[illegible]	3% (13%)	3% (10%)	30% (60%)	36%

Fig. 18.1 Moodle engagement analytic tool

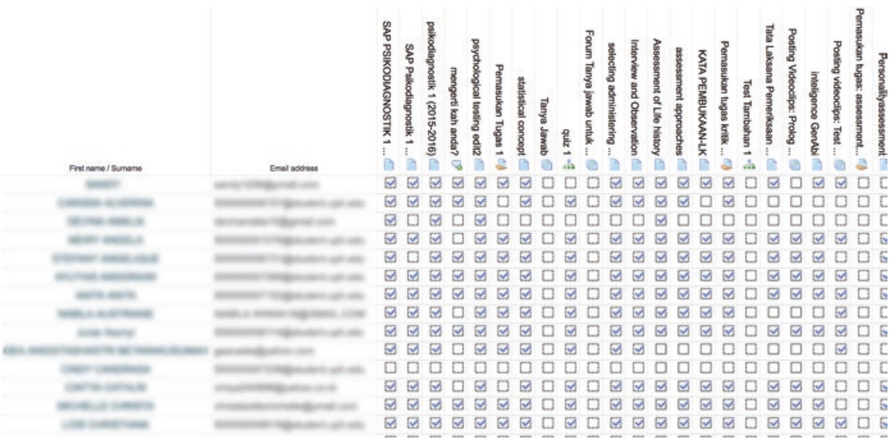

Fig. 18.2 Moodle course completion report

The quantitative evidence is based on students' academic achievement records from campus information system. These quantitative evidences are assumed to represent student learning outcomes. These data consist of four categories: (1) Class Learning Activities score: average of individual and group classroom assignments scores; (2) Mid-term Score, which is an assessment of learning outcomes around session 6th or 7th; (3) Final Exam Score, which is an assessment of learning outcomes at the last session, 15th session; and (4) Final Grade, weighted score of the previous three scores.

The statistical analysis for this study is conducted to find correlation among Moodle logs data and learning outcomes. SPSS version 22 was used to calculate Spearman Rank-order correlation between variables. Moreover, one-way ANOVA is also used to test the difference among data clusters.

A short interview was conducted with ten instructors. These instructors utilized Moodle on a regular basis in their BL scenario for every semester. The goal of this interview was to clarify the role of the instructor in online BL. We borrowed the framework of Alvarez et al. (2009) to understand how instructors usually perform their role in BL scenario. This interview may describe a range of possible instructor tasks applied to the usual BL scenario.

4 Results and Discussion

4.1 Descriptive Data

Depicted in Fig. 18.3, we could see that there was dense student activity just before the second week of October 2015. This activity level happens due to the nature of the classroom session that relies on direct lecturing, 2 sessions of online quizzes,

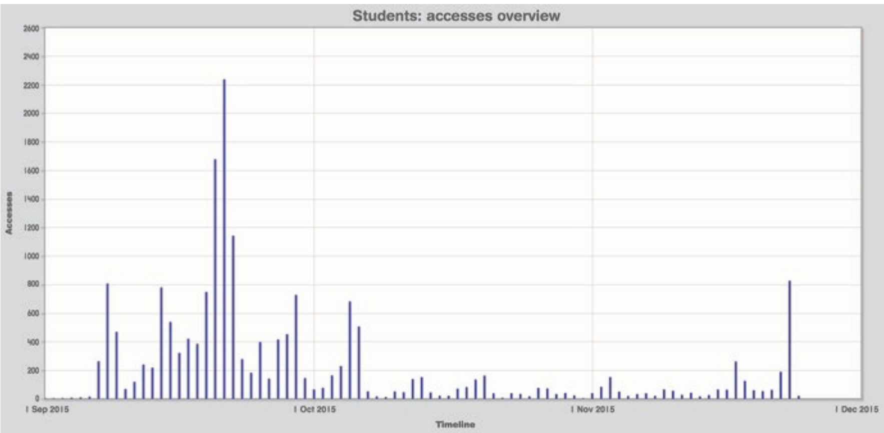

Fig. 18.3 Student activity in moodle course

and also in-class mid-term exam at the first week of October 2015. After the mid-term exam, the classroom activities are conducted in collaborative learning role-playing in the topic of “Psychological Testing Administration Procedure.” In this session, students are grouped to prepare the roleplaying sessions in the classroom and also record the roleplaying practices outside the classroom in video formats, upload the video clips, and share the videos through Moodle forum. It is expected that students will collaborate in group to provide feedback in the online forum. The course is ended with the final exam that is conducted in the classroom at the first week of December 2015. There is an extremely low to none students’ online activities in Moodle prior to this week.

4.2 Quantitative Analysis

Table 18.1 depicts an overall recapitulation of measurement. Student online activities are represented by Moodle access activities data (N = 93, M = 192.67; SD = 103.90). The standard deviation score indicates a wide variation of students’ online activities in this course. The Spearman’s rho analysis reveals a significant statistical relationship between Moodle access activities and four learning outcomes, namely: Classroom learning Activities score ($r_s[93] = 0.585$, $p < 0.01$), Mid-Term Score ($r_s[93] = 0.383$, $p < 0.01$), Final-Exam Score ($r_s[93] = 0.253$, $p < 0.05$), and Final Grade ($r_s[93] = 0.378$, $p < 0.01$). The hypothesis testing concludes that the overall BL strategy from both the instructors in these three parallel classrooms which is combined with one Moodle course indicates a significant relationship with student learning outcomes. This means that the more active students are in an integrated classroom activity and Moodle course, the higher their learning outcomes.

From the above analysis, we conclude that both student extrinsic and intrinsic motivation are affected by the instructor’s instructional strategy in utilizing and sequencing Moodle analytic tools and online quizzes, assignments, and discussion forum with the classroom activities. This is believed as one of the key factors of students’ learning engagement. Generally, motivation is not a stable trait of an individual but it is more situated, contextual, and domain specific (Linnenbrink & Pintrich, 2002). Students’ motivation might vary depending on the situation and context in the classroom or the school. This explains that although all students from three different parallel classrooms have access to the same Moodle course, their

Table 18.1 Overall measurement data

Data	N	M	SD	Min	Max
Moodle access activities	93	192.67	103.90	18.00	482.00
Classroom learning activities score	93	77.75	6.28	58.20	92.00
Mid-term score	93	68.04	12.12	28.20	96.00
Final-exam score	93	67.74	17.62	0.00	100.00
Final grade	93	70.84	10.52	36.00	93.45

motivation is possibly very much related to the role of the instructor in blending the available learning activities in both classroom and online learning environments. In the learning situation where traditional face-to-face meeting is still commonly used, the leadership role of the instructor to monitor and motivate student engagement is highly important. A research done by Al-Qahtani and Higgins (2013) indicates the physical absence of the instructor in e-learning courses where students are used to traditional face-to-face learning where it may be perceived as a disadvantage. Kahu (2013) explained that student engagement is influenced by six psycho-social elements: the socio-cultural context; the structural and psycho-social influences; engagement; and the proximal and distal consequences. He emphasized that student engagement is a psycho-social process influenced by institutional and personal factors, and embedded within a wider social context, integrated the socio-cultural perspective with the psychological and behavioral views. Moreover, the importance of the student-instructor relation is considered the crux of the learning situation.

In applying the above discussion of the role of the instructor in the BL strategy, it is suspected that there are differences in the strategy and application and utilization of Moodle features and classroom sessions by the instructor. In particular, the way the instructor utilizes the monitoring tools in Moodle (analytic tool, course completion, and other statistics data from the logs data), to provide feedback toward student online activity level in the classroom session, is considered a primary factor.

To further analyze the findings, one-way ANOVA is conducted to find differences among student cohorts. The results show that there are significant differences between Moodle Access activities, $F(2, 90) = 11.678$, $p = 0.001$; Classroom Learning Activities Score, $F(2, 90) = 8.249$, $p = 0.001$, Mid-Term Score, $F(2, 90) = 3.221$, $p = 0.045$, and Final Grade, $F(2, 90) = 3.292$, $p = 0.038$. However, there is no significant difference among three student cohorts on the Final-term Scores. Table 18.2 depicts interesting findings where cohort B has higher mean score of Moodle Access Activities ($M = 269.96$, SD = 112.74), Classroom Learning Activities Score ($M = 81.80$, SD = 4.27), and Final Grade ($M = 74.55$, SD = 9.90), compared to other two cohorts. Table 18.2 also shows that Moodle Access activities of cohort A ($M = 161.97$, SD = 84.90) and C ($M = 166.67$, SD = 86.32) are similar. As mentioned before, these classes have the same instructor who is a part-time lecturer. Figure 18.4 visualizes additional qualitative understanding. By observing the tendency of the average length of the bar chart of cohort B, it is concluded that this class has slightly higher activity level in Moodle online activities compared to the other two cohorts.

Summarizing the quantitative analysis, it is confirmed that the role of the instructor in integrating Moodle course and its features with face-to-face classroom activities as an instructional strategy does provide a high substantial contribution to the learning outcomes and achievement.

From another perspective, we add a more detailed analysis in Table 18.2. In each cohort data, a cluster correlation analysis is conducted to find detailed relationship among variables. From the data cluster of cohort A, the Spearman's rho reveals a statistically significant relationship between Moodle Access Activities and

Table 18.2 Total data tabulation of each cohort

Cohort		*N*	*M*	SD	SE	95% Confidence Interval for Mean		Min	Max
						Lower Bound	Upper Bound		
Moodle access activities	A	35	161.97	84.90	14.35	132.81	191.14	20.00	482.00
	B	25	269.96	112.74	22.55	223.42	316.50	135.00	477.00
	C	33	166.67	86.32	15.03	136.06	197.27	18.00	369.00
	Total	93	192.67	103.90	10.77	171.27	214.07	18.00	482.00
Classroom learning activities score	A	35	76.45	6.21	1.05	74.32	78.58	65.10	87.60
	B	25	81.80	4.27	0.85	80.04	83.56	74.50	92.00
	C	33	76.07	6.42	1.12	73.80	78.35	58.20	87.50
	Total	93	77.75	6.28	0.65	76.46	79.05	58.20	92.00
Mid-term score	A	35	64.18	10.51	1.78	60.57	67.79	38.00	84.00
	B	25	69.16	14.86	2.97	63.02	75.29	28.20	90.25
	C	33	71.30	10.56	1.84	67.56	75.04	56.00	96.00
	Total	93	68.04	12.12	1.26	65.55	70.54	28.20	96.00
Final-exam score	A	35	63.63	18.71	3.16	57.20	70.05	0.00	100.00
	B	25	73.16	12.70	2.54	67.92	78.40	44.70	98.30
	C	33	68.00	18.91	3.29	61.30	74.71	0.00	96.00
	Total	93	67.74	17.62	1.83	64.11	71.37	0.00	100.00
Final grade	A	35	67.64	9.66	1.63	64.32	70.96	36.00	86.95
	B	25	74.55	9.90	1.98	70.47	78.64	49.74	92.20
	C	33	71.41	11.10	1.93	67.48	75.35	36.66	93.45
	Total	93	70.84	10.52	1.09	68.67	73.00	36.0.00	93.45

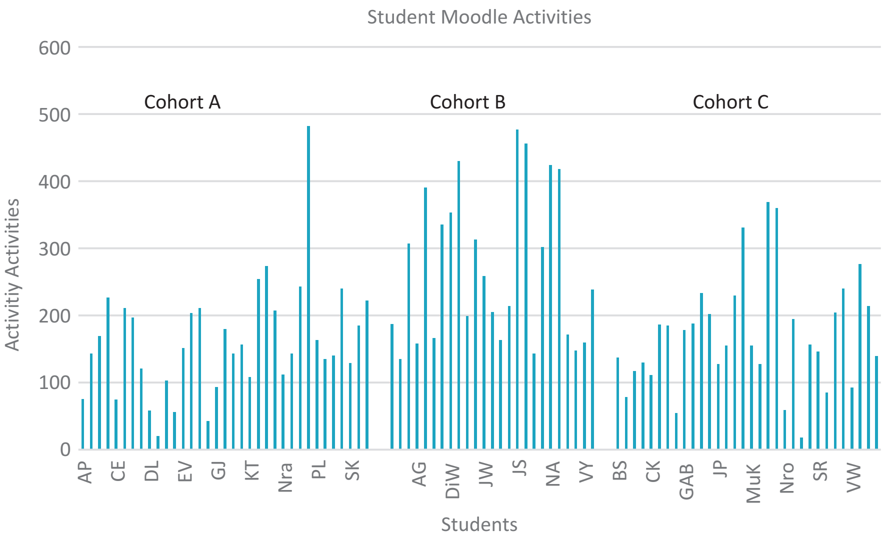

Fig. 18.4 Graphical representation of Moodle activity of each cohort

Classroom Learning Activities Score ($r_s[35] = 0.436$, $p < 0.01$) only. Whereas the data cluster of cohort B, the Spearman's rho reveals a statistically significant relationship between Moodle Access Activities and Mid-Term Score ($r_s[25] = 0.396$, $p < 0.05$) only. The data cluster of cohort C reveals particular findings where the Spearman's rho results in a statistically significant relationship between Moodle Access Activities and four other scores, namely: Classroom learning Activities ($r_s[33] = 0.468$, $p < 0.01$), Mid-Term Score ($r_s[33] = 0.573$, $p < 0.01$), Final-Exam Score ($r_s[33] = 0.405$, $p < 0.05$), and Final Grade ($r_s[33] = 0.413$, $p < 0.05$). By understanding the variations of the significant relationships among scores in each class and taking them into consideration, cohort A has the lowest learning outcomes while cohort B has the highest ones. It is suspected that the Moodle course is utilized differently by the students.

Since students construct meaning through their interactions, all aspects of the learning context should then be aligned to achieve the desired learning outcomes. Thus, a conjunction of the learning environment, curriculum, degree, learning and teaching activities, assessment and learning outcomes should be combined to provide richness of the student experience (Keppell & Riddle, 2012).

It is concluded that regardless the high and low levels of online learning activities, it does not necessarily lead to better learning outcomes. In contrast, a mediocre level of online learning activities does significantly lead to better learning outcomes, even if the differences of all scores from cohorts A and C are marginal. However, this additional finding needs to be further studied.

By combining all the above findings, there are three conclusions than can be withdrawn from the quantitative and qualitative analyses: (1) individual differences among students: cognitive capability and motivation; (2) differences of instructor's pedagogy competency and instructional strategy to blend classroom and online learning activities; and (3) differences of how students collaborate in both Moodle course and in the classroom. In the framework of student engagement, antecedence, and consequences, Kahu (2013) stated that individual differences are related to student's backgrounds, motivation, skills, identity, and self-efficacy; while instructor's role and pedagogy competency are related to how they apply instructional design and strategy to carry out the curriculum, which includes the assessment strategy of learning achievement, discipline, and learning culture. Thus, this explanation could support the variations of significant correlations among student cohorts in this study.

4.3 Interview Results

As mentioned earlier, we borrowed the teacher role framework of Alvarez et al. (2009). The interview of ten instructor yielded the following results. These instructors were used to applying BL strategies using Moodle for a minimum of 1 year. They had received formal training to use Moodle and also had been equipped with pedagogical teacher training.

Designer/planning role; all instructors indicate that they define the procedure of classroom instruction to Moodle course. They always provide students with PowerPoint presentation files and reading materials as provided in the classroom, but only four of them regularly create online quizzes and assignments in Moodle course. They have not considered the adaptation of interactive media to Moodle course, and only three instructors provide recorded lecturing in the form of voice- or video files on a regular basis. All instructors indicate that they adopt the sequence of the course syllabus precisely in weekly topics. Consequently, they adapt the classroom schedule into Moodle. Summarizing the role of instructor in design and planning, it is obvious that the position of Moodle course design structure is secondary, all instructors prefer to focus primarily in the classroom course structure while designing a BL course.

Social role: five instructors claim that they manage cooperative interaction in the classroom and continue the discussion through online forums. Whereas three instructors indicate that they moderate and contribute to the online discussion, inquire students' difficulties to understand specific topics, and maintain the climate of discussion. Other five teachers indicate that they almost never performed their social role in Moodle course. It can be summarized that there is lack of instructor's instructional understanding and competence to carry out cooperative learning with Moodle.

Cognitive role: only two instructors indicate that they use Moodle logs data to evaluate students' interactions with the topics, to check students' understanding by creating self-assessment online quizzes and assignments, and to provide feedback to the quizzes and assignments in Moodle. One instructor indicates that he regularly provides schedules for students to join text-based chatting. Only one instructor indicates that he evaluates his online activity compared to other student activities. In summary, very few instructors are aware of students' cognitive process during online session.

Technological domain: all instructors feel that they require more IT support to manage the university IT infrastructure. They indicate that centralized IT support has the main responsibility to support students' access problem. Eight instructors are concerned with the technical functionalities of Moodle. They are curious with the capabilities of the Moodle features to deliver their BL strategy. Four instructors have started to imply the usage of Moodle to support virtual university model (expanding Moodle usage to all of their courses). In particular, the attention is given to the usability of their concern with the capability of communication tools in Moodle to support the BL learning communication style. Other factors such as the development of Moodle version are the concern of two instructors.

Managerial domain: four instructors indicate that they manage and drive the virtual course and shared file area (i.e., adjust the sequence and schedule as scheduling problems found in the classroom). They also monitor the classroom praxis by providing complementary online content from diverse resource. In summary, there are a small number of instructors who could apply their role in developing and adapting planned actions during the application of managerial domain role. There is no indication that they are aware of their technological competencies, especially in responding to students' expectation, motivation, and learning needs. Thus, only a few instructors are aware of their roles in managing, supervising, and tailoring their BL progress.

Even though the samples for this interview are relatively small, there are a number of indications regarding two possible weaknesses for the role for instructor: *cognitive* and *social role*. According to Moodle development framework, this LMS is based on social constructivist and student centered learning approach and it is very flexible in usage, providing a number of features to support collaborative learning (Costello, 2013). Unfortunately, this added-value is not fully understood by the instructors who emphasize more on the classroom interaction. In a study of Korean University student, it is found that communication interaction that represents the social presence of the instructor in online learning environment is related to students' satisfaction toward their achievement (Kang & Im, 2013). However, this personal interaction should not be too intimate as it might threaten the perception of students toward their achievement.

Lack of instructor's *cognitive role* is related to the validation of students' cognitive process and learning outcomes. It is also suspected that the instructor lacks the competence to provide assessment and evaluation strategy in an online learning environment.

5 Conclusions

This study was conducted with Moodle as the virtual learning environment that was added-on to the classroom sessions to elicit the BL scenario. Therefore, the priority of the learning relied on the direct interaction between lecturers as instructors and their students in the classroom. Thus, the course in Moodle was customized to support classroom interactions. Instead of putting too much emphasis on the technological side (i.e., LMS purchase or high speed Internet) the focus should be aimed on the role of teachers as instructors to apply their instructional strategy within both virtual environment and direct classroom interaction. The position of the virtual learning environment should be equally important to the classroom direct interaction. However, the lecturer should be fully aware that each learning environment has its unique characteristics where their instructional competence will define the usage of instructional design and strategy. The role of the teacher as an instructor is central to this learning context, the aim is to reach students' engagement in BL scenario, where self-regulated learning is part of the requirement. Thus, the position of the lecturer to regulate students' motivation is essential among other factors such as:

1. Standardized setting and features of Moodle learning environment which reflects the design of the online course. Lecturers need to form a standardized setting and features of LMS to start the course, to limit the gap of design problem in teaching.

2. Lecturer's competence in instructional design and strategy in both online and direct classroom interaction.
3. Awareness of student characteristics: background information, cognitive and motivation level.
4. Quality of course materials and the learning objectives: standardized templates with measureable learning objectives.
5. Assessment and evaluation strategy must be defined before the course starts, this should be determined as a minimum requirement to start a course.
6. Technological infrastructure supports: centralized IT support at the university level.

The roles of lecturers as instructors in online learning environment should be given more attention specifically on *cognitive* and *social roles*—evaluating and assessing students' cognitive process, guiding learning, and communicating online. The lecturers should be more trained to use various assessments of learning outcomes and formative evaluation strategy and tools, with an emphasis on monitoring students' cognitive functioning. Hence, students' individual differences in cognitive functioning could be tackled earlier in BL strategy. More student self-assessment activities and formative evaluation toward learning outcomes are required to stimulate the pattern of self-regulation learning. The development of the lecturer competency could be done in lecturer professional development, such as in in-service training or in other formal training programs to enhance their capability in maintaining cooperative learning in online environment.

Moreover, it is recommended to benefit flipped classroom approach as the main instructional design and strategy to integrate online learning environment and classroom interaction.

Further research needs to be done to investigate the instructor's roles/tasks and their competency development in an online learning environment. Second, a preliminary measurement to assess students' cognitive level should be conducted prior to the data collection. This should be monitored during the BL strategy to identify the development of student knowledge acquisition. Lastly, the Moodle course as the VLE should be enhanced through the implementation of multimedia content such as voice lecturing note files and video files, and animations.

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Chapter 19
The Effect of the Mathematical GASING Method and Spatial Intelligence on Science Achievement

Sapiudin Fiun

Abstract Along with the development of information and communication technology, learning science at schools should provide resources and strategies that are creative and innovative to enhance learners' development and improve the future leaders of our nation. To achieve this goal, teachers are required to be able to create or choose a learning method or strategy which is based on learners' characteristics and the learning purposes to be achieved. The aim of this research was to determine the effect of the mathematical GASING instructional method and spatial intelligence on science achievement. Faizi, 2013 states that the GASING method (making learning easy, fun and enjoyable) teaches how to think like physicists in solving science exercises through a logical approach and is based on the foundations of science. This research used a 2 × 2 design by level with a sample of 40 students in an elementary school in East Jakarta. The data collection method used multi-stage random sampling. The result of this research shows that there is an interaction between instructional methods and spatial intelligence on science achievement. The results indicate that a mathematical GASING instructional method can be used effectively with elementary students when considering students' characteristics.

1 Introduction

The progress of a nation is determined by the quality of education. Education as a means to educating the citizens plays an important role in developing human resource quality, with success indicators that include (a) qualified experts, and (b) skilled, creative, and innovative workers with positive attitudes and behaviors.

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K.A. Persichitte et al. (eds.), *Educational Technology to Improve Quality and Access on a Global Scale*, Educational Communications and Technology: Issues and Innovations, https://doi.org/10.1007/978-3-319-66227-5_19

Education is a sector of national development that focuses on educating the nation. In Indonesia, the vision is to have an educational system that is a strong and authoritative social institution, empowering all citizens as capable and proactive individuals to answer the challenges of the changing times. The Indonesian Act No. 20 of 2003 mandates national education to realize the development of each learner's personal qualities. This is believed to be a determinant factor for developing the Indonesian state and nation throughout the ages with a focus on the education of the next generations to come.

Based on the data, the education quality in Indonesia has not shown the maximum results. Various publications issued by the United Nations, Asia Week, and other sources indicate a low quality of education in Indonesia. Until now, the Indonesian workforce is dominated by workers at the elementary education level, with 46.95% of the workforce at that level. Based on the report from the United Nations Development Program (UNDP, 2015) Indonesia was low on the Human Development Index (HDI) in 2015 being ranked 110 out of 188 countries.

In Indonesia, the teacher quality based on the world education agency (UNESCO) was listed last among 14 developing countries in the Asia Pacific region. Based on the data of reading ability, Indonesia was ranked 39 out of 42 developing countries. The data was not much different with the condition which occurred in elementary schools in East Jakarta. The results of national examinations, especially in science subjects, are low. In spite of the 2003 and a serious national effort, Indonesian education remains at a low level.

An important factor to help prepare the next generation with skills and positive character values is through the improvement of the learning process with the selection of an innovative instructional model/instructional method that is appropriate for the learners' characteristics and the material being taught. A 2005 government law mandates that the process of learning within an educational unit should be organized in an interactive, inspiring, fun, challenging, and motivating way so that learners can actively participate and be provided opportunities for innovation, creativity and independence according to their talents, interests and physical development as well as psychological needs. Based on these conditions, the learning process needs to be planned in order to reach the learning purpose while paying attention to physical development as well as the psychological needs of learners in order to develop their talent, potential, and skills.

One of the instructional methods that can increase creativity and student achievement is called the GASING instructional method. The GASING instructional method, *Gampang*, *Asyik*, and *Menyenangkan* (Indonesian words for easy, fun, and pleasing), is one of the innovations in the field of mathematics and science education. It was developed by Yohannes in 1996 and aims to make mathematics and science more easy, fun and pleasing to be learned. The purpose of choosing this instructional method is to encourage Indonesian students to enjoy learning mathematics and science which can then help improve the quality of education in Indonesia. In addition, Yohannes had a vision for Indonesia Jaya through mathematics and science education.

GASING is an abbreviation from *gampang*, *asyik*, and *menyenangkan* (for easy, fun, and pleasing). Faizi (2013) argues that the GASING method teaches how to think like physicists in solving science exercises through a logical approach that is based on the foundations of science. There are five steps in applying GASING instruction:

1. *Simple Dialog*. Dialog is a two way communication between teacher and learner. Edward Lee Thorndike in Santrock (2004) states that a behaviorist makes an important contribution to the application of classical conditioning to the learning process, especially with regard to the effect of the relationship between stimulus and response in the formation of behavior and consequences for the formation of the desired behavior. Furthermore, he added that the relationship between stimulus responses (R–S) will be stronger if the gain is positive reinforcement. Conversely, if the relationship reinforcement is negative then the relationship will be weakened. Thus the response will grow stronger if followed by things that are pleasant and would be weakened if followed by things that are not pleasant.
2. *Imagining and/or fantasy*. Imagination and fantasy in the learning process might be essential for students, but this aspect is usually largely ignored by the teacher, imagination is important because the student's imagination will create a concept that may be creativity, innovative and represent actual behavior in life. Albert Einstein said that imagination is more important than knowledge because knowledge is limited and encompasses the world's imagination. Imagination will be born if the environment supports it and when the learning conditions do not respect freedom of thought, the power of imagination is hard to develop. Thus imagination and fantasy are described as a function that allows students to be oriented in an imaginary realm. The impact of imagination and fantasy is shown when: (a) students are able to comprehend, understand. And appreciate the culture of other students, (b) students are able to think beyond space and time, so they can understand the things that exist and occur in another time, for example in studying the motion of an object, (c) students are able to escape from the hardships and problems in learning science, and (d) the students can resolve the imaginary real conflict, so it can reduce the psychological tension in learning science.
3. *Exercise that is relevant*. Exercises and training are effective teaching methods to inculcate habits, as found in nearly all instructional models and methods. Feedback on exercises is obviously an important aspect.
4. *In-depth materials*. Hopefully by giving the meaning of science, students understand the phenomena experienced by each object in each item of the exercise. Rather than simply present facts to memorize, engage students with curiosity to explore challenging aspects of the subject.
5. *Variations that matter*. Tasks or recitation is a way to present the lesson material in which the teacher gives specific tasks; variations are significant so as to ensure transfer of learning, deep understanding, and the development of responsible citizenship skills. The task assigned by teacher can deepen the materials and also can check the content of material that has been studied. Tasks can stimulate students to learn actively in individually or in groups.

Learning natural science has a close relationship to human life on earth. The natural sciences examine the process and the development of the cosmos and all that is contained in the universe. The deepened learning in the natural sciences is important because there are a lot of natural and manmade events that have not been well understood and which deserve further investigation. Deepening an understanding of natural science should be of benefit to all mankind.

Natural science has a close relationship with the process of developing knowledge. Learning natural science should be an opportunity to foster the learners' curiosity and ability to investigate things not well understood. Students are required to be active and creative in the process to seek and investigate matters independently. The GASING method is also supported by the learners' characteristics and aims to promote have higher levels of curiosity.

The process of learning science in elementary school should be to provide a series of real activities which can be understood reasonably by students and through their social interactions. Thus, in learning science, students should be involved in concrete activities that allow them to construct meaning. Trial activities through practice of a planned learning experience, in order for students to directly interact with and discuss observations will produce a learning experience. Practical activities cannot be separated from learning science. If science is taught by unpleasant methods and prioritizes rote learning then students are likely to get bored and result in low student achievement.

Besides the GASING method, which is a somewhat open inquiry and guided discovery approach, there is another method that can be and traditionally has been applied to learning science in elementary school. It is the direct learning method. The direct method generally proceeds in one direction (teacher to student). In the learning process, teachers tend to be active and students passively accept what is presented by the teachers who become the main sources of information. As it happens, direct instruction has rarely been a pure form of instruction as teachers instinctively realize the importance of student engagement.

In addition, an important factor that affects student achievement in school is intelligence. The experts have difference opinion about the definition of intelligence. Piaget in Hergenhahn and Olson (1997) states that "An intelligent act is one cause an approximation to the condition for an organism's survival. in other words, intelligence allows an organism to deal effectively with environment" Moreover, Slavin (2006) states intelligence is a general aptitude for learning or an ability to acquire and use knowledge or skill.

That definition explaining the intelligence as an act which led to the calculation of the conditions that are optimal for the organism can live in touch with the environment effectively. Intelligence always tends to create optimal conditions for the organism to survive in what condition. Slavin (2006) states intelligence is a general aptitude for learning or an ability to acquire and use knowledge or skill.

Moreover, Gardner (1999) states that in fact every human being has intelligence to a wider aspect. Gardner identified at least eight types of intelligence: (a) linguistics, (b) logical-mathematical, (c) visual-spatial, (d) bodily-kinesthetic, (e) musical, (f) interpersonal, (g) intrapersonal, and (h) naturalistic. The theory of intelligence proposed by Gardener can be characterized or simplified in terms such as: (a) decorator interior, (b) architect, (c) artist, or (d) inventor. This intelligence framework stresses sensitivity to color, line, form, space, and relationships that exist in a space or a design. These items include the ability to visualize, represent the ideas of visual or spatial graphics, and they orient themselves appropriately in a spatial matrix. This is worth mentioning as visualization can be used to support learning. Spatial Intelligence is all too often overlooked in science education.

Armstrong (2009) states that spatial intelligence is the ability to understand the world accurately visually and spatially (for instance as a hunter, scout, or guide) and make changes in performance or actions based on those perceptions (for example, a hunter must judge the distance of an animal being pursued and take into account wind and other factors in the environment). With regard to learning science, the following questions based on this approach should be investigated:

1. Is there a difference between the learning achievements of students who are studying science with the GASING instructional method and Direct learning method?
2. Is there an interaction effect between teaching methods and students' spatial intelligence with regard to students' science learning achievement?
3. Are there differences in science learning achievement for students who have a high spatial intelligence to learn with GASING instructional methods and Direct learning method?
4. Is there a difference in science learning achievement for students who have low spatial intelligence that studied with GASING instructional methods and Direct learning method?

The goals of this research are to: (1) determine how to systematically improve students' achievement in learning natural sciences; (2) help teachers improve the quality of learning natural sciences using appropriate instructional methods; (3) enable teachers to choose appropriate instructional methods in learning natural sciences in order to improve student achievement; (4) provide input for the policy makers in the Department of Education for improving the quality of education.

The significance of this research is both theoretical and practical. Theoretically, it is expected to develop instructional methods and spatial intelligence that can improve natural sciences achievement. Practically it can assist teachers in improving the quality of science teaching.

2 Research Methodology

This research was conducted in an Elementary School in East Jakarta in even Semester academic year 2013/2014. The research method was a comparative quantitative approach with a 2 × 2 design. The dependent variable measured was learning achievement. The independent variables were the instructional method (GASING or Direct), and the learning method and learner attributes (visual-spatial vs. non-visual-spatial students).

The population in this research were all students in the fifth grade, academic year 2013/2014, consisting of two groups each with 20 students. The treatment and sampling was done by a Multistage Random Sampling. The variable treatment in this research was the instructional method. GASING instructional methods were used in the experimental group and the direct learning method was used in the control group. Data was used to test spatial intelligence in the form of a standard test developed by a Jakarta State University Psychology Specialist whereas science achievement was based on multiple-choice tests. Hypothesis testing was done using analysis of variance (ANOVA) and two paths of the Tukey test.

3 Results and Discussion

This research used a design of treatment by level 2 × 2, and the data grouped into: (1) The result of natural science achievement that used the GASING instructional method (A_1); (2) The result of natural science achievement that used the Direct learning method (A_2); (3) The result of natural science achievement for group of students who have a high spatial intelligence (B_1); (4) The result of natural science achievement for students who have low spatial intelligence (B_2); (5) The result of natural science achievement for students who have a high spatial intelligence that used GASING instructional method (A_1 B_1); (6) The result of natural science achievement for students who have the low spatial intelligence that used GASING instructional method (A_1 B_2); (7) The results of Natural Science achievement for students who have high intelligence that used direct learning method (A_2 B_1) (8) The result of natural science achievement for students who have low intelligence that used direct learning method (A_2 B_2). Those data are summarized in Table 19.1.

Table 19.1 shows that the average score of students' achievement for group of students who have a high spatial intelligence that used GASING instructional method is 27.8, whereas the average score of students' achievement for group of students who have a high spatial intelligence that used direct learning method is 11.9. It is different with the average score of students' achievement for group of students who have low spatial intelligence that used GASING instructional method is 14.7, meanwhile the average score of students' achievement for group of students who have low spatial intelligence that used direct learning method is 16.6. From the data, it can be seen that the average score of the students' achievement who have a high spatial intelligence and who were taught with the GASING instructional method is greater.

Table 19.2 shows that $X^2_{\text{observe}} = 6.27 < X^2_{\text{table}\,=}$ 7.81 significance level α = 0.05. It can be concluded that the four groups of the data above came from a homogeneous population. Homogeneity testing shows that the scores of natural science achievement seen from either the instructional method that was used or spatial intelligence of students came from the homogeneous population. Therefore, the requirement of analysis of variance with two paths was fulfilled, namely the data followed a normal distribution and was homogeneous.

Table 19.1 Data summary

Students' spatial intelligence	Instructional method		
	GASING (A_1)	Direct (A_2)	Total
High (B_1)	$N_1 = 10$	$N_2 = 10$	$N_{b1} = 20$
	$\sum X_1 = 278$	$\sum X_2 = 119$	$\sum X_{b1} = 397$
	$\sum X_1^2 = 7774$	$\sum X_2^2 = 1473$	$\sum X_{b1}^2 = 9247$
	$\bar{X}1 = 27.8$	$\bar{X}2 = 11.9$	$\bar{X}b1 = 19.85$
	$(\sum X_1)^2 = 77 , 284$	$(\sum X_2)^2 = 14 , 161$	$(\sum X_{b1})^2 = 157 , 609$
Low (B_2)	$N_3 = 10$	$N_4 = 10$	$N_{b2} = 20$
	$\sum X_3 = 147$	$\sum X_4 = 185$	$\sum X_{b2} = 332$
	$\sum X_3^2 = 2253$	$\sum X_4^2 = 3625$	$\sum X_{b2}^2 = 5878$
	$\bar{X}3 = 14.7$	$\bar{X}4 = 18.5$	$\bar{X}b2 = 16.6$
	$(\sum X_3)^2 = 21 , 609$	$(\sum X_4)^2 = 34 , 225$	$(\sum X_{b2})^2 = 110 , 224$
Total	$N_k = 20$	$N_{k2} = 20$	$N_t = 40$
	$\sum X_{k1} = 425$	$\sum X_{k2} = 304$	$\sum X_{t2} = 769$
	$\sum X_{k1}^2 = 10 , 027$	$\sum X_{k2}^2 = 92 , 416$	$\sum X_t^2 = 15 , 125$
	$\bar{X}k1 = 21.25$	$\bar{X}k2 = 15.2$	$\bar{X}t2 = 18.225$
	$(\sum X_{k1})^2 = 180 , 625$	$(\sum X_{k2})^2 = 92 , 416$	$(\sum X_t)^2 = 591 , 361$

Table 19.2 Homogeneity test of variance population through Bartlett test

S^2 Gabungan	B	dk	X^2_{Observe}	X^2_{Table}	Conclusion
11.03	37.53	3	6.27	7.81	Homogen

Table 19.3 Analysis of variance of two paths

Sources of variance	df	JK	RK	F_o	F_{table}	
					0.05	0.01
Instructional method	1	1056	1026	9.57**	4.11	7.39
Spatial intelligence	1	366	366	33.18	4.11	7.39
Interaction (A × B)	1	9702	9702	13	4.11	7.39
In group	36	3971	3971	87.96		
			1103			
Total	39	18.389				

Research hypothesis testing was done with Two Paths (ANOVA Two Paths). Then the analysis was tested by a Tukey test. Because in this case the amount of data as much $n = 10$. The main effect was differentiated by instructional methods and spatial intelligence. The calculation result of ANOVA Two-Paths is presented in Table 19.3.

Table 19.3 confirms the analysis presented previously when discussing Table 19.1. Furthermore the Tukey test shows that the average score for students who have low spatial intelligence and were taught using the GASING instructional method is smaller than the average score for students who were taught by the Direct learning method. Figure 19.1 depicts this interaction effect.

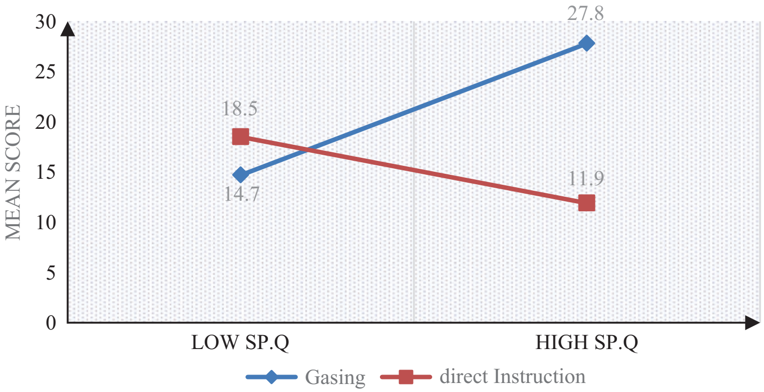

Fig. 19.1 Interaction between instructional method and spatial intelligence toward natural science achievement

Table 19.4 Result of the Tukey test

Group	n	Q_o	Q_t	Explanation
A_1-A_2	20	8.17	3.58	Significant
$A_1B_1-A_2B_1$	10	15.14	3.88**	Significant
$A_1B_2-A_2B_2$	10	3.61	3.88	Not significant

The result of this research show that there is an interaction between the instructional method and spatial intelligence toward natural science achievement. The next analysis is a Tukey test (see Table 19.4).

The results of Tukey Test in Table 19.4 show: (1) the average score for group of students who have a high spatial intelligence that was taught by GASING instructional method is higher than the average score for group of students who have a high spatial intelligence that was taught by Direct learning method, because $Q_o = 15.14 > Q_{\text{table}}$ (0.05, $n = 20$, df = 3) = 3.58. H_0 is rejected so the average score for group of students who have a high spatial intelligence that was taught by GASING instructional method is higher than the average score for group of students who have a high spatial intelligence that was taught by Direct learning method. (2) the average score for students who have low spatial intelligence that were taught by the GASING instructional method is same as the average score for students who have low spatial intelligence that were taught by the Direct learning method, because $Q_o = 3.61 > Q_{\text{table}}$ (0.05, $n = 20$, df = 3) = 3.58. H_0 is rejected so the average score for students who have low spatial intelligence that were taught by the GASING instructional method is lower than the average score for group of students who have a high spatial intelligence that was taught by Direct learning method.

The first hypotheses research rejected the null hypothesis (H_0) stated that the average score for group of students who was taught by GASING instructional method is same as the average score for group of students who was taught by Direct learning method, because $Q_o = 8.17 < Q_{table}$ ($\alpha = 0.05$, $n = 20$, df = 3) = 3.58. H_0 is accepted, so the average score for students who were taught by GASING instructional method is lower than the average score for students who were taught by Direct learning method. With the GASING instructional method, the students were confronted directly with tools and simple demonstrations. As students are more active in learning, they become more confident in working on real problems. The students taught using the GASING instructional method were able to develop their attitude to conduct an exploratory study of the material being studied. Giving the chance to the students in order to involve and make their own experiments, followed a standard scientific methodology (observing, experimenting, recording conditions and processes, etc.).

The Direct learning method is more monotone, passive, and boring for the students, all the material explanations comes from one direction (teacher). It is difficult for students who lack the ability to listen to and take note well, likely to result in verbal, much less provide opportunities for students to participate totally, the teacher's role more as a learning resource, the subject matter is tend to memorizing and learning processes in the teacher's authority. Although after giving the explanation, there was question and answer between teachers and students but it makes students feel bored.

Jacobsen, Eggen, and Kauchak (2009) states that Direct learning is an instructional design to teach the basic knowledge and basic skills that students need to learn. Direct learning is very effective when it was given to students who were less well prepared but who had high spatial intelligence. Based on the research that was conducted by Joyce, Weil, and Calhoun (2015), the Direct instructional approach becomes the main focus allowing a large percentage of students to reach some level of success.

Joyce, Weil, and Calhoun (2015), states that there are two main purposes of direct learning are (1) to maximize the students learning time and (2) to develop independence in achieving and realizing educational goals. Learning behavior which correlates with actual student achievement is also associated with the time-on-task and student success rate in performing tasks, which is closely linked to student achievement. Behavior that is closely related to the direct instruction was designed to create an educational environment that is academically oriented and well-structured and that requires students to be actively involved during the implementation of direct learning.

Barak and Robert in Woolfolk (2009) state that direct learning is also called active teaching because it can improve student learning achievement. Further research by Hariyani (2013) showed that the real media environments provide a relatively better effect than the media map concept; there is the effect of a learning model of direct instruction that uses concept maps and real media environment on biology achievement. As previously suggested, purely direct instruction rarely occurs and this is an example of a kind of hybrid Direct-GASING approach, likely to be effective with many students.

Spatial intelligence is one of the factors that must be taken into account in the selection of instructional methods. Spatial intelligence is the ability to create mental maps, and then to think rationally, and to use resources effectively when facing challenges. Spatial intelligence involves the ability to understand the environment and the nature of the situation, and then apply logical reasoning skills, and attitudes. Direct learning methods and GASING learning method are both methods that require the teacher's role in the learning process. High spatial intelligence students seem to be able to absorb and understand the materials and activities associated with the GASING method better than low spatial intelligence students. Similarly, low spatial intelligence students seem better able to cope with Direct instruction.

The GASING learning method is a method of student-centered learning that emphasizes active student engagement. The role of the student is to understand and solve a problem. Students with high spatial intelligence have the character that corresponds to gassing learning methods. Students with high spatial intelligence will have the ability to more quickly solve problems in conducting experiments performed.

The results of data analysis showed that results for students that learned with the GASING learning methods higher than the learning achievement of students that learned with the Direct learning method. This is possibly because the learning GASING method challenges students to think creatively and understand the significance of what they are learning. This is consistent with the general purpose of learning science, which requires students to have an understanding of science concepts (theory) and be able to do scientific work (practice). Merging theory and practice helps to develop creativity and curiosity as well as support problem solving.

The Direct learning method is a method of teacher-centered learning although there are interactions with students and many of those who practice the Direct method deviate from time to time. Typically, the teacher explains the material being studied and follows up with questions and answers. So it takes a students' ability to remember what was presented by the teacher. This study found that students with high spatial intelligence and who were taught using the GASING learning method had higher outcomes when compared with the method of Direct learning. This is possible because students with high spatial intelligence may have benefited in the past on account of that ability and, as a result, have developed the ability to observe carefully, think critically and respond in a positive manner to a challenge. On the other hand, with the Direct learning method, success in learning is largely determined by the quality of the teacher. Moreover, the Direct method can result in students with high spatial intelligence and strong background knowledge in becoming bored and disengaged.

With regard to the fourth hypothesis, the null hypothesis (H_0) was rejected; that is to say that the average of students with spatial intelligence that were taught used by the GASING instructional method would be equal to the average score of students with spatial intelligence taught using Direct learning method [$Q_h = 3.61 > Q_{\text{table}}$ ($\alpha = 0.05$, $n = 10$, db = 3) = 4.33]. With the rejection of H_0 then the alternative hypothesis (H_1) is accepted—students with low spatial intelligence that using the Direct learning method scored higher than that using the GASING learning method.

Students with low spatial intelligence have the characteristic lack of sensitivity in observing and lack the ability to think visually. The learning success of students who have low spatial intelligence depends on the help of others, especially teachers. The Direct learning method is a method of learning that is primarily centered on the teacher. Students who have low spatial intelligence have more chance of getting attention from the teacher to get an explanation.

The GASING learning method is not well suited for students who have low spatial intelligence. The GASING learning method is a method of teaching a student-centered and demanding activity for students with high spatial intelligence. Students who have low spatial intelligence will not get good learning outcomes when teaching through the GASING learning method.

These findings are consistent with other published results. Sarwana research results (2013) suggest that learning physics through the GASING method can improve student learning outcomes on dynamic power which is evident from the percentage of students who increased from 22.6 to 81.3%. Sukarmin's (2013) research results show that increasing mastery of the concepts of physics on learning. Research of Sitohang (2010) suggests that the learning outcomes of students who are taught using interactive multimedia higher than that using media images. In addition, the GASING approach is consistent with current emphasis on experiential learning, authentic problem solving, and inquiry approaches. However, the low number of students involved is a limitation of this study. One likely lesson to carry forward is that any particular instructional approach is not likely to be optimal for all students.

4 Conclusion

The conclusion of this study is evidence that the overall result of learning science teaching with the GASING method for students with high spatial intelligence is better than the results of students learning science by the Direct learning method. Secondly there is interaction between the learning methods with spatial intelligence for students' natural science learning outcomes. Thirdly, the GASING instructional method give results of higher learning for students who have high spatial intelligence, whereas the method of Direct learning may work better for students who have low spatial intelligence.

The implications of this research are as follows: Firstly, the GASING instructional method can be an alternative innovative method in teaching science learning for elementary students. Secondly, the selection of appropriate learning methods positively correlates with prior learning outcomes. Thirdly, students with high spatial intelligence are appropriate subjects for the GASING instructional method. Fourthly, the Direct teaching method for students who have low spatial intelligence may still be a preferred approach.

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Chapter 20
Analysis of Collaborative Learning in Filmed Role Play on Social Media: A Case of Hospitality Students

Gemala Garibaldi

Abstract Role play has been widely used as an instructional technique in promoting collaborative learning. The use of smartphones to record role playing and upload videos on social media is also deemed as an important element that determines the occurrence of collaborative learning. The collaborative learning process in filmed role plays on social media is analyzed through a simple framework which was built on earlier work on the subject; consisting of positive interdependence, promoting interaction, individual accountability, interpersonal and small group skills, and group processing. The research was conducted specifically on hospitality students for practical skills are in high demand in the industry. Filmed role plays and collaborative learning are considered as a fitting media to support the mastery of skills. Fourteen students were asked to create role play videos on hotel check in and check out situations and upload them on YouTube. Qualitative data were obtained from a focus group interview and YouTube comments. The results showed that filmed role plays on social media foster collaborative learning, with reports of relatively high positive interdependence and promotive interaction. The use of social media on filmed role playing was also reported as fun and enjoyable, which appeals more to students' interests in demonstrating collaborative learning.

1 Introduction

Nowadays, student's involvement and participation in collaborative learning is considered essential in ensuring the success rate of a learning process. Educators emphasize how collaborative learning plays an important role in supporting student-centered learning environments, a system that is more fitting in encouraging students to be more active instead of just being a passive recipient of information.

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K.A. Persichitte et al. (eds.), *Educational Technology to Improve Quality and Access on a Global Scale*, Educational Communications and Technology: Issues and Innovations, https://doi.org/10.1007/978-3-319-66227-5_20

In other words, students are responsible for one another's learning as well as their own and that reaching the goal implies that students have helped each other to understand and learn (Dooly, 2008). In collaborative learning, students inevitably encounter differences, and must grapple with recognizing and working with it, building the capacities for tolerating or resolving differences, for building agreement that honors all the voices in a group, and for caring how others are doing (Smith & MacGregor, 1992). Collaborative learning analysis is assessed through five elements (Johnson, 1994 in Klopfer, Perry, Squire, & Jan, 2005), which comprise: positive interdependence, promotive interaction, individual accountability, interpersonal and small group skills, and group processing (Johnson, 1994 in Klopfer et al., 2005). This study investigated how these five elements are demonstrated during the filmed role play sessions by hospitality students.

Filmed role playing itself has been widely used in hospitality schools where practical skills are deemed of the utmost importance. Recording the role play using smartphones is considered more effective as students are able to watch and reflect on their own performances, yet it also enables students to engage in collaborative learning. One of the subjects that hospitality students need to master in the classroom is "Hotel English", where they learn and practice their communication skills in English within the context of delivering hotel service situations. This might occur as a challenge in Indonesia as the country has not met the requirement of providing enough competent employees in hospitality and tourism (Pacific Asia Travel Association, 2010) as well as their lack of ability to communicate in English which has become a main issue among hospitality employees (Bali Post, 2008). Therefore, the role playing technique could use additional supporting tools to enhance its effectiveness. In this research, recording videos using smartphone were integrated with role playing in order to promote collaborative learning among students. The use of smartphones is also perceived as more attractive and enjoyable compared to conventional techniques (Jewell, 2006 in Soon Bee Ling, 2009).

With social media taking the world by storm, it is apparent that the education sector also benefits from this global phenomenon. However, higher education institutions are still primarily relying on traditional learning management systems (LMS) that do not fully capitalize on the potential of social media for enabling participation in global learning networks, collaboration, and social networking (Dabbagh & Kitsantas, 2012). Furthermore, questions arise about the impact of social media on academic performance and the possibility of using it as an effective pedagogical tool to improve the academic performance of students (Al-Rahmi, Othman, & Yusuf, 2015). Social media is believed to bring a whole new perspective of learning, especially in higher education. In higher education, students are considered as mature enough to utilize smartphones as a supporting learning tool. Using social media seems to be associated with greater amounts of inspiration, affective learning, along with a better class atmosphere (Al-Rahmi & Othman, 2013, p. 1542). Thus, filmed role plays on social media generates more feedback, student participation, and fosters collaborative learning in a more productive manner as students will be more engaged in a less formal learning environment.

The focus of this chapter is to investigate the demonstration of collaborative learning in filmed role playing using social media. A number of 14 students were asked to record a video off campus. They worked in a team of two, where they took turns performing the role of front desk agent and guest with a provided script from the instructor on handling check in and check out situations in English. The video duration was around 5–8 min each. The videos were then uploaded to YouTube, using an account that the instructor has created earlier. After completion of the first video, students were required to comment on all videos and record another one using the same script. The second video should be the improved version based on given comments and feedback from YouTube. Aside from YouTube comments, the main data collection was also acquired from a focus group interview.

2 Literature Review

2.1 Defining Filmed Role Playing on Social Media for Hospitality Students

Role plays have been applied in various academic activities, mainly in subjects which require the mastery of skills. In hospitality education, role plays are used to teach skills associated with customer service and staff management and are used frequently (Armstrong, 2003). Role playing can also be incorporated into a four-step training method as the application step in which trainees act out what they have learned especially in such areas as restaurant service, front desk service, beverage service, and safety and emergency response (Forrest, 1990).

This technique has also been used to teach communication skills (Mcmanus, Vincent, Thom, & Kidd, 1993) as well as promoting active learning and engaging students with real-world situations (Joyner & Young, 2006). Filming the process using smartphones or tablets will not only enable students to see, hear, review, and reflect on their learning (Bennett & Dodge, 2014) but it also attracts more of a student's interest as smartphones and tablets have become a vital part in their daily life activities.

Social media is viewed as growing and being adopted as communication relevant to academic purposes (Al-Rahmi & Othman, 2013, p. 1541). It is a technology that facilitates social interaction, makes possible collaboration, and enables deliberation across stakeholders, which includes blogs, wikis, media (audio, photo, video, text) sharing tools, networking platforms, and virtual worlds (Bryer & Zavattaro, 2011 in Chen & Bryer, 2012). In comparison to normal websites, social media has specific applications that provide various ways to collaborate (Al-Rahmi et al., 2015). They comprise different tools elaborated by Kaplan and Haenlein (2010), which include collaborative projects (Wikipedia), blogs, content communities (YouTube), and social networking sites (Facebook). Social media does not merely allow knowledge transfer but it also facilitates students' collaborative learning to creating understanding among students, discussions with peers, lecturers, increased knowledge sharing, and improved research students skills (Redecker, Ala-Mutka, Bacigalupo, & Punie, 2009). Moreover, students who enjoy their experiences become highly engaged with the social media, which is often viewed positively by students, researchers, and technology providers. Turel and Serenko (2012) suggested that enjoyment can lead to presumably positive outcomes, such as high engagement. Based on the definitions, filmed role plays on social media might have the potential benefits to create learner-centered education systems needing to be further exploited and well understood by learners (Li, El Helou, & Gillet, 2012).

2.2 The Definition and Elements of Collaborative Learning

"Collaborative learning" is an umbrella term for a variety of educational approaches involving joint intellectual effort by students, or students and teachers together (Smith & MacGregor, 1992). Collaborative learning is not to be mixed up with cooperative learning as the two terminologies seem to overlap in definition. Collaborative learning requires working together toward a common goal; it is more than cooperation which entails the whole process of learning (Dooly, 2008). It is not just a classroom technique, but it suggests a way of dealing with people with respect and highlights an individual's group member's abilities and contributions (Panitz, 1999). This may include students teaching one another, students teaching the teacher, and of course the teacher teaching the students, too (Dooly, 2008). It is aimed at getting the students to take almost full responsibility for working together, building knowledge together, changing and evolving together and of course, improving together (Dooly, 2008). Teachers who use collaborative learning approaches tend to think of themselves less as expert transmitters of knowledge to students, and more as expert designers of intellectual experiences for students as coaches or midwives of a more emergent learning process (Smith & MacGregor, 1992).

Johnson and Johnson (1999, 2009) pointed out that pedagogies for collaborative learning should take care of five conditions that should be satisfied because otherwise "collaborative learning" will not be effective in achieving the learning goals (Kirschner, Kreijns, Phielix, & Fransen, 2015). When these five conditions are realized, group members are interdependent during collaboration and, therefore, have to plan task-related activities, discuss collaboration strategies, monitor collaboration process, and evaluate and reflect on how they collaborated (Kirschner et al., 2015). In this chapter, collaborative learning on filmed role playing through social media is examined based on a combination of the earlier work by Klopfer, Perry, Squire, and Jan (Klopfer et al., 2005) and Johnson's model of collaborative learning. The difference between Klopfer's and Johnson's design lies in interpersonal skills, which is similar to the appropriate use of collaborative skills. According to Johnson and Johnson (Felder & Brent, 2007) Table 20.1, the following five conditions are:

- *Positive interdependence*: Team members are obliged to rely on one another to achieve the goal. If any team member fails to do their part, everyone suffers consequences.
- *Individual accountability*: All students in a group are held accountable for doing their share of the work and for mastery of all of the material to be learned.
- *Face-to-face promotive interaction:* Although some of the group work may be parceled out and done individually, some must be done interactively, with group members providing one another with feedback, challenging reasoning and conclusions, and perhaps most importantly, teaching and encouraging one another.
- *Appropriate use of collaborative skills*: Students are encouraged and helped to develop and practice trust-building, leadership, decision-making, communication, and conflict management skills.
- *Group processing:* Team members set group goals, periodically assess what they are doing well as a team, and identify changes they will make to function more effectively in the future.

Table 20.1 Five elements of collaborative learning in filmed role plays on social media

Collaborative learning elements	Explanation
1. Positive interdependence	Student won't be able to complete his/ her role if the other group member doesn't play his/ her part accordingly
2. Promotive interaction	Each student gives encouragement during practice toward the other group members; other students give encouragement and evaluation through watching the videos before posting feedback and comments on YouTube
3. Individual accountability	Each student is responsible for his/ her own performance as front desk agent/ guest, the final result is assessed based on compilation of comments and feedbacks
4. Appropriate use of collaborative skills	Students need to communicate using verbal and nonverbal language in giving encouragement and feedback (oral communication, listening, empathy, tones), decision-making, and conflict management skills
5. Group processing	Group members watch and discuss their performance during practice, watch the completed video, monitor and discuss the end result before uploading it on YouTube, collaborating on the comments and feedback to improve both performances for the next video

3 Method

3.1 Data Collection

Qualitative methodology was used in the study to gain a more in-depth explanation and detailed description of the collaborative learning experience. The debriefing process as part of the role playing process was conducted in a focus group interview to identify feelings, opinions, and experiences during the making of filmed role plays and assessing others' videos on YouTube. Focus group interviewing is a form of collecting data from a group of people through an interview process (Creswell, 2008). The focus group interview was held after the completion of two videos where students shared their experience of collaborative learning during filmed role plays.

3.2 Participants

Initially, there were 22 students who volunteered for the study. Purposive sampling was conducted from a population of final year hospitality students who had passed the subject "Basic English," as a prerequisite to "Hotel English" subject. However, due to other class activities and conflicting schedules, eight of the students decided to withdraw from the study. This meant 14 participants were left. Participants were hospitality students in their final year, comprising seven males and seven females within the age range of 21–23.

3.3 Data Analysis

The focus group interview was filmed and audio recorded as well to be later transcribed for analysis. The questions were directed toward the five elements of collaborative learning, where the transcripts of students' answers were classified into the five elements. The transcript was then examined to seek common ideas and thoughts which reflected the five elements within collaborative learning. The YouTube comments were also compiled to check for additional information that could be included into the demonstration of collaborative learning.

4 Results and Discussion

The focus group interview revealed that students experienced a process of collaborative learning within different contexts. Twelve of fourteen students reported that filming the role play process and watching it on social media was seen as a learning activity that is "fresh, fun, and enjoyable" (Garibaldi, 2016). As for YouTube comments, they were assessed within two pillars of collaborative learning which were promotive interaction and interpersonal skills. There were a total of 103 comments posted for video 1 including the instructor's comments, and 135 comments for the second video. In general, the comments for video 1 mostly fell along the simple praises and common forms of encouragement words such as *"Good job!"* or "*Nice work"* with little evidence of constructive criticism. (Garibaldi, 2016). In a more detailed description, the overall findings from the interview and YouTube comments were explained individually based on the five pillars of collaborative learning.

4.1 Positive Interdependence

There were several mixed responses in regards to whether students were dependent on their partner's performance in order to complete the video. From the first video, two of the students stated that there were no specific preparations before filming the video. ADP mentions that, *"We went straight to making the video because each of us has the basics already. Just follow the script and it's done"*. A similar statement was said by SH, *"Just do it, no need to think too much. It doesn't matter who plays as front desk or guest first, just do your part and say your lines."* Interestingly, both of their videos received extreme differences in terms of comments. In general, ADP's video received positive feedbacks while SH's videos drew more negative feedbacks which were given in a more joking if not mocking manner. Examples of the comments are, *"Hahahaha…what kind of guest/front desk is that?"* or *"If I were greeted (by a front desk agent) like that I would complain to the manager and stay in another hotel."* It seems that their lack of preparation occurred due to different reasons. The first one (ADP) appeared confident and fluent in the video with only minor mistakes in the performance, while the other one (SH) appeared as not taking the role play in a serious manner. As demonstrated in the video, this of course affected the other group members to also not take the front desk agent seriously. Interestingly, this was one example of a classic case that often occurs during role playing. There was an indication that the objective for creating the video was misperceived by some students. Instead of focusing on result (Forrest, 1990), the completion of the video stopped at simply completing the video. According to Forrest (1990), role playing should not be confused with a play or skit that is performed primarily for entertainment. This is also a note for the instructor to be more strict and clear when the students are given the first briefing on the role playing procedures, since it is done off-class with no direct supervision.

Garibaldi (2016) found that how their role play partner responded to the dialogue would also affect how the other reacted, which then determined whether the objective of the role play is completed or not. This was mostly the case with students who experienced frustration upon preparation for the role play process. Twelve students admit that they had to go through a number of takes before recording the full video. While SH admits that each person should just focus on their own parts, YD interjects by saying, *"But it goes both ways. If SH and AKP (SH's other team member) only focuses on their parts individually, I feel that how I play the role will also affect my partner. If I can't keep a straight face for example, or forget my lines, or didn't speak coherently, that means I'm dragging my partner down with me as well. Can you imagine doing that in real life?"* YD's response was confirmed by Klopfer et al. (2005) which pointed out that collaborative learning develops positive interdependence where group members will perceive that they are linked with each other so that one cannot succeed unless everyone succeeds. Johnson and Johnson (1984) also stated that group goals and tasks, therefore, must be designed and communicated to students in ways that make them believe they sink or swim together.

However, another interesting comment was made by DN which gained a lot of approval from the other students. DN said that despite that role play also affected the other member's performance, it depended on the amount of time they had left on completing the video. It appears that what started as positive interdependence might also lead to less interdependence or lack thereof. *"Given the limitation of time when we record the video, I think when we don't have enough time, we just want to finish the video, not really caring if the partner is performing well or not. I mean, in the real world…you just have to do it on the spot, right? Maybe it's because this is scripted, you tend to think too much. Sometimes the video result is different from what we have planned and rehearsed. I might be worse, or better. But that doesn't mean we can't do better in real work situations, right?"* The issue of time and location might be a result of their decision to use a classroom on campus, which they were only authorized to use in a limited time schedule. As for some students who decided to record off campus, they reported that they have more freedom and more time to rehearse before finally filming the video. Should any mistakes were made in the video, they had more time to redo the video and perfect the flaws, where students who recorded on campus did not have the opportunity to do so. Therefore, with the right time management and selection of location, the act of positive interdependence can be well maintained.

4.2 Promotive Interaction

The act of promotive interaction gained a majority approval from the students. No matter how minor the encouragement was, students admitted that each of them gave encouragement and feedback during rehearsal and through posting comments on YouTube. Ten students who recorded the first video on campus received encouragement and feedback from their team member and other students who were watching the filming process while waiting for their turn to use the classroom for filming. Students who recorded off campus only received feedback from their team member. As for video two, students not only received additional encouragement from the team member and other team members (before and after the video) but also feedback on the YouTube comments section which they had compiled from video 1. Four students also reported that during the preparation the more English advanced students played the role of the front desk agent first. MMW says that despite that all students had to play both parts as front desk agent and guest, the central character here was playing the role of the front desk agent as they cannot control the types and characters of guests who are staying in the hotel. AP is among one of the students to perform the role of the front desk agent first because his team member MCL, asked him to do so. *"Even though we have rehearsed a little bit, I asked AP to go first so I can learn more from his skills before I perform my role as front desk agent in the video. I know he's better than me at this."* Johnson et al. in Klopfer et al. (2005) defined this in the research as augmented role playing where promotive interaction covers the act of students promoting each other's success by helping, assisting, supporting, encouraging, and praising each other's effort to learn. This was also proven by Garibaldi (2016) in her previous research that the more advanced student might assist the less advanced student in improving their skills while the less advanced observes and take notes from the more advanced.

The comments on YouTube provided an insight on how each student had the opportunity to watch all the other team's videos and give feedback. As stated earlier in this chapter, most comments on the first video merely fell along the lines of simple form of praises without further constructive criticism. According to Dabbagh and Kitsantas (Dabbagh & Kitsantas, 2012), peer feedback promotes technological based learning environments and social media in informal learning. However, based on the interview, students were found to be more enthusiastic in reading what the instructor had to say on YouTube (Garibaldi, 2016) compared to their friends feedback. SH says, "*I am more interested in your (the instructor) comments compared to my friends because you are the expert on the subject. Besides, I think some of us were only watching the video for fun despite that you told us to give feedbacks.*" DA adds, *"It's not that peer feedbacks are not important. Maybe it's because we are not used to doing this type of learning…yet. Especially that I am not really interested in social media."* DN also added that she would like the instructor to be more involved and be less formal as the filmed role plays are conducted in an informal learning environment.

On the first video, the instructor did not post comments until it was near the deadline of comment posting. On the second video, the instructor started giving feedback once the videos were uploaded. Students had then become more interactive and posted more specific and constructive feedback on the performance. Instead of just simple praises, comments such as *"You need to work on your eye contact when talking to the guest*" and *"You need to be more direct with your words, dude!"* had shown much progress and interest compared to the first video. This might have occurred as from video 1 students were still trying to grasp and adapt to the new learning environment, figuring out how and what is appropriate and acceptable. Such affinity or even frequent use should not be assumed to mean that young people know how to use social media in educational contexts, or for learning purposes (Henderson, Snyder, & Beale, 2013). Another reason would be the level of involvement of the instructor which was identified by some students. It seems that students tended to perceive the teacher's credibility as higher if they disclosed themselves on social media (Mazer et al. 2009 in Dabbagh & Kitsantas, 2012). It also appeared that being the first one to comment on the video indicated a symbol of openness, which lowered the teacher-student barrier where a teacher acts as an authoritative figure (Garibaldi, 2016). Hence, instructors should not ignore the fact that providing room for collaborative learning on social media also calls for the instructor to be actively involved in the process through guidance and feedback.

4.3 Individual Accountability

Despite that each student had to play both roles as guest and front desk agent, students were aware that the final result came down to whether students were able to demonstrate the role of a front desk agent. Individual accountability was the belief by each individual that she/he would be accountable for her/ his performance and learning (Johnson & Johnson, 1984). In other words, although the two videos were done as a team, the final grade was assessed individually instead of as a group assessment. Students were assessed on his/her communication skills in English as a front desk agent. The final product was the video which could not be completed without positive interdependence, ADP says. "*That's why I didn't really prepare and rehearse with my team member. Not trying to be overconfident, but I know I can perform well as front desk agent but still need to collaborate well with our partner in order to get the work (video) done. They are two different things, but no video no good front desk agent"*. This explains how positive interdependence and individual accountability is interdependent. This student was unable to demonstrate individual accountability without previously performing positive interdependence. Hence, if one of the team members did not collaborate in the process of video making, none of them would be able to take account of their role as a front desk agent. In particular, positive interdependence and individual accountability were key conditions (Kirschner et al., 2015).

4.4 Appropriate Use of Collaborative Skills

In giving encouragements and feedback, particularly, students needed to have the appropriate collaborative skills (Felder & Brent, 2007). In this area, all students agreed that since it was done among peers and social media, all suggestions and improvements could be given in a more casual and relaxed manner. AFV states, *"Because these are our classmates, you just say what you have to say. No filter needed."* Despite that feedback was given verbally during the practice session, students also needed to be aware that it was also accompanied by nonverbal language and listening skills as well. It appeared that extra attention needed to be given to students who were less advanced in the subject. For instance, SS felt that among the other students, she considered herself as shy and rather weak in communicating in English. *"I have my team member (DN) assisting me a lot, she had been very patient* *because I made a lot of mistakes that we had to do several takes before we completed the videos,"* One student also commented that it took a lot of patience when dealing with a partner that he felt was less advanced than him. "*There was this one time when AA (his team member) told me to take it easy when I kept telling him to say the correct expression. What started as casual comments has become a little bit harsh, based on my intonation."* It can be implied that the pressure was felt among team members who did not have the same level of knowledge and skills on the subject. Loui (2008) identified that role playing simulations facilitate student understanding and appreciation of perspectives, values, and feelings of others as well as helping them develop skills such as empathy. The ability to empathize is also needed when giving encouragement as to avoid conflicts among team members. DA jumped in by saying that listening skills are important, especially in the beginning of the filming process. *"Both of us have different ideas on how to decorate the front desk and what kind of attire the guest is wearing. There were some disagreements concerning details but nothing major."* Others agreed that since it was a form of peer assessment and social media, they felt there was no need to communicate formally. Empathy and listening skills were two collaborative skills that they felt the need to work upon during the rehearsal. No comments were made regarding serious conflict, nor were major decision-making skills.

4.5 Group Processing

This element took place during rehearsal, before and after the completion of the video. Group processing, as described by Johnson and Johnson, requires reflecting on and regulating one's own actions with respect to the needs and goals of the others in the group and the group as a whole (Kirschner et al., 2015). Each team watched the video and decided whether it was good enough to upload on YouTube, or decide on whether they should create another video where both performed well in English. An interesting finding for filmed role play here, group processing appeared to have the least contribution to collaborative learning. Team members set group goals, periodically assessed what they are doing well as a team, and identified changes they would make to function more effectively in the future (Felder & Brent, 2007). Not a lot of comments were made for this element. Most students agreed that all the group feedback was mostly directed to the poor quality of the video due to the background noises. As for other feedback, it related more to the individual accountability due to the fact that students were focusing more on their individual performance as the front desk agent. None of them created more than one video. *"Because we already rehearse, and we mostly discuss on the mistakes during 'cut' and retakes. We just have to go with the end product and hope it's good enough"* says DA. This process did not really taken place until they made the second video. Representing majority of the participants, AA said, "*Yes, but it hasn't really sunk in until it's time to make video 2. Because we have enough feedbacks from YouTube now we have a reason to discuss and make a better video. Both the quality of the video and our*

English skills as well. For instance, I ask my team member…what do you need? Or the other way around…do you think my smile is too creepy?" However, all agreed it was not significantly performed during the discussion. This might be caused by the fact that students were still a bit hesitant in giving criticism on the first video, or the task that had become rather simple. Despite the improvement students had made on the second video, the opportunity for a more thorough group processing was unavailable as they were only asked to create two videos. Of note is that constructive comments and feedback were not present until it was time to comment on video 2.

5 Conclusions

Based on the result of the focus group interview and YouTube comments, filmed role playing does foster collaborative learning among hospitality students. Among the identified five elements, positive interdependence and promotive interaction stood out as two elements that contributed the most to the learning process. Most students also acknowledged that they enjoyed the activity, as it facilitated the opportunity to help, assist, and support each other's performance in completing the task (Klopfer et al., 2005). Two students reported that the technique was found to be ineffective. One student preferred not to use social media even during leisure time. Another student reported that despite getting a lot of support from the other team members, filmed role playing was considered ineffective as she does not like being placed in the spotlight with the other students watching.

Students experienced positive interdependence during practice and filming. In order to complete the video, they needed to collaborate well by ensuring that the other team member was also well prepared. Role interdependence existed when specific roles were assigned to team members and needed to be performed in order for the team to function (Johnson & Johnson, 1984). Another important note for the instructor is to ensure that students do not see role playing as a skit. Time and location should also come into consideration to ensure that students maintain positive interdependence between team members. Poor time management and lack of practice might also lead to students' adequate, if not poor performance in the video. Positive interdependence automatically relates to individual accountability. When students became more interdependent for the completion of the video, student related individual accountability to their ability in communicating properly in English as a front desk agent. This was proven by their reports claiming that they placed more focus on rehearsing as the front desk agent compared to being the hotel guest.

The use of social media on filmed role playing is also proven to be helpful and create more engagement among participants although it does not guarantee to immediately attract a student's interest. Instructors should "break the ice" by being actively involved from the beginning, such as posting comments and feedbacks on YouTube instead of merely observing. Instructors play a central part in this element where they should not be carried away with the aim of collaborative learning which is to shift the responsibility of learning to students (Garibaldi, 2016). There was also a trend during the second element where the more advanced students took the first turn in playing the part of the front desk agent. Therefore, the less advanced could learned and also improved on their English skills based on observation.

Collaborative skills and group processing did not go through much exploration unless the need to develop more empathy and listening skills particularly when paired with team member from different levels of English communication skills. Discussion and planning occurred among students in group processing, yet it was not considered a gruelling process. There should be video number 3 as students were unable to go into heavy discussion for improvement since it was lacking feedback from video 1.

6 Limitations

Since all the videos were recorded with no direct supervision and observation during the rehearsal and the filming process, the instructor was unable to check the accuracy of all information and students' reports. The conflicting schedules also reduced the number of the sample which made it more difficult to generalize the findings. The initial plan to create three videos also had to be called off due to campus activities and a study week before the mid exam.

7 Recommendations

A quantitative approach might be included to gain more in-depth information and analysis to support the findings of the interview. The study could also use a larger number of samples to generalize the key findings in the research. The instructor should also be more clear and strict with the rules and regulations of filming the role playing process, as well as reemphasizing the objective of the study after the completion of video 1. Another important aspect which also comes as feedback from the students related to the script, where students would like to have the opportunity to develop their own script for the role playing. This activity has a potential for students to become more collaborative as they have to produce not just a video yet also come up with a role play scenario.

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Chapter 21
Use of the Concept Mapping Strategy to Improve Academic Writing

Benny Agus Pribadi

Abstract Academic writing is considered a difficult activity for the majority of academics in Indonesia. Only a few Indonesian lecturers and researchers are able to publish their research papers in reputable international journals. Compared to other Southeast Asian countries such as Malaysia, Singapore, and Thailand, Indonesia ranks last in terms of the number of papers published in reputable international journals. Indonesia has to solve this problem by conducting effective courses in academic writing. One of the approaches that may be used to create an effective writing course is a concept mapping learning strategy. The purpose of this study was to explore the effectiveness of using a concept map learning activity in an academic writing course to increase faculty writing ability. Participants in the course were open and distance learning graduate students enrolled in an academic writing tutorial program. The results of this research indicate that the concept map learning strategy applied to learning activities of academic writing helped the students find and construct the main topical ideas of their academic article. In addition, students showed increased motivation from using the concept map strategy in writing their academic paper projects

1 Introduction

In general, academic writing is still a big problem for teachers and academics in Indonesia. In order to deal with these academic problems, the Ministry of Education and Culture of the Republic of Indonesia has encouraged several teacher training institutions to conduct workshops to improve academic writing skills. Unfortunately, these workshops have not been effective in increasing the academic writing ability of the teachers.

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K.A. Persichitte et al. (eds.), *Educational Technology to Improve Quality and Access on a Global Scale*, Educational Communications and Technology: Issues and Innovations, https://doi.org/10.1007/978-3-319-66227-5_21

Most of the workshops on academic writing are not designed to provide students with hands-on experience in writing academic papers. After completing the workshops the students have a good knowledge of writing, but do not have the real skills required to write academic papers. Also, students who participate in the academic writing workshop have low motivation and self-efficacy to finish their academic writing assignments.

Universitas Terbuka (UT), the open and distance learning university of Indonesia, which implements an open and distance learning system, has conducted an inservice teacher education program to enhance teachers' professional qualifications. One of the courses offered by this program is *Academic Writing*.

The course is perceived as a difficult subject by most students. After completing the course, only a few students have gained the ability to write and to publish academic papers. In this situation, it is necessary for UT to explore and find an appropriate learning strategy that can be applied to facilitate students' learning in order to master academic writing. It is necessary for UT to find a learning strategy that can help students produce well-written academic articles.

One of the learning strategies that promise to help students achieve the ability to write academic papers is concept mapping. Concept mapping can be used as a learning strategy to equip the students with the skills to explore and synthesize the knowledge required to write an academic paper. The purpose of this article is to elaborate on the use of concept mapping as a strategy to support open and distance learning students to successfully write academic articles. Each chapter in this Edited Volume is intended to represent an up-to-date and extended version of your paper or presentation at ETWC 2016.

2 Research Questions

Two research questions were explored in this study:

1. What kind of writing problems do students face in completing academic writing assignments?
2. Does the concept mapping learning strategy help students improve their academic writing skills?

3 Research Purpose

The purpose of this article is to elaborate the use of concept mapping as a learning strategy to facilitate the open and distance learning students to produce well-written academic articles. The result of the study will be used as input to improve the *Academic Writing* course.

3.1 Universitas Terbuka (UT)

UT was established on September 4th, 1984. The aim of establishing UT as a higher education institution was: (1) to provide a wider opportunity for Indonesian citizens and foreign nationals to obtain a higher education; (2) to provide higher education for those who, because of work or for other reasons, cannot continue their education at face-to-face colleges; and (3) to develop academic and professional education programs in accordance with the real needs that have not been developed by other universities. Recently the total number of UT students **is** 299,317, 59% of which are teachers. The majority of UT students reside on the main islands of Sumatra, Java, Bali, Nusa Tenggara, Sulawesi, Kalimantan, Papua, and overseas (www.ut.ac.id).

The separation between teacher and learner is considered one of the main characteristics of the distance education system (Heinich et al., 2005; Moore & Kearsley, 1996; Simonson, Smaldino, & Zvacek, 2016). In the UT system, education institutions which either partly or fully employ distance education deliver learning content through various types of instructional media. Simonson et al. (2016) describe a typology of instructional media used in distance education: (1) correspondence postal system; (2) prerecorded media; (3) two-way audio; (4) two-way audio with graphics; (5) one-way live video; (6) two-way audio, one-way video; and (7) desktop two-way audio/video (p. 2).

The students have to implement self-directed learning to attain their required learning competencies. Knowles (1995) defined self-directed learning as:

> *"… a process by which individuals take the initiative, with our without the assistance of others, in diagnosing their learning needs, formulating learning goals, identify human and material resources for learning, choosing and implement appropriate learning strategies, and evaluating learning outcomes."* (p. 18).

In self-directed learning, the students have to take initiative to learn and to explore learning materials in order to achieve predetermined learning goals. In addition, the students have to *responsibly complete their learning activities.* Even though the use of media is dominant, UT provides tutorial sessions to support student learning as part of the distance system.

Several modes of tutorial programs—face-to-face and online modes—are provided to support the learning process. Face-to-face tutorials are compulsory for students. Online tutorial programs are offered to all UT students as a form of student support. One of the important courses offered in the Teacher Education Program is the *Academic Writing* course.

The aim of the *Academic Writing* course is to provide academic writing experience and skills for the participants who are enrolled in the Teacher Education Program. The instructional goal of the academic writing course is stated as follows: *"… After completing the academic writing course the student will be able to write an academic paper based on their interest and selected topic."*

In general, the students—primary school teachers enrolled in this Teacher Education Program—have no hands-on or real experience in writing academic papers. Most of the students view the academic writing course as difficult due to the rigorous learning activities they must complete (Al Badi, 2015).

The academic writing course requires students to habitually read relevant academic materials. They have to explore prior knowledge and decide upon a topic of interest in order to write a proper academic paper. Most of the students have high motivation to attain the predetermined *Academic Writing* course objectives.

3.2 Academic Writing

Ericsson, Krampe, and Tesch–Romer in Silvia (2007) noted that writing is a skill not an innate gift or a special talent. Like any advanced skill, writing must be developed through systematic instruction and practice. People must learn rules and strategies and then practice them. In order to be able to write an academic paper properly, it is necessary for the prospective writer to engage in intensive writing practice.

Academic writing is broadly defined as various forms of expository and argumentative prose used by university students, faculty, and researchers to convey a body of information about a particular subject (Nordquist, 2017). Academic writing is required for publications that are read by academics and researchers or presented at conferences.

Academic writing is also defined as writing activity done by scholars—students or academics—for other scholars to read. The product of academic writing can take many forms: journal articles, textbooks, dissertations, group project reports, etc. Academic writing is usually done by university students and researchers to convey a body of information about a particular subject. In general, academic writing is expected to be precise, semiformal, impersonal, and objective.

Academic writing has three main characteristics: (1) Academic writing is writing done by scholars for other scholars; (2) Academic writing is devoted to topics and questions that are of interest to the academic community; and (3) Academic writing should present the reader with an informed argument (http://www.depts.washington.edu/owrc).

Villalon and Calvo (2011) noted that writing develops not only communication skills, but also higher-level cognitive processes that facilitate deep learning. The general purpose of academic writing is to present information that demonstrates a clear understanding of a subject. The writer must demonstrate that he/she has a deep understanding of the specific academic topic (p. 16).

The most common purposes in academic writing are to persuade, analyze /synthesize, and inform (http://www.amarris.homestead.com). Writing academic papers is not an easy task as the writer has to find an appropriate topic. In order to be able to write a good journal article, the writers have to compile complex scientific ideas, methodological detail, and statistical analyses into a tight article (Silvia, 2007).

When writing the academic paper, students often face difficulty in selecting the right topic. This is due to their lack of experience in expressing ideas or knowledge in an academic manner. In this sense, Al Murshidi (2014) found that generating ideas about their topics could also be a barrier that hinders students to progress with their writing. Grami (in Al Badi, 2015) stated that: "… Writing could be a difficult

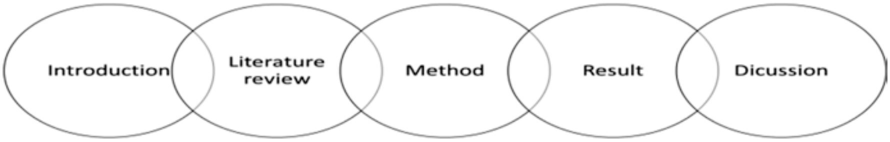

Fig. 21.1 Basic structure of an academic article

skill to be learnt or taught due to the fact that it is not a simple cognitive activity; rather it is believed to be a complex mental production which requires careful thought, discipline and concentration" (p. 66).

Academic writing is comprised of three stages: pre-writing (brainstorming and developing supporting ideas), writing, and post-writing (reviewing and revising). A good academic article requires time, research, preparation, and revision. The simplicity of these steps should not disguise their importance. Following them will ensure collegiate writing proficiency (Raley & Keaton, 2013). Zemach and Rumisek (2005) list six steps that should be implemented in writing an academic paper: (1) choose a topic; (2) gather ideas; (3) organize; (4) write; (5) review structure and content; and (6) revise structure and content. In addition, Johnson (2016) described a systematic process of academic writing that includes the following steps:

- Step 1: Research to gather data.
- Step 2: Pre-draft.
- Step 3: Write a first draft (sloppy copy).
- Step 4: Revise.
- Step 5: Edit.
- Step 6: Share or publish.

An academic paper or article basically consists of related parts: (1) introduction, (2) body of article, (3) conclusion, (4) references. Perneger and Hudelson (2004) noted that the basic structure of a typical research paper is the sequence of introduction, methods, results, and discussion (Fig. 21.1).

Difficulty starting an essay is often the first problems that students face in writing an academic paper due to lack of pre-writing activities and experience. To solve this problem, the prospective writer has to identify the purpose of the paper and then brainstorm ideas to achieve the goal. Brainstorming will work best if the writer does not immediately discount any generated ideas; instead they should write down as many ideas as possible. Brainstorming the ideas can be accomplished using concept map learning strategy.

4 Concept Mapping as a Learning Strategy

Novak and Gowin (1984) noted that the knowledge that we have about a subject area is a construction of the concepts of that knowledge area into a coherent hierarchical system. These concepts are linked together, forming propositions that are distinctive for each individual. This system can be symbolized by concept mapping. Concept mapping is one technique that allows a person to convey meaning to another in a visual format. Concept maps have been shown to foster a joint understanding between two individuals viewing the same map (Freeman, 2004; Hoover & Rabideau, 1995; Malone & Dekkers, 1984; Novak, 1977, 1998).

Concept maps are graphical tools for organizing and representing knowledge. They include concepts, usually enclosed in circles or boxes, and relationships between concepts that are indicated by a connecting line linking two concepts. Words on the line, referred to as linking words or linking phrases, specify the relationship between the two concepts. We define concept as a perceived regularity in events or objects, or records of events or objects, designated by a label (Novak & Canas, 2006). A concept map can be regarded as a type of graphic organizer that is distinguished by the use of labeled nodes denoting concepts and links denoting relationships among concepts. The links in a concept map may be labeled or unlabeled, directional or non-directional (Nesbit & Adesope 2006). The use of concept mapping will help learners in organizing and structuring their thoughts to further understand information and discover new relationships. Concept maps in general represent a hierarchical structure, with the overall, broad concept connected to subtopics and more specific concepts.

A concept map is a visual organizer that can enrich student understanding of a new concept. Using a graphic organizer, students think about the concept in several ways. Most concept map organizers engage students in answering questions such as, "What is it?" "What is it like?" "What are some examples?" Concept mapping deepens understanding and comprehension (http://www.readingrockets.org).

The use of concept mapping provides benefits to all students across many content areas (social studies, mathematics, Spanish as a second language, vocabulary, reading, and writing), multiple grade levels (first through senior high school), and different student populations (regular education students and students with learning disabilities) as verified in an experimental study conducted by Asan (2007).

The use of concept maps in the academic writing process offers several benefits for learners: (1) helping students brainstorm and generate new ideas; (2) encouraging students to discover new concepts and the propositions that connect them; (3) allowing students to more clearly communicate ideas, thoughts and information; (4) helping students integrate new concepts with older concepts; (5) enabling students to gain enhanced knowledge of any topic; and (6) evaluate the information.

Several studies have been done regarding the implementation of the concept mapping strategy in the academic writing process. Villalon and Calvo (2011) studied the use of a concept map as a visual organizer and cognitive organizer. Their study noted that a concept map can be used as part of learning activities, as a form of scaffolding, or to trigger reflection by making conceptual understanding visible at different stages of the learning process. In addition, the authors noted that the precision of using a concept map depends on the level of summarization (number of concepts) chosen.

Lee (2013) conducted a study aimed at examining the use of concept mapping technique in a course module for Korean language learning with US college students. The results of the study indicated that concept mapping enhanced the students' achievement in writing academic articles. Lee also found that peer collaborations for constructing concept maps did not support improvements in composition scores.

Kozminsky, Kozminsky, Nathan, and Horowitz (2012) conducted a study related to the implementation of the concept map strategy to teach academic writing. They found that concept mapping instruction and application during pre-writing activities contributed to the accessing and use of prior knowledge for written essays and improved the rhetorical structure in comparison to a control instruction group. However the use of concept maps in pre-writing did not relate to the quality of the writing product.

The use of concept mapping as a learning strategy not only provides benefit in academic writing, but also in other fields or subjects. Vanides, Tomita, and Ruiz-Primo (2005) conducted a study of the use of concept mapping strategy in science and found that concept mapping allowed students to think deeply about science by helping them to better understand and organize what they learned, and in helping them to store and retrieve information more efficiently. Students also improved in their ability to articulate concepts and challenge their thoughts about science when they discussed their maps with each other.

Wan Mohamed and Omar (2008) conducted a study on the use of concept mapping to facilitate writing assignments. The findings of their study indicate that concept mapping can be a tool to facilitate students in writing assignments. Students of all levels, whether primary school level, secondary school level, undergraduates level or postgraduate level may benefit from constructing a concept map prior to actually writing their assignments because it helps them generate ideas, enables them to identify relationships among ideas or other content, and visually organize what is going to be written (p. 4).

The benefits of using concept mapping for writing and learning purposes are listed by Weiderman and Kritzinger (2003) as follows:

- Users can distinguish between essentials and nice-to-know outcomes.
- Set ways of thinking are challenged.
- Concepts which are key to more than one discipline can be identified.
- Appropriate learning materials can be selected.
- Provide a basis for discussion.
- Support a holistic style of learning.

Kozminsky et al. (2012) researched the use of concept mapping in facilitating writing activities. The results showed that the advantages gained from concept mapping instruction during the planning phase were not translated into writing quality. The students were able to take advantage of prior knowledge in the introduction section of the essays.

Villalon and Calvo (2011) studied the use of concept maps as cognitive visualizations of writing assignments. The results of their study noted that the concept map as a tool for cognitive visualization supported writing activities by scaffolding the author's reflection during the process of writing and served to encourage them to revise their work.

In general, the use of concept maps provides positive contributions for students to generate topics and subtopics and to create an outline for writing academic papers. Students can elaborate their existing knowledge to generate topics and subtopics required in writing academic papers. Concept maps as visual organizers help students to: (1) organize new information; (2) make meaningful connections between the main idea and other information; and (3) compose the paper.

5 Research Method

This study used the research and development model of Gall, Gall, and Borg (2007) which adopts the systematic design of instruction model of Dick, Carey, and Carey (2005). Borg et al. define the research and development method as:

> … the use of research findings to design new products and procedures, followed by the application of research methods to field test, evaluate and refine the products and procedures until they meet specified criteria of effectiveness, quality, or similar standards.

This model was applied to design develop a tutorial program on academic writing for UT.

The systematic design of instruction model (Dick et al., 2005) consists of several steps: (1) identify instructional goal; (2) conduct instructional analysis; (3) analyze learners and context; (4) write performance objectives; (5) develop assessment instruments; (6) develop and select instructional materials; (7) develop instructional strategy; and (8) design and conduct formative evaluation of instruction.

The steps of the Systematic Design of Instruction model are shown in Fig. 21.2.

The first step of this study was collecting data regarding students' prior knowledge, skills, motivation and learning experience in writing an academic paper. The purpose of this phase was to gather input for defining the instructional goal. Based on the results of data analysis of the first phase, the instructional goal of the tutorial program was: *"After completing this academic tutorial program the students will be able to write an academic paper based on the selected topic and academic writing rules."* To achieve this instructional goal, it was necessary for the students to engage actively in the learning process.

The instructional analysis process was implemented to determine the subcompetencies that students need to write an academic paper. The instructional analysis procedures were applied to identify the relevant skills and subordinate skills and information required for a student to achieve the goal (Dick et al., 2016). This step was followed by developing writing performance objectives related to the stated instructional goal.

Developing the assessment instruments was the next step along with creating an academic writing rubric to measure learning. This phase was followed by developing and selecting instructional materials that would be used to facilitate students' ability to write an academic paper.

The concept map approach was used as the primary instructional strategy to support the face-to-face tutorial sessions. The class consisted of 30 students ($N = 30$) in

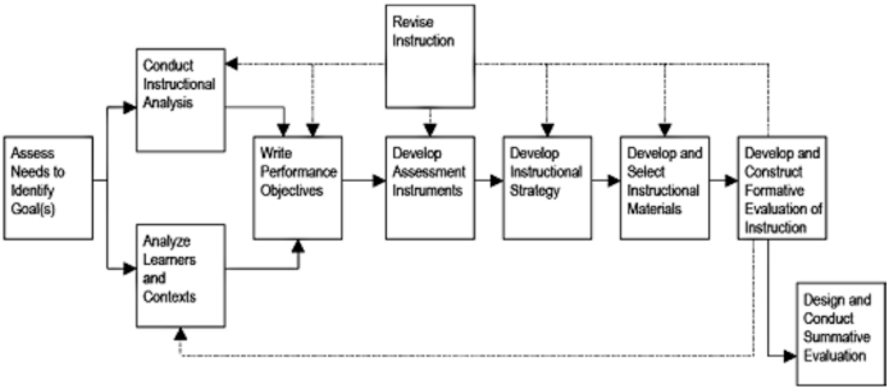

Fig. 21.2 The systematic design of instruction model. Source: Dick, W., Carey, L, & Carey, J. O. (2016). *The systematic design of instruction*. Columbus, Ohio: Pearson.

the academic writing face-to-face tutorial program. The tutorial program consisted of the following learning activities:

- Determining the idea or topic of the academic paper.
- Developing the outline of the academic paper.
- Reviewing and revising the outline of the academic paper.
- Writing the draft of the academic paper.
- Reviewing and revising the draft of the academic paper.
- Finalizing the academic paper.

During the tutorial session, students had to be taught how to use concept maps. In addition, the formative evaluation step consisted of one-to-one, small group, and field trial sessions in this study. During the study, students were observed, tested, and interviewed regarding the use of concept mapping in the academic writing tutorial program. This was done to gather valid information regarding student difficulties in learning academic writing.

The data were collected and analyzed to reveal the benefits and challenges of using the concept mapping learning strategy in writing an academic paper. In addition, pretest and posttest sessions of the field trial were conducted to measure the impact of using the concept map learning strategy to enhance students' knowledge of academic writing.

6 Results and Discussion

Collecting data regarding the students' prior knowledge, skills, motivation, and experience in writing an academic paper indicated that the majority of the students have a low level of knowledge in doing academic writing. In addition, they have no hands-on experience in writing academic papers. However, they have high motivation to be competent in writing academic articles. The students' motivation in learning academic writing skills is high because they recognize that writing skills will help them improve their future academic career as a teacher.

The stated instructional goal was analyzed through an instructional analysis process to determine the sub-competencies or skills that the students had to master in order to be able to write an academic paper based on a selected topic and rules of the academic writing process.

The results of the instructional analysis process resulted in the following learning objectives and topics: *(1) To explain the importance of academic writing for teachers and academics; (2) To generate the ideas or topic for an academic article by using concept mapping strategy; (3) To review the written ideas or topic for an academic article; (4) To compose the outline of the academic article; (5) To review the outline of the academic article; (6) To write a draft of the academic article; (7) To review the draft of the academic article; (8) To finalize the draft of the academic article; and (9) To explain the procedure of academic writing.*

The tutorial program of *Academic Writing* was designed and developed based on the analyses of the previous steps. The design and development phase of the tutorial program involved a content expert and instructional designer to provide input to ensure the effectiveness of the program.

The design and development phase of this study was followed by the formative evaluation phase. This formative type of evaluation consisted of the following sessions: one-to-one, small group, and field trial.

In one-to-one sessions, the observation results indicated that all respondents enjoyed the tutorial program. Implementing the concept mapping strategy in writing activities allowed the students to easily determine and elaborate the themes and topics for their academic paper project. In this sense, Senita (2008) noted that the development of concept maps allows students to see how ideas are connected.

In small group sessions, the respondents shared a positive response when working on their writing project. We found that the concept map learning strategy implemented in the program helped the respondents to generate proper topics of their academic writing paper. This is related to the findings of the concept mapping study done by Chang, Chen, and Sung (2002). Sung and Chen (in Villalon & Calvo, 2011) noted that all approaches to concept mapping improve text comprehension and summarization skills. An example of the students' writing projects is shown in Fig. 21.3.

In addition, the results of the small group sessions indicated that the students were able to develop a systematic outline of their paper. This outline was then used as a guideline to continue their academic writing project.

The concept map learning strategy was implemented in all phases of the academic writing process. The students were directed to determine topics and subtopics that would be used for writing an academic paper. In this activity, the students implemented the concept map strategy to determine the topic and to develop the outline of their academic paper. Observations indicated that the students felt enthusiastic and enjoyed the process of selecting the topic and composing the outline of

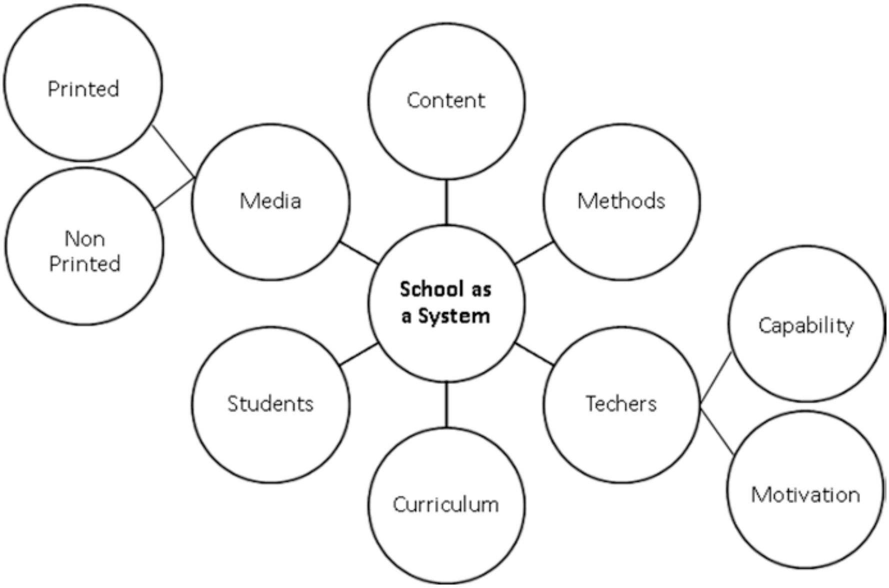

Fig. 21.3 Concept map of school as a system created by students

their academic paper. Additionally, the students were able to generate ideas and to elaborate their previous knowledge related to the selected topic.

At the end of the tutorial, the respondents were directed to write a draft of their academic paper based on their selected topic. A rubric for the academic writing paper was prepared to grade students' academic paper projects. SMART (specific, measurable, attainable, realistic, and time) criteria from the Elements of a Successful Research Paper were used to grade the quality of the students' academic paper. These criteria are described in the following table (Table 21.1).

Additionally, an interview guide was used to gather information regarding the students' responses to using the concept map learning strategy on their academic writing assignment.

The result of field trial sessions indicated that students were able to identify appropriate topics for their academic paper. The concept map learning strategy indeed helped the students generate ideas to be used to compose an outline of the paper. In this sense, the use of a concept map enabled students to explore and utilize their prior knowledge in creating a foundation for the topic of the academic writing paper.

At the end of the face-to-face tutorial program, the students were able to compose and write the draft of the academic article which was based on their previous article outline. The interviews conducted with the students indicated that all of the respondents enjoyed and were satisfied with the use of concept map strategy implemented in the academic writing face–to-face tutorial program. The majority of the respondents ($N = 30$) noted that: "...the use of concept map strategy assists the students in finding and composing, and elaborating the topics in the academic article."

Table 21.1 Elements of a successful academic paper

Criteria	Description
Specific	An academic paper should be specific. It should focus on the given subject of research—answering a specific research question—and it should be consistent with the written topics or subjects
Measureable	An academic paper must consist of specific, proven research, and research sources and relevant literature must be included
Attainable	An academic paper must provide a thesis statement, one that answers the research question and contributes to the knowledge of the given subject. It should answer the stated research question and should be based on an existing body of knowledge
Realistic	An academic paper must be objective and realistic. It should present interpretations, arguments, or evaluations. In addition, it should be based on valid evidence from reliable sources
Time	An academic paper must note the scope and limitations of the research paper

Source: http://www.gradesaver.com/writing-help/

7 Conclusions

The concept map strategy which is defined as a visual organizer helps in connecting students' present and previous knowledge. The concept map strategy allowed the students to generate relevant ideas and topics required in writing their academic paper. Generally speaking, the use of concept mapping in writing activities made it easier for UT students to select relevant topics and develop them in an outline for their academic article. The use of the concept mapping strategy did not assist the students in completing the academic paper writing project, because, ultimately, the process required deep understanding of the topic.

The implementation of concept maps as a learning strategy in writing the academic paper provided some benefits: (1) helping students to brainstorm and to generate new ideas in writing; (2) encouraging students to discover new and relevant concepts and the propositions that connect them; (3) allowing students to articulate ideas and information clearly; (4) helping students to integrate new concepts with prior concepts; and (5) enabling students to enhance their knowledge to elaborate the topic.

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Chapter 22
Challenges and Solutions of Web-based Learning on Mobile Devices

Tepati Hak Kewajiban, Mustaji, and Bachtiar S. Bachri

Abstract According to a 2014 Google report, more Google searches take place on mobile devices than on computers in ten countries including the USA and Japan (Dischler, 2015). This report raises awareness of the use of Web-based learning on mobile devices. Unlike the desktop, mobile devices vary in terms of screen size and primary use of the touch screen. These characteristics result in a different interaction and experience on a mobile device than non-mobile devices. Web-based learning also has had to adapt to these characteristics. This chapter discusses the challenges faced by Web-based learning on mobile devices along with solutions that may be used to overcome these challenges.

1 Introduction

According to Dischler (2015) on Google's official blog for news, tips and information on AdWords, more Google searches take place on mobile devices than on computers in ten countries including the USA and Japan. According to Mander (2015), PCs and laptops remain in pole position, with 91% of Internet users aged 16–64 saying that they personally own one. However, smartphones have now established themselves as mainstream devices too. An impressive 80% of online adults say that they have one, suggesting that soon they will reach parity with PCs and laptops. Tablets are also nearing an important landmark. Close to 50% of Internet users report owning one.

These reports indicate that in addition to the high rate of adoption of mobile devices, they have become a common device to access the Web. Web technology has long been used in learning. With the presence of smartphones that can access the full Web, learners are provided with opportunities, especially in the field of Web-based learning in integrating the Web into instructional strategies on mobile

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K.A. Persichitte et al. (eds.), *Educational Technology to Improve Quality and Access on a Global Scale*, Educational Communications and Technology: Issues and Innovations, https://doi.org/10.1007/978-3-319-66227-5_22

devices. This change of course accompanied by the challenges required the need to look for solutions both in terms of technology and learning.

2 Mobile Devices

According to Brandon (2010), previously when someone said "mobile learning" the main focus of concern was almost always mobile phones, at least if the discussion was among those who designed and developed content. On January 27, 2010, Apple launched the iPad, and the discussion has not been the same since. The focus of attention for mobile learning and performance support shifted substantially to include tablets. At about the same time, the Android operating system took off, adding another set of delivery channels, with some interesting similarities and differences in capability.

Smartphones, mobile phones with more advanced computing capabilities and connectivity than regular mobile phones, came onto the consumer market in the late 90s, but only gained mainstream popularity with the introduction of Apple's iPhone in 2007. The iPhone revolutionized the industry by offering customer friendly features such as a touch screen interface and a virtual keyboard. The first smartphone running on Android was introduced to the consumer market in late 2008. The smartphone industry has been steadily developing and growing since then, both in market size, as well as in models and suppliers. By 2017, over a third of the world's population is projected to own a smartphone, an estimated total of almost 2.6 billion smartphone users in the world (Statista, 2015).

3 Common Characteristics of the Technology

3.1 Portability

Mobile learning tools are small and portable (Ahonen, Pehkonen, Syvanen, & Turunen, 2004; Cavus & Ibrahim, 2009; Quinn, 2000). Students can use them everywhere during their learning activities. Instructional theory in this mobile age should be learner-centric rather than technology- or teacher-centric. This is because mobile technologies offer new opportunities for student's educational activities in that they can be used across different locations and times (Uden, 2007).

3.2 Small Size

According to Baudisch (2004), web pages are often designed with a desktop screen in mind; on a small screen device such pages can be hard to read. If rendered in a desktop-like two-dimensional layout, such pages can require users to scroll not only vertically, but also horizontally while reading. Among the problems faced by the small screen size is difficulty in accessing the navigational tools, especially on the Web that is not designed for mobile devices.

3.3 Wireless Communication

Mobile learning promises to help learners function in a networked world where they can learn at any time and from anywhere (Ally, 2005). The world is connected by telecommunication technology. Hence, information for learning should not be taken from one source but should be assembled from many sources to reflect the networked world and the diversity of thinking and resources. Learning should be delivered in a multichannel system where different communication technologies are used to deliver the learning materials to facilitate optimal learning (Mukhopadhyay & Parhar, 2001). Mobile devices are typically capable of communication with other similar devices, with stationary computers and systems, and with networks and portable phones. Base mobile devices are capable of accessing the Internet through Bluetooth or Wi-Fi networks, and many models are equipped to access cell phone and wireless data networks as well. Email and texting are standard ways of communicating with mobile devices, although many are also capable of telephony, and some specialized mobile devices, such as RFID and barcode readers, communicate directly with a central device.

3.4 Touch Screen

Although an external hardware keyboard is an option for use with mobile devices, the primary means of interacting with Web content is through touch. The software keyboard appears when a form requires text input. Users interact with Web content directly with their fingers, rather than using a mouse. This creates new opportunities for touch-enabled interfaces, but does not work well with hover states. For example, a mouse pointer can hover over a Webpage element and trigger an event; a finger on a Multi-Touch screen cannot. For this reason, mouse events are emulated. As a result, elements that rely only on *mousemove, mouseover, mouseout* or the CSS pseudo-class hover may not always behave as expected on a touch-screen device such as an iPad or iPhone (Fletcher, 2011).

3.5 Resource Constraints

Anderson (2008) states that the main disadvantages of using mobile devices are the small display screen, reduced storage capacity, and reliance on a battery-powered device. Mobile devices have far more limited elements such as battery, CPU, memory, and screen space. Every design decision should take into account the limited CPU, memory, storage capacity, and battery life of mobile devices. Battery life is usually the most limiting factor in mobile devices. Backlighting, reading and writing to memory, wireless connections, specialized hardware, and processor speed all have an impact on the overall power usage.

4 Various OS Platforms and Device Fragmentation

Android is a strong leader in the mobile OS space with 82.8% market share according to the IDC's report for Q2 2015. iOS-based devices come second with 13.9%, Windows Phone 2.6%, Blackberry OS 0.3%, and Others 0.4% (Fig. 22.1).

Mobile device fragmentation is often associated with Android, Google's mobile OS. Mobile device fragmentation is not as much of an issue with iOS devices.

Screen size, the actual physical size is measured on the screen's diagonal. For simplicity, Android groups all actual screen sizes into four generalized sizes:

1. Small screens are at least 426dp × 320 dp.
2. Normal screens are at least 470dp × 320 dp.
3. Large screens are at least 640dp × 480 dp.
4. Xlarge screens are at least 960dp × 720 dp.

Screen density is the quantity of pixels within a physical area of the screen; usually referred to as dpi (dots per inch). For example, a "low" density screen has fewer pixels within a given physical area, compared to a "normal" or "high" density screen. For simplicity, Android groups all actual screen densities into six generalized densities:

1. Ldpi (low) ~120 dpi.
2. Mdpi (medium) ~160 dpi.
3. Hdpi (high) ~240 dpi.
4. Xhdpi (extra-high) ~320 dpi.
5. Xxhdpi (extra-extra-high) ~480 dpi.
6. Xxxhdpi (extra-extra-extra-high) ~640 dpi.

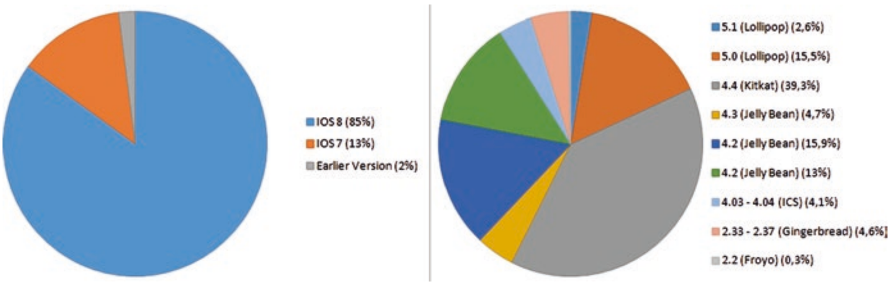

Fig. 22.1 Android version fragmentation in comparison with apple iOS version (Source: Open Signal, 2015)

Each generalized size and density spans a range of actual screen sizes and densities. For example, two devices that both report a screen size of normal might have actual screen sizes and aspect ratios that are slightly different when measured by hand. Similarly, two devices that report a screen density of hdpi might have real pixel densities that are slightly different. Android makes these differences abstract to applications, so you can provide user interface designed for the generalized sizes and densities and let the system handle any final adjustments as necessary (Fig. 22.2).

According to Google, below are the relative number of devices that have a particular screen configuration, defined by a combination of screen size and density (Table 22.1).

Prior to Apple iOS, iPhone app developers had it easy. There was one phone—the iPhone—and one screen size. Then came an iPad, and another iPad, and a few more screen sizes. But with the iPhone 6 and 6 Plus, Apple's constellation of screens has multiplied to seven different sizes (Fig. 22.3).

Screen resolution is very important for web development. In his advice on best practices for device resolution in design, Neilson (2006) of the Neilson Norman Group points out that you never want to design a Website for a monitor size. For one, users with uber-screens, such as a 30-inch, may never maximize a window due to their abnormally wide monitor. Also, screen sizes come in way too many shapes and sizes. It is simply much more efficient to focus on the resolution.

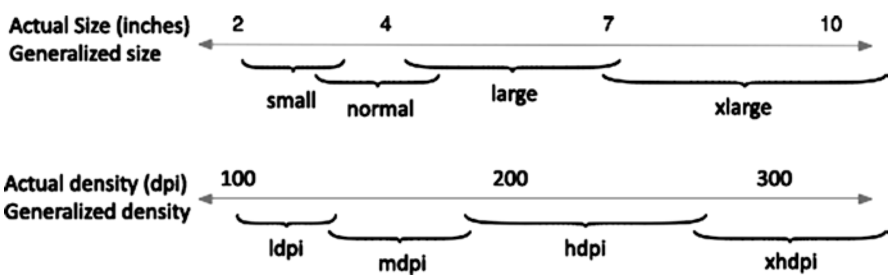

Fig. 22.2 Illustration of how Android roughly maps actual sizes and densities to generalized sizes and densities (figures are not exact) (Source: Android Developer, 2016)

Table 22.1 The relative number of devices that have a particular screen configuration, defined by a combination of screen size and density

	ldpi	Mdpi	Tvdpi	hdpi	xhdpi	Xxhdpi	Total
Small	2.4%						2.4%
Normal		4.9%	0.1%	41.5%	23.9%	14.9%	85.3%
Large	0.3%	4.6%	2.2%	0.5%	0.5%		8.1%
Xlarge		3.2%		0.3%	0.7%		4.2%
Total	2.7%	12.7%	2.3%	42.3%	25.1%	14.9%	

Source: Android Developer, 2016

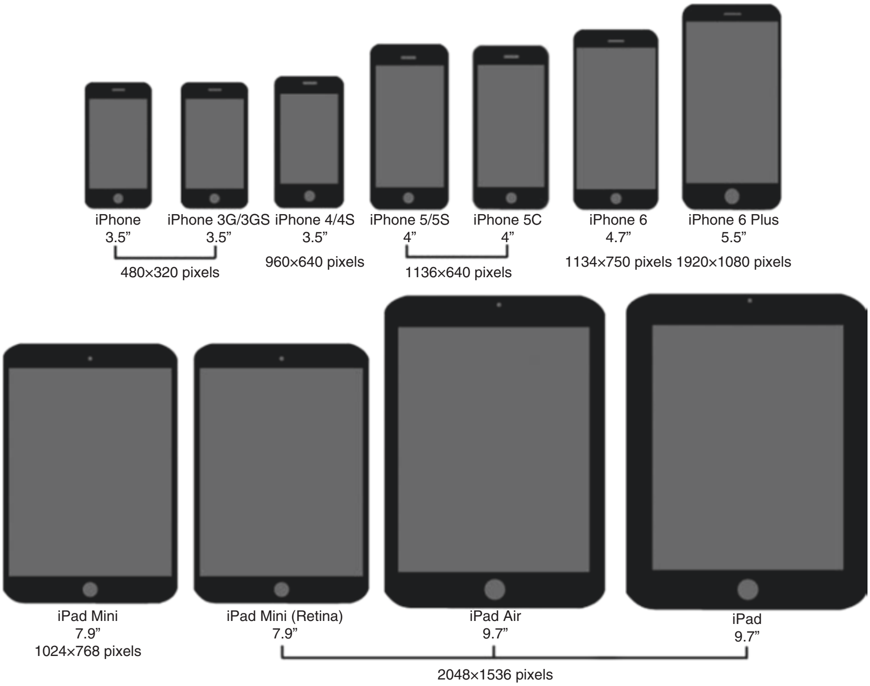

Fig. 22.3 The expanding world of iOS screen sizes (Source: International Business Times, 2014)

Developers of educational technology in the field of Web-based learning are faced with a number of variations in screen resolution. The Web that was once widely accessible via desktop screens is now even more accessible through mobile devices. The problem is that a Website designed not for mobile devices will only lead to nonoptimal learning experiences and can even be frustrating.

5 Solution

5.1 Content

Some educators opine that mobile devices are not the be-all, end-all solution to addressing the needs of today’s learners, and that performance improvement and optimized environmental conditions for learning should be the focus – rather than the technology itself (Rushby, 2005). Nonetheless, these emerging technologies appear to complement many of the characteristics of today’s learners and of other media used for delivery of distance education programming. Avellis and Scaramuzzi (2004) remind us that, although there is great potential for m-learning, there are relatively few successful implementations from which best practices can be studied.

The "distinction between software and supporting learning is blurred because of the way the application runs, which affects its educational effectiveness, and the educational purpose, which underlies the design of the software therefore, both aspects must be carefully considered" (p. 16).

Mobile sites have fewer graphics for easy loading and to accommodate the small screen sizes. The desktop user interface should differ from the mobile user interface because of user behavior associated with each type of device, e.g., how people scan and read text on their mobile device, the particular context of use and the number of things that can be viewed at a glance on a mobile device's small screen. Mobile users need a different design than desktop users, but equally, desktop users require a different design than mobile users.

5.2 Touch Friendly

It is important that the mobile website's call-to-action buttons, navigation labels and links are designed as tap-able for touch screens and not for a click of a mouse as per a desktop Website. Improving these interactions will in turn improve the user experience, preventing accidental taps and touches that can frustrate the user. Adequate sizes and spacing of buttons will ensure users can easily activate them with their fingertip. It is also equally important to make interactive elements reachable to speed up processes within the user journey. Hypertext is great for encouraging users to view related topics and read further information when they click links using a mouse on a computer but tapping links using a finger on a touch screen mobile device is not easy. For example, a finger is not able to hover over a link on a mobile Website. Considerations over user experience design interactions are required in order for a Website to work effectively on both desktop and mobile devices, providing a flawless user experience (Kedinger, 2015).

5.3 Navigation

Anderson (2008) states that problems with navigation, structure, inter- activity, complexity, security, stability, and time wasted by undisciplined or confused users does affect devices usefulness. He later recommends that navigation must be logical and well organized. The use of global navigation should remain consistent across a Website as it assists users in understanding where they are and so they do not get lost. Improving hierarchy and using contextual navigation works well when organizing the content on mobile Websites, as users do not have to dig too deeply to find the content that is appropriate to their needs. Quite often navigation on mobile devices is hidden, so it is important that users can still access the available information quickly and easily without searching through layered navigation with many subcategories like on many desktop Websites.

5.4 Screen Size and Resolution

It is nearly impossible to design for every screen size. But planning for the smallest size is always simpler than choosing popular phones such as the iPhone 6 or Galaxy S5, which have larger screens than most other smartphones. To ensure wider compatibility, start with a design that works on a phone that is at least 2–3 years old. Mobile device screen resolution is another concern associated with screen size. Many mobile devices have added HDPI or Retina screens, which are double the pixels of the actual screen size. As such, all of your site's images will need to be twice as large, to ensure that they do not appear grainy or of inferior quality (Kedinger, 2015).

In 2010, Ethan Marcotte, proposed a design strategy called Responsive Web Design (RWD). The term RWD was defined by Marcotte (2011) to unify a series of existing technologies under the same work space. There are many terms that refer to the same work technique, like fluid design, elastic container, and adaptive or flexible design. These technologies corresponded to the use of fluid containers, flexible images, and media queries. When these different technologies were unified as a single technique, the way Websites were designed was changed in order to benefit both the user and the author of the content. Lestari et al. (2014) state that RWD is capable of maintaining the quality of information, site functionality, content readability and user experience satisfaction in a Website in contrast to a Desktop version of the same application. Results of their investigation also showed a decrease of 74% of actions like screen scrolling to access content in contrast to a nonresponsive mobile Website. Zhu (2013) states that one of the main reasons of the implementation of this strategy is to save time, even if this could mean a possible increase in development cost. Nevertheless, compatibility amongst different platforms is what allows the Website to reach the majority of devices.

5.5 Load Time

Although most modern smartphones have support for broadband Internet over cellular connections, it is still essential to ensure the Web loads quickly. Keeping Web total size less than 1 MB will accelerate the load time. One typical page load time issue is that sites will often hide all desktop design elements while on the mobile version. All resources—images and JavaScript, for example—still load, even though they are not visible on the page. There are, however, many techniques for selectively loading images and other resources like HTML and JavaScript on mobile devices (Kedinger, 2015).

5.6 HTML5 Over Flash

Adobe has repeatedly said that Apple mobile devices cannot access "the full Web" because 75% of video on the Web is in Flash. What they do not say is that almost all this video is also available in a more modern format, H.264, and viewable on iPhones, iPods, and iPads. YouTube, with an estimated 40% of the Web's video, is included in an app bundled on all Apple mobile devices, with the iPad offering perhaps the best YouTube discovery and viewing experience. Another Adobe claim is that Apple devices cannot play Flash games. This is true. Fortunately, there are over 50,000 games and entertainment titles on the App Store, and many of them are free. There are more games and entertainment titles available for iPhone, iPod and iPad than for any other platform in the world (Jobs, 2010).

6 Conclusion

In conclusion, the authors found that there are many challenges encountered in Web-based learning on mobile devices. The challenge is not just in terms of technology but also in terms of learning. So as to find the right solution also requires an approach both in terms of technology and learning design.

Since mobile learning is spreading rapidly and likely to become one of the most dominant ways to access the Web in the future, it has become necessary to examine its implication for the design of teaching and learning experiences. The challenges we face can also change quickly. The solutions offered in this chapter are not intended to be a rigid solution but it is open to further discussion.

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Chapter 23
Integrating the Values of Local Wisdom into the Learning Model: Building Positive Student Character

Ni Nyoman Parwati, I Made Tegeh, and I Made Mariawan

Abstract The role of technology in helping people to learn is a very important activity in the field of Educational Technology. Success or the lack of success in running an educational program cannot be separated from the role of technology. A problem encountered by Indonesian people currently is the problem of moral degradation and the weakening of the national focus on character values. In an effort to solve the problem, the task of Educational Technology is developing learning models capable of building a more positive national character. This chapter discusses how to develop a teaching model to enable building the students' positive characters. The discussion is done based on library research findings. The result is the development of such models by integrating local community wisdom values. The existing and developing local wisdoms are full of great values that have been transmitted from one generation to another. The authors believe that the integration of the local wisdom values into learning strategies will enhance the students' positive character.

1 Introduction

The continuing modem age of technology and information has had a significant impact on the development of education both positively and negatively. In recent years the negative effect started to be felt within the society of Indonesia; in particular in consumerism, corruption, violence, sexual harassment, vandalism, mass fighting, and unproductive political life (Minister of National Education, 2010; Washburn et al., 2011). In this globalization era, life has become more complex and the possibility exists that the problems encountered will become more complex, and even more uncertain.

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K.A. Persichitte et al. (eds.), *Educational Technology to Improve Quality and Access on a Global Scale*, Educational Communications and Technology: Issues and Innovations, https://doi.org/10.1007/978-3-319-66227-5_23

In facing such a situation, the education sector is expected to be able to adapt the curriculum to make it more responsive to the development of the era (Parwati & Sudiarta, 2013; Pornpimon, Wallapha, & Prayuth, 2014 and Wagner & Ruch, 2015). Educational institutions can play a major role in preventing such negative effects caused by the development of technology and information, by trying to develop a generation that is intellectually competent with positive characters that conform to the high national character values. This chapter discusses how to develop a teaching model to enable instructors to build students' positive characters. The discussion was done based on library research findings.

2 Discussion

2.1 The Nature of Educational Technology

According to the 2005 definition, educational technology is "the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources" (Januszewski & Molenda, 2008, p.15; Spector, 2012). One of the key phrases in the definition is *ethical practice of facilitating learning* that indicates that to help others to learn is very important in the profession. In other words, in teaching and learning activities, it is important for the teacher to consider how learning takes place. Such a paradigm of teaching and learning ensures the teacher focuses on ethical learning activities.

In reality, teaching and learning activities still place their stress on teaching. This can be seen from various education programs run by the Indonesian government that focus on the effort to improve teachers' teaching competencies. Such programs include in-service teacher certification, with training on how to teach and various academic activities that focus on instruction. In the meantime, the learners are not part of the government's attention and even are often "guinea pigs." Errors in implementing many of the teaching focused policies have had bad effects on the quality of student processes and outcomes. This negative effect is integrated into almost all of the subjects that students learn. The focus of how the students learn does not receive enough serious attention.

On the other hand, the weaknesses in the implementation of teaching strategies are still focused on the effort to master factual knowledge. The emphasis on content without supporting elements of character education and ethics is missing when implementing teaching activities. In an effort to prepare a superior generation of citizens, it is not enough that the learners are provided with factual knowledge only, but more important than this is they have also been equipped with national character education. National character education can be developed through the existing local wisdoms and values in the Indonesian society and culture.

In an effort to improve the quality of learning, one of the areas in educational technology that plays an important role in this field is instructional design. Instructional design is done to select, determine, and develop an optimal teaching method to attain the desired optimum learning achievement (Reigeluth & Carr-Chellman, 2009). Based on prescriptive theory, the selection of the teaching method has to be based on an analysis of the conditions and expected learning outcomes. The prescriptive theory is goal-oriented, which means that the variables are observed to develop the optimum method to achieve the objectives (Reigeluth, 1983). Further he said that the parameters of the condition and output variables desired (which perhaps interact) are used to determine an optimum teaching method (as dependent variables). This is different from descriptive theory that regards the condition and method variables as independent variables and learning output as dependent variable (goal free). In this discussion, the theory used as the guideline to develop an optimum teaching method/model to achieve the desired learning objectives is prescriptive theory.

2.2 Character Education Through a Local Wisdom Oriented Problem Solving Teaching Model

Character is an individual's disposition, behavior, or personality formed as a result of internalization of various *virtues* believed and used as the basis for perspective, attitude, and action (Minister of National Education, 2010; Wagner & Ruch, 2015). Furthermore, it is stated that virtues consist of a number of values, moralities, and norms such as honesty, courage to act, dependability and respect for other people. Character comes from a Greek word meaning "*to mark*" and focuses on how to apply virtuous values in the form of action or behavior. So the term character is closely related to an individual's personality, in which a person can be said to have a character (a person of character) if his or her behavior conforms to the morality rule. It can be concluded that character education in principle is the development of values that originate from the way of life or ideology of the nation, religion, and other values that are upheld in the society (Parwati & Sudiarta, 2013; Proctor et al., 2011; Weber, Wagner, & Ruch, 2016).

The National Education System Act No. 20 of 2003 Article 3 states: "The national education functions to develop and form traits and the nation's civilization that has a dignity in the effort to intellectualize the nation's life, aimed at developing the potentiality of the students to be faithful and obedient to God, have a good character, healthy, intelligent, creative, autonomous, and become democratic and responsible citizens."

The act indicates that the objective of education is actually to stress the importance of process and output and that there should be a balance and proportionality between the intellectual development and the spiritual aspect, without separating both dichotomously. This development is the task of all teachers of all subjects. Thus, all teachers are obliged to learn how to develop the character of their students to make them develop optimally in accordance with the objective of education. As the consequence of the implementation of the act, then in the implementation of the teaching, the lesson plan prepared by the teacher, including the syllabus, the lesson plan, and the selection of teaching models have to indicate the development of the

Indonesian nation's character. Any subject has to be oriented towards the effort to develop creativity and innovation, the spirit for the development of the society dynamics in forming the character of the nation's civilization in an effort to intellectualize the nation's life and to realize the vision and missions of Indonesia's national education.

In an effort to develop character education, one thing that can be done is to implement teaching that is related to the society's local wisdom values which are rich with great character values. Thus, the implementation of teaching usually takes place inseparable from the context and the local wisdom values upheld in the local society (Leongson & Limjap, 2005; Meliono, 2011; Mungmachon, 2012). As an example, the local wisdom values of the Balinese society that are worth using as the principle in implementing character teaching include *Tri Kaya Parisuda* (three deeds that are made sacred, i.e., to think about good things, to talk about good things, and to do good things), *Tattwam asi* (I am you and you are me), and *Catur Paramitha* (four teachings of love), i.e., like to help other in trouble earnestly; love others without asking for rewards; sympathetic and friendly, respect others, and careful to put oneself in an appropriate place, and humble). Balinese society also has local wisdom values in the form of slogans, such as "*siat-siat wayang pemuput mepunduh di gedogane*." This sentence means, like a war in shadow puppetry, finally all puppets gather back in *keropak* (a box) used as the place for puppets. This local wisdom contains conflict management values that are considered wise. This expression is usually used for advising those in a conflict. It means to remind us that we all are brothers and sisters with the same political ideology, etc. Thus, the local wisdom "*siat-siat wayang*" has a universal value and gives a contribution to the management of a conflict that has happened.

How to develop character education through problem solving teaching model? Positive character values that can be built in the children of the 21st century, according to *Building a Nation of Character* (2008) are:

1. Being creative: being able to analyze and solve problems;
2. Showing an interest in lifelong education;
3. Thinking creatively;
4. Being able to learn anything in meeting the challenge of the era;
5. Being able to be an effective communicator;
6. Having a courage to take risks;
7. Being able to work hard;
8. Having an integrity: being honest, and responsible and
9. Showing care, tolerance, and being flexible.

Considering the positive character values that can be built in the children, it seems that a problem solving teaching model has a potential for building the necessary values. The local wisdom values upheld by Balinese community are integrated into the steps in the teaching model selected and are used as topics in developing problems in the students' book and the student worksheet, and are used as the basis for writing the guidelines of effective character-oriented student's learning activities.

Problem solving teaching is based on cognitive learning theory and constructivism that assumes that children have innate curiosity and will continually try to understand the world around them and take a class as the representation of a larger community that functions as a laboratory for learning how to solve real life problems (Rizvi, 2004). Another assumption is that intellectual development will take place at the time the individual faces a new and challenging experience and when they try to solve problems that are posed by this experience (Krulik & Rudnick, 1996). The implementation of a problem solving teaching model in teaching gives an opportunity for developing the students' character. This is done by integrating local wisdom values into each step/phase of activities.

Local wisdom is the ways and practices developed by a local community, that come from their deep understanding of the local environment, developed from living in that place from one generation to the next (Rajib & Noralene, 2008). Such knowledge has some important characteristics that make it different from other types of knowledge. Local wisdom comes from the community itself, spread widely in a nonformal way, shared collectively by the community members, developed for some generations and is adaptable as well as inculcated deeply in the way of the people as the means to survive. Local wisdom is something that is related specifically to a particular culture, and reflects the way of life of the community. Another opinion is that the truth that has become a tradition or become consistent in a place is called local wisdom (Rajib & Noralene, 2008). Based on this opinion, in this chapter local wisdom is the integration between sacred values and various values existing in the community in which the local wisdom is developed like the superiority of a local community culture in a broad sense.

The implementation of a problem solving model is started with the posing of a problem to the students. The problem is presented contextually and is selected based on Balinese community local wisdom values, for example, it is related to the community day-to day activities, the environment, culture, or values upheld by the local people. The resources are selected as the context, presented in the form of a problem at the beginning of teaching and learning activities adapted to the material to be discussed and integrated into the phases of the teaching model implementation. Some of Balinese community local values and their integration into a problem solving teaching model and the character values being built can be seen in Table 23.1.

The implementation of a Balinese community local wisdom-oriented problem solving teaching model has some phases with the reaction principles as shown in Table 23.2.

Aspects of local wisdom adapted by Balinese people then would be integrated into any steps of the problem-solving instructional model and selected to become topics

Table 23.1 Balinese community local wisdoms, their integration into the teaching process and the character Values built (Parwati & Sudiarta, 2013)

No	Balinese community local wisdom	Integration into the implementation of a problem-solving teaching model	Character values built
1.	The Teaching of *Tri Kaya Parisudha* (the three sacred acts, i.e., to think good things, to speak good things, and to do good things)	As the basis in conducting a discussion on the concepts learned in the *Explore and Plan, Select Strategies, and Find Answers* phase	Ability to socialize, ability to communicate, ability to make decisions, to work hard, to be responsible, to think critically and creatively, to be honest, to be honest, to be meticulous, to be democratic, and ability to solve problems
2.	Life principle "*puntul-puntulan tiyuke yen sangih pedas dadi mangan*" (meaning, no matter how stupid you are, if you are diligent in studying you will surely be successful)	As a motivation to learn further in the *Read and Think* phase	Motivation to learn
3.	Life principle "*jele melah gelahang bareng*" (meaning, we have got to share the responsibility for the best or the worst of our deed)	As the motivation to work together in the *Explore and Plan* phase	Motivation to learn
4.	The teaching of *Tattwamasi* (meaning, I am you and you are me)	As the basis in conducting discussion activities on the material being learned at *Explore and Plan* phase	Ability to socialize, to be tolerant, and to respect each other's differences
5.	The teaching of *Catur Paramitha* (four teachings of love), i.e., like to help others in difficulty earnestly; love each other without asking for rewards, to be sympathetic, and friendly, respect others; and, to be careful, to be able to place oneself in a situation, and to be humble)	As the basis in conducting the discussion on the material concepts being learned at *Explore and Plan, Select Strategies, and Find an Answer* phase	Ability to socialize, ability to communicate, to respect each other's differences
6.	Life principle "*siat-siat wayang pemuput mepunduh di gedogane*"(like a war in a puppet (*wayang*), at the end all puppets will stay together in their box)	To practice the ability to respect each other's differences among friends in the discussion, presentation of the result of discussion phase	Ability to communicate, to respect each other's differences and ability to solve problems

(continued)

Table 23.1 (continued)

No	Balinese community local wisdom	Integration into the implementation of a problem-solving teaching model	Character values built
7.	Life principle "*apang sing gangsaran tindak kuangan daya*," (Aalways in a hurry in doing a job without a clear rational basis)	To practice the habit of not being in a hurry in doing something, to act meticulously and to base it on a clear rational basis in the *Read and Think, Select Strategies* phase	To be autonomous, to show curiosity, to be motivated, to work hard, to be responsible, to think critically and creatively, to act rationally

Table 23.2 Phases of Balinese community local wisdom-oriented

Phase	Reaction Principle	Character Values being Built
Phase -1 *Read and Think*	The students listen to learning objective in brief, read worksheet given by the teacher, start selected problem solving activity and think of the answer to the problem faced. The teacher motivates the students by reminding them of the life principle: "*puntul-puntulan tiyuke yen sangih pedas dadi mangan*" (No matter how blunt a knife is when you sharpen it, it will be sharp).	Autonomy, curiosity, love for reading, and motivation to learn
Phase -2 *Explore and Plan*	The students define and organize learning tasks related to the problem faced, through group work. The teacher gives help at the time when it is needed. The teacher motivates by asking the students to implement the life principle "*jele melah gelahang bareng*" (whether it is good or bad it belong to us)	Ability to socialize, ability to communicate, to respect each other's differences
Phase -3 *Select Strategies*	The students collect relevant information, doing an experiment/problem solving plan, to obtain the explanation, and to solve the problem. The teacher reminds the students of the teachings of Tri *Kaya Parisudha, Tattwamasi*, and *Catur Paramitha*	Showing respect to other's opinions, being democratic, hardworking and responsible
Phase -4 *Find Answers*	The students plan and prepare work expected, such as: making a report, finding a solution to the problem, and ideas that help them to share tasks with their friends. The teacher asks the students to implement the life principle "*apang sing gangsaran tindak kuangan daya*" (too quick to act without a good reason)	Ability to make decisions, ability to solve problems to think critically and creatively and to act rationally
Phase -5 *Reflect and Extend*	The students reflect about or evaluate and extend the result of their investigation/finding and the processes that they used in various ways. At this phase, the teacher finally reminds the students of the life principle "*siat-siat wayang pemuput mepunduh di gedogane*" (like a war in shadow puppetry, finally all puppets gather back in a box)	Think creatively, never give up, appreciate achievements, be honest, and meticulous

Problem solving teaching model modified from Krulik & Rudnick (Krulik & Rudnick, 1996) and Parwati & Sudiarta (Parwati & Sudiarta, 2013) appropriate to developing problems in the students' textbooks and their work-sheets. An example of integrated local wisdom into the students textbook is the following:

> To obtain better understanding of the concept above, please discuss with your friends '*Ayo Berlatih 1*', Before that please keep in your mind the following proverb "*Siat-siat wayange, pemuputne mepunduh dadi abesik di gedogane*". It means: having different opinions in a discussion is something common and leads the participants to a good conclusion. So please appreciate your friends' opinions.

The learning environment in this case has the following characteristics: open, democratic process, active student participation, and appreciation for local wisdom values. All the processes of teaching and learning help the students to become autonomous. The students are confident with their own intellectual skills and develop positive characters. Although the phases are structured, the norms around the teaching process are open and free in the expression of opinions. This learning environment stresses the importance of the central role of the students, not the teacher's. The instructional effect and the nurturing effect of this problem solving (PS) model can be seen in Fig. 23.1.

The problem-solving teaching process is not oriented towards final answers to the problems, but towards how the answers are found. The problems presented are the ones that are capable of giving opportunities to the students to give answers that conform to what they want by giving reasons that can be accounted for. The problems presented are ideally open-ended problems or presented realistically/contextually oriented towards local wisdoms (Parwati & Sudiarta, 2013).

According to Krulik and Rudnick (Krulik & Rudnick, 1996), some things that need to be done in implementing the problem solving teaching model are as follows. (1) Select suitable problems; (2) Develop a lesson plan; and (3) Implement it in accordance with the phases of the problem solving teaching model. The problems presented in the problem solving teaching model have the characteristics as follows; it encourages the students to think from different points of view; it has to be within the students' ability level; it has to have a clear orientation, and it has nothing to make them confused (Parwati, 2011).

Based on the characteristics of the problem and problem solving teaching model, the advantages of this model are as follows:

1. The students are actively engaged in the teaching and learning process.
2. The students learn from their friends through group work, discussion and peer correction.
3. The teaching and learning process stresses the importance of problems.
4. The students' behaviors are developed based on their own awareness, and the reward for good behaviors is in the form of self-satisfaction.
5. The students use critical and creative thinking skills, are fully engaged and responsible for effecting an effective teaching and learning process, and bring their own schemata into the learning process.

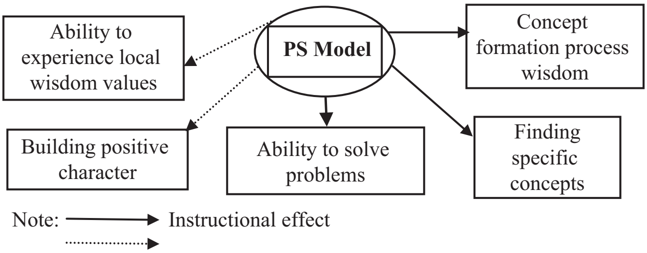

Fig. 23.1 Instructional effect and nurturing effect of local wisdom-oriented problem solving teaching model

6. Appreciation for the students' experiences is given a priority.

Based on some advantages that are pointed out here, one can see that in the problem solving teaching model, the stress is the student centered concept and it offers a very big opportunity to the effort of building positive characters. However, in addition, besides having the advantages that have been discussed, this model also has weaknesses, which include:

1. It needs a relatively longer time for implementation;
2. It is not always easy to relate mathematical materials learned by the students to everyday problems; and
3. The teacher needs to make an in-depth preparation in presenting problems of the problem solving type.

By knowing its weaknesses, it is expected that in its implementation, the teacher can minimize the weaknesses.

3 Conclusion

One of the roles of Educational Technology is to develop an instructional design. There are two theoretical bases in designing an instruction, i.e., descriptive and prescriptive theories. Descriptive theory is goal free, while prescriptive theory is goal-oriented. In prescriptive theory, the condition and learning output variables are regarded as independent variables to produce an optimum method/model. The condition variable is defined here as the characteristics of the subject and the process of building the nation positive characters as the desired variable.

Thus, the Local Wisdom-oriented Problem Solving Model is expected to arouse the students' motivation and improve their problem solving ability. The local wisdom values that are integrated into the problem solving teaching model train the students in understanding great values contained in the community local wisdoms. Hence, individuals with superior personalities and positive characters who are academically intelligent will become a reality.

Acknowledgements Thanks to Rector Undiksha for moral support and the ETWC committee 2016 in Sanur, Bali for the silver award for this chapter.

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Chapter 24
The Influence of Competence and Self-Confidence on Elementary School Teacher Performance

Mohamad Syarif Sumantri and Prayuningtyas Angger Wardhani

Abstract The quality of learning is determined by teacher performance, which is influenced by an individual's competence and their confidence in teaching. The aim of this research was to gain an understanding of the causal relationship between competence and confidence in relation to teacher performance. We found that individual competence had a strong influence on confidence. Although there were limitations in the sampling, the findings of this study have implications for teaching performance. Further research could study differences and interrelations between social competence, personal competence, and professional competences, as well as other factors that affect the performance of teachers.

1 Introduction

Competence and self-confidence are important qualities in the definition of "a professional." A profession, teaching included, is considered to be a job or role that is a means of livelihood and which requires expertise, skillfulness or competence to meet a particular quality standard or norm. The importance of teacher professionalism will depend on the realization of school organizational climate. The more conducive the school organization climate, the higher the value of professionalism.

A good organizational climate is essential in elementary schools and has an impact on the quality of the learning process and student outcomes in the classroom (Hoy, 1990). This study is about one dimension of teacher professionalism as a factor in elementary school teacher performance. It is important because teacher performance, self-confidence, and individual competence variables are significant factors for learning in the elementary school. The findings of this study have a direct

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impact on the quality of teacher performance and an indirect impact on the success of student learning in the classroom.

Teacher performance is defined as performance in all the duties and responsibilities required for teaching and learning management, to meet certain standards and criteria. These duties and responsibilities include how the teacher plans the lesson, carries out the teaching activities and evaluates the learning outcomes. Three indicators are used: mastery of the teaching materials, the ability to manage learning, and the commitment to performing tasks.

Self-confidence includes an individual's expectations of performance and self-evaluations of abilities and prior performance. Self-confidence enables people to achieve various goals in life. The indicators are objective self-evaluation, honest appraisal of self, positive thinking, self-affirmation, and risk-taking.

Individual competence, in the simple sense, is a combination of knowledge, skills, and attitudes. Each individual holding a position must have the required competence to bring about the desired result. Individual competencies guide a person in acting, thinking, or generalizing the situation adequately over the long term. Personal competence as it relates to teaching includes not just the ability to perform the teaching task, but also the ability to be a steady, mature, wise, and authoritative person, and a role model for learners.

Dilworth and Imig (1995) explained that a professional is determined by individual competence. A teacher's individual competence, therefore, needs to be taken into account so that the teacher is able to teach professionally and perform well. Attention as a motivation needs to be paid to the quality of teacher performance in the elementary school, so that teachers can be motivated to improve their competence. In general, high performance is associated with high motivation. Conversely, low motivation is associated with low performance. Performance of a teacher is related to competence because there are factors of self and work environment that affect performance. Teachers have to clearly understand their main duty and function to be able to give professional service to students. Teachers are professionals in charge of planning and implementing the learning process, assessing learning outcomes, conducting mentoring and training, conducting research, and community service.

Several elements of the learning system have an influence on the quality of the learning activity and the achievement of the school's vision, mission, and target. One of these is human resource management, in which teachers are integrated in one learning system, working toward quality teaching and a shared goal.

Spector, Merrill, Elen, and Bishop (2008) suggested that teacher performance is an indicator of successful learning programs. The indicator is used as a standard to measure the success and failure of the execution of a learning program in meeting the set objective observed through personality, attitude, teaching style, communication skill, and competence of the teacher. Gläser-Zikuda and Fuß (2008) noted that competence is a combination of knowledge, expertise, and the attitude one has in appraising, mastering, and performing one's duty in a professional way. Competence is required to complete a duty and meet the set standard. In brief, competence is a prerequisite if someone is to perform well.

Competence means to possess the knowledge, expertise, and ability that a job demands. Competence also relates to a specific performance that is rational and considered to be a web of knowledge, expertise, and the ability to meet the objectives for success. Limsila and Ogunlana (2008) emphasized that individual competence is a basic characteristic of a worker who uses part of their deepest personality, and it influences their attitude when they encounter the job. Competence ultimately influences their ability to achieve the desired work outcome.

In relation to individual competence, Ostrow et al. (1986) pointed out that being professional relates to personal competence demonstrated in a performance and to accomplishment of desired goals pursued in achievement motivation. Lee and Moray (1994) stated that self-confidence is a deep-rooted quality that allows the individual to face life's challenges and to work toward achieving goals. Dalley-Trim (2007) noted that self-confidence has an impact on one's learning, managing, decision- making, and problem-solving in basic life challenges, leading to one's satisfaction or happiness.

It can also be said that self-confidence is an attitude that allows one to believe in oneself, so that the individual takes control over their life and can achieve their aims. In the case of the elementary teacher, they need a high level of self-confidence to make decisions and perform their duties and responsibilities.

Pintrich and McKeachie (2000; as cited in Lindblom-Ylänne, Trigwell, Nevgi, & Ashwin 2006) consider confidence not as a generic concept, but as a reflection of the person's perception of their capacity to achieve a particular goal in a specific situation. Therefore, the particular teaching context is likely to be central to an individual's level of self-confidence.

Some studies do provide insight into the relevance of self-confidence for teaching and teacher development. Sadler's (2013) research results show that confidence has a role in teacher development efforts. In one study, two teachers, who were given the lowest rating by students in a law school, were interviewed and observed before and after a program for improving instruction (Hativa, 2000). Low self-confidence in teaching ability was outlined as a key trait of one of the teachers in the study. As the teachers altered their teaching behavior, such as speaking more slowly and improving the clarity of the organization of the lesson, self-confidence appeared to improve. However, the findings can only be considered as being preliminary due to the use of only two participants from the same subject area and teaching context. In a study of academics 'conceptions of their own development as a teacher, Åkerlind (2003) identified one way to increase comfort, confidence, and ease of teaching. This method was considered to be entirely self-focused; however, it did relate to both teacher-focused and student-focused understandings of teaching. This provides a slightly different perspective on the role of confidence in teaching, but it does indicate that confidence is an important dimension for development regardless of an individual's conception and approach to teaching. Therefore, the aim of the current study is to consider the role of self-confidence upon the approach to teaching and development as a teacher.

In most societies, self-confidence is widely regarded as a valuable individual asset. Going back at least to William James, an important strand in psychology has advocated “believing in oneself” as a key to personal success. Mowday (1979) emphasized that self-confidence is the belief in oneself and personal abilities; it describes an internal state made up of what we think and feel about ourselves. This state is changeable according to the situation and our responses to events going on around us. It is not unusual to feel quite confident in some circumstances and less confident in others. It is also influenced by past events and how we remember them; recalling a former success has a very different outcome in terms of our confidence levels than thinking about an occasion when we failed.

Professional teachers have to take responsibility and be innovative. Self-confidence is essential for these objectives. This, then, leads to satisfaction in carrying out activities and increased motivation in performing instructional duties. Someone with confidence will be able to complete a task and have the disposition to complete it to the best of their ability. In short, if they have positive self-confidence, teachers will be able to complete their job well (McDonald & Elias, 1976).

Performance is the ability to perform a duty in accordance with set measures or standards. Schemerson et al. further defined performance as the quality and quantity of the accomplished assignment, performed by either an individual or organization. Work performance implies that the concept of work performance is an end-product of a chain of processes—setting up the vision, mission, goal, target, policy, program, and activity and all of these aspects are closely related to one another. Lester, Garofalo, and Kroll (1989) correlate self-confidence with work performance indicating that a high level of self-confidence leads to work satisfaction and promotes productivity and performance.

2 Method

This research used the survey method of causality. The data collection technique used in this study is a Likert scale model questionnaire. The variables were individual competence (X1), self-confidence (X2), and performance of teachers (X3), with five alternative answers: (1) Strongly Agree, (2) Agree, (3) Undecided, (4) Disagree, and (5) Strongly Disagree. Positive statements are scored: SA = 5, A = 4, U = 3, D = 2, and SD = 1, and negative statements with SA = 1, A = 2, U = 3, D = 4, and SD = 5. The analysis of normality test data in this study uses the Lilliefors test. Hypothesis testing of the relationship between research variables X1, X2, and X3 was conducted using a path analysis technique.

The questionnaires were completed by elementary school teachers in each school after an explanation from the researcher. The respondents were elementary school teachers working in government schools with an average of 5–10 years’ experience. They were generally certified teachers who had graduated from undergraduate education programs. The study used the purposive sampling technique. The number of samples was $N = 30$ classroom teachers from 30 elementary schools in Tangerang City, Banten.

A hypothesis test was conducted to examine the influence of individual competence (X1) and self-confidence (X2) in teacher performance (X3). This hypothesis

Table 24.1 Correlation results

		Individual competence (X1)	Self-confidence (X2)	Teacher performance (X3)
Individual competence (X1)	Pearson correlation	1	0.957**	0.982**
	Sig. (1-tailed)		0.000	0.000
	N	30	30	30
Self-confidence (X2)	Pearson correlation	0.957**	1	0.966**
	Sig. (1-tailed)	0.000		0.000
	N	30	30	30
Teacher performance (X3)	Pearson correlation	0.982**	0.966**	1
	Sig. (1-tailed)	0.000	0.000	
	N	30	30	30

Table 24.2 Coefficient—Dependent variable: Individual competence (X1)

	Unstandardized coefficients		Standardized coefficients		
Model	B	Std. error	Beta	t	Sig.
1. (Constant)	23.859	4.509		5.291	0.000
Self-confidence (X2)	0.746	0.043	0.957	17.526	0.000

was examined by employing a path analysis statistics test. This research reveals that individual competence (X1) and self-confidence (X2) are cause variables (exogenous variables), while teacher performance (X3) is an effect variable (endogenous variable). The initial calculation was performed using the SPSS program to investigate the value of correlation among variables. Table 24.1 shows the result of the calculation.

The calculation shows that the correlation value between X1 and X2 is 0.957, which is considered strong. The following path coefficient can be derived based on the correlation between variables. Two path analysis structures were conducted in this research. They were self-confidence (X2) toward individual competence (X1) as structure one, and teacher performance toward (X3) individual competence (X1) and self-confidence (X2). A hypothesis analysis to investigate the influence of respective variables was then applied by calculating the coefficient of each path of exogenous and endogenous variables. The result of the path analyses on structure one and structure two using SPSS can be seen in Table 24.2.

2.1 Structure 1: Self-Confidence (X2) toward Individual Competence (X1)

From Table 24.2, the following can be stated:

From Table 24.3, it can be seen that the *R* square or determination coefficient is 0.916, which describes that the contribution of individual competence (X1) and

Table 24.3 Model summary—Predictors: (Constant), self-confidence (X2)

Model	*R*	R^2	Adjusted R^2	Std. error of the estimate
1	0.957[a]	0.916	0.913	1.35723

[a] is a predictor or constant of self confidence variable

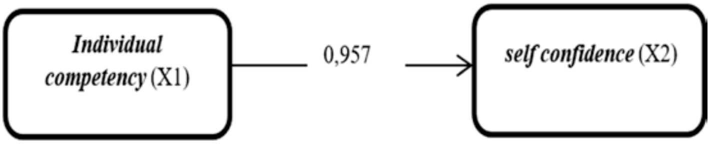

Fig. 24.1 Path coefficient one—analysis

Table 24.4 Coefficient—dependent variable: teacher performance (X3)

Model		Un-standardized coefficients		Standardized coefficients	t	Sig.
		B	Std. error	Beta		
1	1. Constant	9.782	4.437		2.205	0.036
	Individual competence (X1)	0.810	0.131	0.687	6.159	0.000
	Self-confidence (X2)	0.283	0.103	0.308	2.760	0.010

self-confidence (X2) toward teacher performance (X3) is 91.6%. The following path analysis equation can be derived from Fig. 24.1 and Table 24.3:

$X_2 = 0.957$, X_1 and $R^2 = 0.916$. Table 24.3 shows that the path coefficient of individual competence (X1) toward self-confidence (X2) is 0.957 and p-value is $0.00 < 0.05$. There is a significant influence in individual competence (X1) toward self-confidence (X2).

2.2 *Structure 2: Teacher Performance (X3) Toward Individual Competence (X1) and Self-Confidence (X2)*

Table 24.4 shows the standardized coefficients column as the path coefficient of variables X1 and X2. It can be described as in Fig. 24.2

Table 24.5 demonstrates that the *R* square or determination coefficient is 0.972, which describes the contribution of individual competence (X1), and self-confidence (X2) toward teacher performance (X3) is 97.2%. The following equation can be derived from the Fig. 24.2 and Table 24.5: $X_3 = 0.687X_1 + 0.308X_2$ and $R^2 = 0.972$. It can be seen from Table 24.5 that:

- The path coefficient of individual competence (X1) toward teacher performance (X3) is 0.687 and *p*-value is $0.000 < 0.05$. This means that individual competence (X1) has a significant influence on teacher performance (X3).

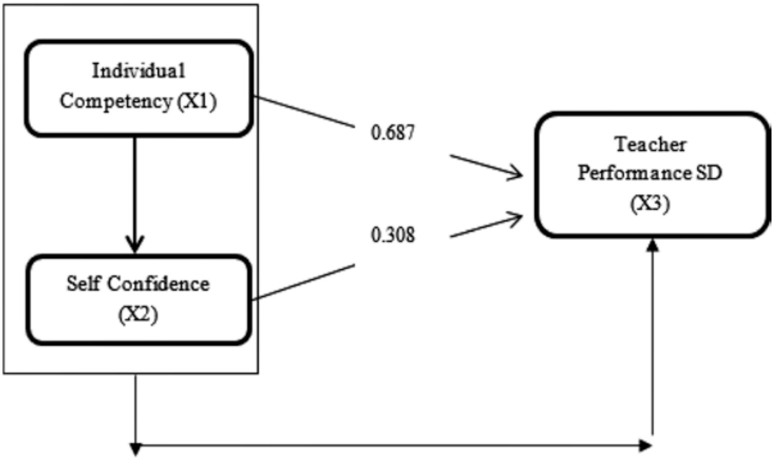

Fig. 24.2 Path coefficient two—analysis

Table 24.5 Model summary—Predictors: (constant), self-confidence (X2), individual competence (X1)

Model	*R*	*R* square	Adjusted *R* square	Std. error of the estimate
1	0.986	0.972	0.970	0.94439

- The path coefficient of self-confidence (X2) toward teacher performance (X3) is 0.308 and p-value is 0.010 < 0.05. This means that self- confidence (X2) has a significant influence on teacher performance (X3).

2.3 Direct and Indirect Influence

The indirect influence of individual competence (X1) on teacher performance (X3), of self-confidence (X2) on teacher performance (X3) and of individual competence (X1) on self-confidence (X2) can be derived by combining path analysis 1 and 2 as follows (Fig. 24.3):

Table 24.6 demonstrates that individual competence (X1) has an indirect influence on teacher performance (X3) by as much as 0.294.

3 Discussion

The analysis here shows that there is a positive influence between individual competence and self-confidence, both together and as individual factors, also on teacher performance in an elementary school. This positive influence means that

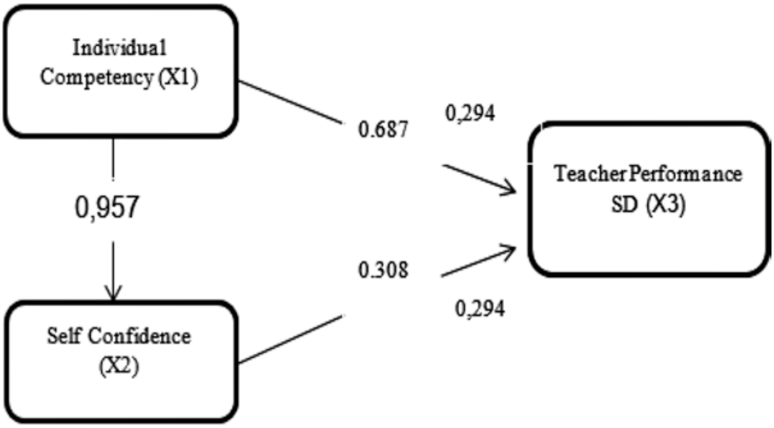

Fig. 24.3 Combination of coefficient analysis of paths one and two

Table 24.6 Summary of path analysis structure 1 and structure 2

Hypothesis	Direct influence (1)	Indirect influence (2)	Total influence (1) + (2)
H_1: $X_1 \rightarrow X_2$	0.957	----------	0.972
H_2: $X_1 \rightarrow X_3$	0.687	0.957 × 0.308 = 0.294	1.251
H_3: $X_2 \rightarrow X_3$	0.308	----------	0.308

an increase in individual competence and self-confidence is followed with improved teacher performance. This influence indicates that teacher performance can be traced, explained, or predicted by ascertaining individual competence and self-confidence.

The result of the hypothesis test shows that an alternative hypothesis ($X_1 \rightarrow X_{2,}$ H_2: $X_1 \rightarrow X_3$ H_3: $X_2 \rightarrow X_3$) proposed can be significantly accepted. Firstly, this hypothesis test concludes that there is a strong influence of individual competence on the self-confidence variable that results correlation of determinant coefficient of 0.916. This means that the contribution of individual competence on self-confidence is 91.6% and the remaining 8.4% is not included in the model. The path coefficient of individual competence toward self-confidence is 0.957 with *p*-value of 0.00 < 0.005. This indicates a highly significant influence of individual competence (X1) on self-confidence (X2). It means that the higher the individual competence, the more self-confidence. This finding is supported by Nelson (2013), who states that individual competence is influenced by many factors.

Secondly, this hypothesis test concludes that there is an influence between individual competence (X1) and self-confidence (X2) on teacher performance (X3) in elementary schools, as indicated by the determinant coefficient value of 0.972. It signifies that the contribution of individual competence (X1) and self-confidence (X2) on teacher performance (X3) is 97.2% and the remaining 2.8% is not included in the model.

Teaching is not an easy job. It takes courage and strong confidence. One could argue, however, that everyone is basically capable of teaching. The difference is in one's will to develop oneself as a good teacher. There are both external and internal factors that affect self-confidence. Internal factors are the ability of the individual, the success of the individual in getting something done and the desire and strong determination to persevere until the desired end is realized. External factors are their work environment, family environments, the attitude of colleagues, the support network, education, etc. will have an impact on one's personality patterns.

There are many elements that shape and inhibit the development of one's self-confidence. Internal factors include: (1) Self-concept: the formation of self-confidence in a person begins with the development of self-concept derived from association and interaction in a group; (2) Self-esteem: a positive self-concept will form positive self-confidence as well; and (3) Experience can be a factor in the emergence of confidence. Conversely, experience can also be a factor in decreasing a person's confidence.

Teachers can increase their self-confidence through advanced studies, relevant short courses, joining teaching associations, taking professional certification, and carrying out joint research. The path coefficient of individual competence (X1) toward teacher performance (X3) is 0.687 with p-value of $0.00 < 0.005$. This means that there is a highly significant influence of individual competence (X1) toward teacher performance (X3). This is supported by research by Lobman (2011) and Muralidharan and Sundararaman (2009), who state that teacher performance is mainly related to knowledge, attitude, and personal expertise. The hypothesis test above shows that elementary school teachers should have optimal performance if they have good individual competence. It indicates that the higher individual competence, the higher teacher performance.

Teaching competence is the ability and authority of teachers to carry out their profession. These abilities can be learned, trained, and developed. Competence includes in-depth proficiency through further studies to improve the knowledge and skills that support individual performance. Teachers need competence in their field of study, in organizing learning, and in continuous professional development. Teaching performance includes loyalty, responsibility, obedience, honesty, cooperation, initiative, and leadership. By understanding and developing the required competencies, teachers are able to improve their performance.

The implication of this research, in finding a positive and significant correlation between teacher competence and teacher performance, is that primary school management can develop teacher competence and performance through appropriate motivation, through awards, opportunities to train, and to attend workshops and seminars to improve skills.

The path coefficient of self-confidence (X2) toward teacher performance (X3) is 0.308 with p-value $0.001 < 0.005$. This means that self-confidence (X2) has a significant influence on teacher performance (X3). It indicates that the higher the self-confidence, the higher the teacher performance.

The findings of this study are in accordance with the opinions of Hunter (2013), Lenney (1977), and Civelli (1998) that a person's performance is influenced by some aspects of their background experience, self-confidence, emotional maturity, and intellect. Performance is a reflection of the way a person sets and achieves goals. A good teacher plans carefully to achieve goals and standards. The difference in performance between one person and another in the work situation comes down to the different experiences and characteristics of the individual. Performance is the result of the interaction between self-confidence and basic ability. If confidence is high but basic skills are low, then performance will be low. If the ability is high but the confidence is low, then the performance will be low.

Teacher performance is central to the success of a school and its learning environment. Teacher performance includes work quality, work accuracy, initiative, skills, and communication. Teacher performance is the actualization of teacher competence related to the management of learning, the mastery of the field of study, attitude or personality and social interaction. Personal competence and teacher performance are supported by confidence. Thus, individual competence and confidence levels have a positive impact on improving teacher performance.

4 Conclusion

The findings of this research can be summarized as follows:

- Individual competence has a direct and actual influence on teacher performance in Tangerang, Banten public schools. This shows that the better the individual competence, the better the teacher performance in public elementary schools.
- Individual competence has a direct and actual influence on self-confidence. This shows that the better the individual competence, the higher the self-confidence.
- Self-confidence has a direct and actual influence on teacher performance in Tangerang, Banten public schools. This shows that the higher the self-confidence, the better the teacher performance in public schools.
- Individual competence and self-confidence significantly influence teacher performance in Tangerang, Banten public schools.

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Author Index

K.A. Persichitte et al. (eds.), *Educational Technology to Improve Quality and Access on a Global Scale*, Educational Communications and Technology: Issues and Innovations, https://doi.org/10.1007/978-3-319-66227-5

Subject Index

K.A. Persichitte et al. (eds.), *Educational Technology to Improve Quality and Access on a Global Scale*, Educational Communications and Technology: Issues and Innovations, https://doi.org/10.1007/978-3-319-66227-5