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DEVELOPMENT ARTICLE

Creativity in the training and practice of instructional designers: the Design/Creativity Loops model

Gregory Clinton · Brad Hokanson

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Abstract This article presents a discussion of research and theoretical perspectives on creativity and instructional design, offering a conceptual model of the connection between these two constructs that was originally proposed in the dissertation work of the first author (Clinton, Creativity and design: A study of the learning experience of instructional design and development graduate students, Unpublished doctoral dissertation, University of Georgia, Athens, 2007) and that we call the Design/Creativity Loops (DCL) model. Central to the model is a representation of the iterative, looping problem-solving cycle that can include established stages of creative thinking. As an instructional designer is routinely confronted with the next task or design problem in a project, these tasks or problems spawn iterative mental excursions that are opportunities for creative thinking. This article also explores ways that the design and development process can benefit from an emphasis on creativity and offers suggested directions for future research.

Keywords Creativity · Design · Instructional design · Instructional systems design · Instructional development · Mental models · Self-efficacy · Problem solving

Within education, instructional design holds a unique position in that it is considered a design discipline (Nelson and Stolterman 2003). Because design is included in the conceptualization of instructional design, so too is the creative element that is recognized in other design disciplines. However, the field of instructional technology has tended to give little or no formal treatment of the importance of creativity in instructional design.

In this writing, as background, we examine the natural connection that exists between design and creativity through the literature both on creativity and on instructional design. By extension, this is followed with an exploration of the connection *between* creativity and

G. Clinton (✉)
University of Georgia, 1022 Quiet Waters Lane, Lawrenceville, GA 30045, USA
e-mail: gclinton@uga.edu

B. Hokanson
University of Minnesota, Minneapolis, MN, USA
e-mail: brad@umn.edu

instructional design. We contend this connection has always been present, but has usually been conceptualized in a very informal and tentative fashion. We then offer a conceptual model for thinking about the role of creativity in instructional design and development, the Design/Creativity Loops (DCL) model. The model illustrates that as an instructional designer is routinely confronted with the next task or design problem in a project, these tasks or problems spawn iterative mental excursions that are opportunities for creative thinking.

There is a need for the connection between creativity and instructional design to be formally conceptualized, included routinely in the discourse of our field, and incorporated into the training of new instructional designers. The inclusion of the *create* element in the recent definition of the field published by the Association for Educational Communications and Technology (AECT), and the elaboration of this element in the accompanying definition book (Januszewski and Molenda 2008), is a positive step in this direction. However, the presence or absence of an emphasis on creativity in the models presented to instructional designers, whether in training or in the workplace, remains non-trivial. Inclusion of some conceptualization of creative work among designers helps to send a message that creative ideas are taken seriously in a particular work environment and that creativity is 'built-in' to the work of instructional design, rather than being an 'add-on.' And while learning outcomes and the creative experience of instructional designers' learners is of critical importance, the focus in this article is rather on the development of instructional designers and the process of design.

Creativity

Creative work is the engine that drives civilization forward. "Most of the things that are interesting, important, and *human* are the results of creativity" (Csikszentmihalyi 1996, p. 1). Economist Richard Florida states, "Human creativity is the ultimate economic resource. The ability to come up with new ideas and better ways of doing things is ultimately what raises productivity and thus living standards" (Florida 2002, p. xiii). Governments as disparate as the People's Republic of China and the United Kingdom actively support the development of creativity skills in their residents (see Cox 2005; Tischler 2006). The report of the New Commission on the Skills of the American Workforce placed high value on innovation and creativity skills for every American worker and viewed it as a matter of national importance (National Center on Education and the Economy 2007).

While a common understanding about the nature of creativity is not to be found in professional and research literature, what one does find is a core definition that is fairly consistent: creativity is understood to be the generation of ideas that are both novel and useful, usually in response to a problem that needs to be solved (Csikszentmihalyi 1996; Feist 1999; Root-Bernstein and Root-Bernstein 1999; Sternberg and Lubart 1999). Varied forms of creative thinking have been identified; these include divergent thinking (multiple ideas in response to a given proposition), problem identification, and evaluative thinking (judging the value of an idea; Plucker and Renzulli 1999).

A wide array of theoretical perspectives and research methods has been brought to bear on the study of creativity. These range from mystical characterizations to cognitive theories to social frameworks, and, it would seem, everything in between (see Albert and Runco 1999; Sternberg and Lubart 1999). Part of the reason for this variety is that creativity has not been an easy phenomenon to study. Theoretical perspectives abound, but data shedding clear light on the subject are hard to come by. Issues such as the nature of creativity, how it happens, factors that influence the process, who is really creative, and what is considered creative work remain difficult to objectively define.

Many researchers have therefore limited their study samples to the lives and works of eminently recognized creators such as Einstein, Mozart, or Picasso (e.g., Csikszentmihalyi 1996; Policastro and Gardner 1999; Simonton 1999). The creativity of such persons is often referred to as 'Creativity with a capital C' or 'Big C Creativity' (Gardner 1993). If there is an international consensus that an individual is a creative genius, valid information can be gathered about his or her practices and capabilities. However, many others find this limiting of scope and lack of generalizability unsatisfying. Even 'Big C Creativity' researchers acknowledge that day-to-day levels of creativity exist.

In contrast, educators tend to be interested in the creative potential of all learners. This view in the field of education can be traced in part to the writings of John Dewey, whose influential book *Art as Experience* (1934) presented a broadly inclusive view of creativity. Dewey argued eloquently for a continuum of creative experience, from the most mundane of human activities to the highest expressions of artistic genius. He did not deny the existence of great works of art; however, to Dewey the isolation of works of art in museums, along with the elevation of individual artists to an elite status, was an artificial development arising out of the tendency of industrialized society to sap the vitality out of day-to-day experience. Through monotonous tasks and impersonal social structures, daily existence had become unnaturally void of creative vitality, causing the emotional impact of works of art, when viewed, to seem separate from the rest of life. To Dewey the potential for what we might now call 'little c creativity' was everywhere and in need of being re-awakened. This view is now broadly accepted, as exemplified in the fields of cognitive science and artificial intelligence:

> Creativity is not a special "faculty," nor a psychological property confined to a tiny elite. Rather, it is a feature of human intelligence in general. It is grounded in everyday capacities such as the association of ideas, reminding, perception, analogical thinking, searching a structured problem-space, and reflective self-criticism. It involves not only a cognitive dimension (the generation of new ideas) but also motivation and emotion, and is closely linked to cultural context and personality factors. (Boden 1998, p. 347)

A large body of work, in fact, has been done by researchers endeavoring to study this broad range of creative ability (see Albert and Runco 1999; Paulus and Nijstad 2003; Sternberg and Lubart 1999). Approaches include experimental evaluations of immediate influences on creative output, such as variations in instructions for a task (Runco and Sakamoto 1999); psychometric tests of aptitudes such as divergent thinking, problem identification, and evaluative thinking (Plucker and Renzulli 1999; Torrance 1974); attempts to empirically validate techniques for judging creative products using consensus-based (Amabile 1983) or analytical (Besemer and O'Quin 1999) processes; and the development of cognitive theories to account for creativity as an aspect of intelligence (Ward et al. 1999; Weisberg 1999). This research has helped develop a broader understanding of the complex nature of creativity and problem solving and, significantly, treats as self-evident the existence and importance of a wide range of creative ability in human life.

Key concepts in creativity research as it relates to instructional design

Creativity and problem solving

There are several points of emphasis in creativity literature that have special importance to the field of instructional design. First, there is a close connection between creativity and problem solving. Many creativity theorists include problem solving (or problem identification) in their definitions, descriptions or discussions of creativity (Csikszentmihalyi 1996; Feist 1999; Paulus and Brown 2003; Policastro and Gardner 1999; Root-Bernstein and Root-Bernstein 1999). Often experimental studies of creativity are essentially studies of performance in problem solving tasks (Runco and Sakamoto 1999). Theories of problem solving emphasize arriving at viable solutions by means of formal, step-by-step processes of reasoning (Bruning et al. 2010) or by heuristics (Polya 1945). However, the emphasis of creativity is on the possibility of finding novel solutions that expand the knowledge base of an individual, a community, or a domain. While not identical, the two constructs overlap. Problem solving may be more formulaic than creative and may occur without overtly creative processes; but problems in need of solving may be regarded as opportunities for creative work.

Stages of creativity

The second point of emphasis is that the creative process has been described as occurring in fairly recognizable stages. Originally proposed by Wallas (1954/1988), stages of creative thinking have not been completely verified by empirical means. However, they have been widely adopted by scholars, sometimes with minor variations (e.g., Csikszentmihalyi 1996; Lawson 1980; Penney et al. 2004). The stages are commonly described as Preparation, Problem Identification, Incubation (during which the creative task is set aside and allowed to 'simmer'), Illumination (the 'eureka' moment), and Elaboration/Verification (working out the details and developing the results). Everyday occurrences of creative thinking may not explicitly manifest these stages; however, eminent creators such as those studied by Csikszentmihalyi (1996) often reported such stages, particularly incubation, in their work on difficult problems. Relative to the level of expertise of an individual designer, it may be that less difficult problems simply engage an automated version of the cycle.

Enhancing creativity

The third point of emphasis is that efforts to enhance creativity, while difficult to prove successful (Nickerson 1999), can be fruitful to a degree. Attempts to do this have taken many forms, including providing incentives for creative ideas, facilitating favorable group interactions for creativity, modifying the social and/or physical environment to favor creativity, and training in creative thinking (Nickerson 1999; Scott et al. 2004). Many theorists believe that individuals' creative capacity can at least be optimized if not increased (Paulus and Brown 2003; Runco and Sakamoto 1999). An important part of optimizing creative performance is amelioration of factors that are known to hinder creativity, such as arbitrary rules regarding working conditions, expectation of one's work being evaluated, or the condition of being watched while one is working (Collins and Amabile 1999).

A review of 70 creativity training studies by Scott et al. (2004) presents a positive view of improving creative output. The studies measured results in terms of divergent thinking, problem solving, performance, and/or attitude and behavior. The authors found that "well-designed creativity training programs typically induce gains in performance with these effects generalizing across criteria, settings, and target populations" (p. 361). Notably, creativity gains were greatest when training content was domain-specific. That is, training to help people become more creative in general is less likely to be successful than training to help people become more creative in a particular domain. Also, studies with larger effect sizes tended to be those that taught specific cognitive skills associated with creativity such as problem identification, conceptual combination, idea generation, and idea evaluation.

Creativity and self-perception

The fourth point of emphasis about creativity is that there appears to be an important relationship between perceptions of self and creativity. Experimental studies reviewed by Runco and Sakamoto (1999) and Scott et al. (2004) suggest that how problems are presented and how performance expectations are discussed make a difference in creative output; the manner in which creative tasks are presented influences individuals' conception of their personal creative potential and, thereby, their creative performance. Perceptions of self in relation to creativity may be regarded as an important individual difference to consider among learners of professional skills such as instructional design. Heightened self-awareness hinders creativity in some contexts (Szymanski and Harkins 1992). However, this effect can apparently be moderated or even eliminated by setting up favorable self-performance expectations through the manner in which a creative task is introduced (Silvia and Phillips 2004).

Creativity and social context

While early research on creativity was predominantly the study of individual characteristics (see Albert and Runco 1999), the role played in creative work by group, social, and even cultural and historical contexts has increasingly been recognized (Csikszentmihalyi 1996; Paulus and Nijstad 2003; Simonton 1999, 2003; Sternberg and Lubart 1999; Williams and Yang 1999). The relevance of the social element in individual creativity is highlighted by a statement from Feldman (1999): "It is common to find that the unique form of a creator's work is forged within a small group of peers … The group is catalytic to the transformation of style and content" (p. 176). Creativity therefore may be viewed as occurring within a social system, not just within the individual. This is similar to a constructivist view of learning in which the social context is emphasized. "Creativity does not happen inside people's heads, but in the interaction between a person's thoughts and a socio-cultural context. It is a systemic rather than an individual phenomenon" (Csikszentmihalyi 1996, p. 23). This dynamic may be regarded as *situated* creativity, in which the whole collective performance can be greater than the sum of its parts (Dennis and Williams 2003; Hooker et al. 2003; Nemeth and Nemeth-Brown 2003).

Creativity within constraints

A final point to consider about creativity is that all creativity happens within constraints (Stokes 2006). Nelson and Stolterman (2003) have described the necessary 'framing judgment' that must be made about a design, discerning the scope of a project based on situational realities and design-oriented perception. This framing judgment "is used for defining and embracing the space of potential design outcomes. It is also used for forming the limits that define the conceptual container … it is used for determining what is to be included in the design process, and what lies beyond consideration" (p. 199). Just as physical boundaries are necessary for billiard balls to find the available paths to a chosen pocket, ideas must bounce off of conceptual boundaries in order to have definition and achieve direction. Knowing what lies beyond consideration, that is, the limits of scope, provides these boundaries, forming the container within which design and innovation must occur. It is clear that too much pressure or restriction can hinder the flow of creative ideas (Collins and Amabile 1999); however, creativity is not necessarily promoted by a casting-off of all constraints. Complete freedom can be a hindrance to creativity (Stokes 2006), but a reasonable amount of limitation and constraint can spur creative work forward.

Design, instructional design, and creativity

The topic of design has its own body of literature containing many ideas in common with the literature of creativity (e.g., Lawson 1980; Nelson and Stolterman 2003). Design has been proposed as a discipline in its own right that transcends multiple fields (Archer 1979) and entails a distinctive 'designerly' way of knowing (Cross 1982). Like creativity, design is concerned with "the conception and realization of new things" (Cross 1982, p. 221). The obvious affinity between creativity and design is developed in Nelson and Stolterman's book *The Design Way* (2003). "To come up with an idea, and to give form, structure and function to that idea, is at the core of design as a human activity" (p. 1).

The foregoing description of the design process bears some resemblance to the stages of creativity (Lawson 1980; Sternberg and Lubart 1999; Wallas 1954/1988), including the emergence of one or more seed ideas. Understood in this way, design might seem to be the same as creativity. However, the design perspective, as exemplified by Nelson and Stolterman (2003), treats creativity as a sub-component of the process of design, referring primarily to the seed idea, whereas design is conceived of as the holistic or inclusive term that encompasses multiple processes, such as interpretation and measurement, imagination and communication, and design judgment.

Design is thus seen as having a broader scope than most views of creativity. But creativity can be present in a wide range of designs large and small. Just as with Dewey's (1934) view of art, Nelson and Stolterman's view of the scope of design work encompasses all designs, with no distinction made between 'eminent' designers and the rest of the world. Any designer can be creative at some relative level, whether splendid or mundane, whether good or malevolent.

In view of this broad conception of design and creativity, the treatment of creativity in other specific design disciplines can serve as an example for instructional design. Fields in which this role is made explicit include engineering, architecture, and software design (Akin 1994; Blicblau and Steiner 1998; Court 1998; de Young 1996; Kelley and Hartfield 1996; Löwgren and Stolterman 2004; Smith and Tabor 1996). As one example, Court (1998) stated that "the need for engineering design students to understand that creativity is an important part of their educational development and also for a sound basis for their future role in industry has been well established" (p. 141).

According to Molenda et al. (2003), instructional design is "a construct that refers to the principles and procedures by which instructional materials, lessons, and whole systems can be developed in a consistent and reliable fashion" (p. 574). The most commonly used instructional design framework is based on a systems approach and is represented by ADDIE (Analysis, Design, Development, Implementation, and Evaluation). Other widely used process models such as that of Dick et al. (2008) and Smith and Ragan (2005), may be counted among the large family of ADDIE-related models (Gustafson and Branch 2002) that have been proposed over the last several decades. More recently, alternative models that attempt to convey a more constructivist set of assumptions have also been proposed. Notable examples of these include Willis and Wright (2000) and Shambaugh and Magliaro (2001). However, as Molenda and Boling (2008) point out, "models based on the systems approach are the most widely discussed and taught, and possibly, practiced" (p. 119). Publications such as *Instructional Design: The ADDIE Approach* (Branch 2009) suggest that ADDIE is still very much in use. In any case, none of these models include any specific mention of creativity.

The idea of systematizing the development of instruction had its roots in an era dominated by behaviorism; "the historical roots of much of what today is referred to as instructional design was Skinnerian psychology, especially as it was manifested in programmed instruction" (Dick 1995a, p. 5). Early behaviorists showed little interest in the study of creativity; and logically, specific attention to creativity is largely omitted in their descriptions of formalized instructional design processes. The constructivist-oriented models offered more recently represent a contrast to this way of thinking; constructivism implies a more holistic, learner-centered approach and one that acknowledges the importance of social contexts. However, epistemic perspectives such as constructivism are, at root, about how people learn and know; the concern of this writing is a specific perspective not of how people learn and know, but rather of how people design—how people design for the purpose of learning.

Instructional design as practiced by professionals today exhibits a high level of variability and complexity that is, in part, reflected in the large number of published models. In a qualitative study, Visscher-Voerman and Gustafson (2004) found no consistent patterns of design behavior among 24 professional instructional designers. Rowland (1993) noted that systematic approaches set forth in various instructional design models were contradicted by emerging knowledge about what instructional designers do in practice. He also characterized the instructional design process as involving both rational and creative processes. Similarly, in concluding a review of seven empirical studies and three case studies of the work of instructional designers, Kenney et al. (2005) observed that the focus of the research literature, while identifying certain non-traditional elements of the ID process, tends to be on "discrete roles and functions" (Discussion section, para 8), whereas the work that instructional designers do is "always about making judgments about design situations that are complex, rich, and replete with tensions and contradictions" (Discussion section, para 10).

Discussions of the scientific approach versus the 'craft' or 'artistic' approach to instructional design have appeared from time to time in the literature (Clark and Estes 1998; Heinich 1984; Hokanson and Miller 2009; Reigeluth et al. 1978), perhaps reflecting a recognition of the need for more divergent approaches to design. In a parallel field, Wroblewski (1991) argued the need for a more craft-oriented approach to software design and development, recognizing the need to address complex contexts. This highlights an important distinction between "routine designing," the rational solution of comparatively simple problems, versus a non-routine process as called for by complex problems requiring creative solutions. Schön (1983, 1987), Visscher-Voerman and Gustafson (2004), and Gero (1996) all note a need for a higher order, more expert application of design skills to resolve problems beyond the 'technical rationality' of a rigid process.

The instructional design profession has also come under criticism periodically from educators who claim that the process by its nature tends to produce unimaginative training products, resulting in boredom for learners. "Used as directed, it produces bad solutions" (Gordon and Zemke 2000, p. 42). Dick (1995a, b) defended instructional design by arguing that common practice among professionals who use the models is not rigid and was never intended to be. Gustafson and Branch (2002) expressed a similar underlying assumption in their review of models. However, other writers have contended that instructional design models ignore creativity (Caropreso and Couch 1996; Rowland 1995), and that creativity needs to be fostered among instructional designers apart from the instructional design models themselves (Caropreso and Couch 1996). Rowland observed that "… current ID models do not adequately reflect or support design processes, but do serve important pedagogical, communication, and management functions" (1993, p. 90). More recent constructivist ID models may do a much better job of reflecting and supporting high-level, flexible design processes but they typically do not attempt to address creativity explicitly (e.g., Shambaugh and Magliaro 2001; Willis and Wright 2000). Other voices calling for instructional design work to be done more creatively have included Alessi and Trollip (2001), Luppicini (2003), Hokanson and Miller (2009), Honebein (2009), and Conole et al. (2008).

One recent and notable acknowledgement of the role of creativity in instructional design is the choice of the term *create* in the 2008 AECT definition of the field, and the corresponding *Creating* chapter (Molenda and Boling 2008) in the Educational Technology definition book (Januszewski and Molenda 2008). The chapter provides an extensive survey of historical, conceptual, and pragmatic issues relating to creating instructional media, including the systems approach but also various alternative approaches and concepts of design. The chapter does not, however, bring creativity literature to bear on instructional design nor address the essential need to foster creative ideas within the design process.

In addition to the practice of instructional design, the preparation of new instructional designers inevitably involves learning and practicing one or more of the models, and thus, by omission, creativity tends to be devalued and not developed. However, some attempts to foster creativity in the training of designers may be found in various "design studio" efforts, for example, Boling (2006), and Clinton and Rieber (2010). Tripp (1994) and Richey et al. (2001) also acknowledged the need for creative processes to be included in concepts of what instructional designers do. Sources such as these indicate awareness in the field that creativity has a role to play in instructional design, and that this role should be highlighted in the training of new designers.

In spite of the increased interest in creativity discussed above, a review of recent instructional technology literature presents only one research report that specifically addresses the role of creativity in the work of instructional designers (West and Hannafin 2010; see the discussion of group creativity in the concluding section of this article). Moreover, as we have seen, creativity is rarely formally acknowledged in models of instructional design, despite its recognized value in parallel design fields such as architecture, industrial design, and fashion design. What is needed is to find meaningful ways to formally and explicitly conceptualize this need in a manner that is specific to our field.

Visualizing the role of creativity in instructional design

One might ask what an instructional design model that includes creativity might look like. First, it may be helpful to highlight the purpose of models. Norman (1983) distinguished between the role of conceptual models of systems and the user's own mental models. "As teachers, it is our duty to develop conceptual models that will aid the learner to develop adequate and appropriate mental models" (p. 14). Thus one of the purposes of conceptual models is to influence the mental models of those who study or learn. This is in one sense a summing up of all that we do in education—we present a seemingly endless stream of conceptual models to learners in order to make a lasting impression on their internal mental models of the world around them. Putting a conceptual model before the minds of designers is therefore no idle exercise—the conceptual models designers use affect their design process and the results of their work. Using a model, or series of models, that excludes creativity generates an understanding of instructional design devoid of an explicit expectation of creativity.

A recent example of a creativity-oriented instructional design model in the literature is Hokanson and Miller (2009). Their Role-Based Design (RBD) model, presented in Fig. 1, is a non-linear representation of four archetypal approaches to design that can be applied as needed to various aspects of instructional design behavior. The archetypes are the artist, architect, engineer, and craftsperson. In general terms, the artist brings a divergent, idea-oriented approach; the architect seeks holistic solutions; the engineer proceeds with scientific precision, and the craftsperson carefully shepherds a process as it evolves towards its conclusion.

> While every metaphor is not an exact match, we seek to apply to instructional design the best qualities from each profession. For example, complementary to the artist's divergent worldview is the convergent and research based understanding of the engineer. … Each role, from the creativity of the artist, to the care and completion of the craftsperson, is critical at some point in the process; each serves as check and balance for the other roles. (Hokanson and Miller 2009, p. 23)

Hokanson and Miller's (2009) RBD model challenges instructional designers to tap into the broad range of 'designerly' kinds of thinking (Cross 1982) with a view to generating creative ideas as well as to successful completion of the necessary tasks of design. Similarly, the DCL model offered in this article is a conceptual model for thinking about the role of creativity. Concepts in this model are drawn from various processes that may occur during instructional design and development. Originally developed as part of the first author's doctoral dissertation work (Clinton 2005, 2007), the DCL model is not meant to be prescriptive in terms of application to instructional design practice, but descriptive, oriented to influence the overall paradigm of instructional design. Toward this end, we are mindful of the prevalence of systems-oriented representations of instructional design and that "the common denominator of most ISD models is the logical progression from

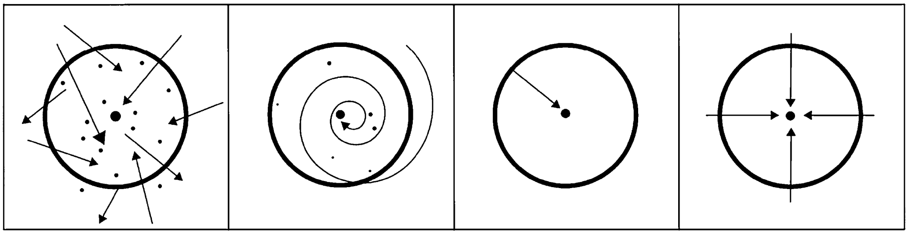

Fig. 1 The Role-Based Design model (Hokanson and Miller 2009). L-R artist, architect, engineer, craftsperson

analysis to design, to development, to implementation, to evaluation in an iterative cycle" (Molenda and Boling 2008, p. 129). Therefore, in the DCL model the systems-based ADDIE framework is used to represent generic processes of instructional design and development. The operations of creativity are described as an overlay in the context of design processes assumed to be at work in most, if not all, models and field processes, regardless of the underlying framework. This is important because regardless of whether a model is perceived as being more linear and less flexible, or less linear and more flexible (requiring more autonomy and responsibility on the part of the designer), the iterative nature of design is essentially the same; the need to include an explicit expectation of creative thinking is still present.

The first way we can try to conceive of a creativity-friendly instructional design model is to think of the designer's creative mindset as an "envelope" or contextual wrap that should surround the entire process. Instructional designers should approach their work with an openness to novel but useful ideas, as is called for in the instructional design competencies outlined by Richey et al. (2001). They may find such ideas being generated throughout the design process. This is similar to the global assumption of idea generation in the RBD model (Hokanson and Miller 2009).

Jonassen (2000) described design problems as "usually among the most complex and ill-structured kinds of problems that are encountered in practice" (p. 80). In writing about design problems he did not discuss creativity explicitly, but the language he used is very similar to the language of theories of creativity. Were they structured or simple problems, convergent means of solving problems would suffice for their solution (Gero 2002). Obviously, design is more than a series of structured problems, more than a direct application of technical skill. Within the design process, there are ill-structured aspects that demand the regular application of creativity.

The solving of design problems may therefore be regarded as an overlap point between problem solving and creativity, or, put another way, a type of task in which theorists' association of creativity and problem solving is substantiated (Feist 1999; Root-Bernstein and Root-Bernstein 1999). The difference in creative opportunity between a tactical design task and a strategic design problem may be one of scale, as each involves the generation of ideas at some level. Design requires both an over-arching idea or vision (Löwgren and Stolterman 2004) and the smaller scale application of creativity in a wide range of supporting design tasks. These design problems/tasks, then, present opportunities for creative thinking to occur. Nelson and Stolterman (2003) say the design process may involve a 'drizzle' of multiple, smaller creative ideas that can add up to the larger design conception.

One can visualize this as a cycle that involves the stages of creative thinking (Lawson 1980; Penney et al. 2004; Wallas 1954/1988). A designer's processing of design problems may be viewed as "opportunistic excursions" (Tripp 1994, p. 117) that permeate almost the entire instructional design process. Scholars in other disciplines have described designing as a looping, iterative process, which is a rapid, ongoing, and repeated sequence of analysis, synthesis, and evaluation (McNeill and Gero 1998) or examining, drawing, and thinking (Akin and Lin 1995). However, we prefer to visualize the cycle as a creative cycle, implying the possible emergence of ideas that are not only useful but also novel at some level.

We call this cycle Design/Creativity Loops. Since the creative process is made possible not only by personal creative ability but also by professional skills and expertise that have been built up over time, many of these excursions may occur in an automated fashion, such that the individual stages of the process may not be apparent. The looping process is nonetheless present. Figure 2 illustrates this cycle. Note that illumination is shown in

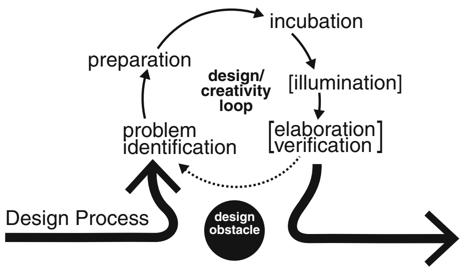

Fig. 2 Design/Creativity Loop

brackets; this is a way of signifying that the cycle does not lead to illumination in every iteration or in every case. A mental loop spawned by a design obstacle may itself have multiple iterations and may ultimately lead to identifying known solutions instead of new solutions. Review of previous cases in solving instructional design problems (Bennett 2009; Boling 2010) can be a source of the needed insight. However, the abundance of these excursions in the overall instructional design process means that the likelihood of entirely new (or relatively new) ideas emerging along the way can be viewed as more than a polite abstraction.

Building on these two ideas, the creativity envelope and the design/creativity loop, one can then re-conceive the full ADDIE instructional design framework in an overlay model that acknowledges the importance of creativity. On the macro level, one sees that the creativity envelope ideally surrounds the entire process. On the micro level, a 'magnifying glass view' into any of the overlapping phases presents a continuous fabric of various design/creativity loops. Figure 3 shows the DCL model consisting of the ADDIE framework with the overlay of the creativity envelope and 'magnifying glass view.'

Every instructional design model, no matter how complex, is an oversimplification of real-life instructional design work conducted by complex human participants in complex contexts. The simple conceptual model offered here is no exception. However, the point of the model is that, to the extent that an instructional designer may be confronted with the next task or design problem in a project (Jonassen 2000), these tasks or problems may be regarded as opportunities for creative work.

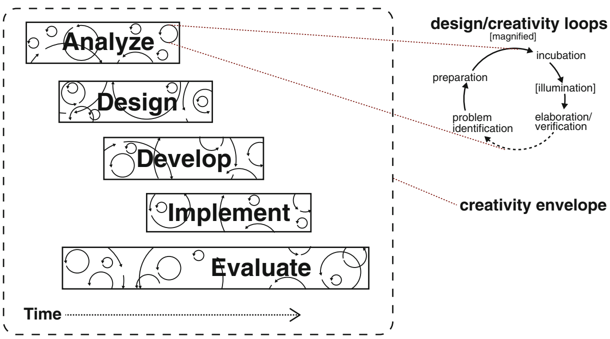

Fig. 3 Design/Creativity Loops model. ADDIE with creativity envelope and "magnifying glass" view. *Note* ADDIE framework adapted from Hill (1998)

How an emphasis on creativity can benefit instructional design

Part of the 'ecology' of an instructional design environment is the common language, symbols, values, and creative processes shared by the members of that environment. These include the conceptual models of instructional design and development that have been adopted and used by leaders as they communicate about projects. The symbolic power of these conceptual models, as discussed above, lies in their ability to influence the mental models of those who use them (Norman 1983).

As noted above, studies of creativity have indeed suggested that the manner in which creative tasks are framed influences individuals' view of their creative potential and, thereby, their creative output (Silvia and Phillips 2004; Szymanski and Harkins 1992). Even the simple instruction to "be creative" may have a facilitative effect toward creative responses (Chen et al. 2005).

Given that creative output can be influenced by the above factors, it is reasonable to conclude that engaging designers in an internal and external dialogue about creativity can help promote creative outcomes. Supportive environments, either in the workplace or in training, can be created in which the role of creativity is conceptualized and this dialogue is fostered. Simply put: thinking about being creative appears to increase the chances that creative ideas will occur. If one's mental model of instructional design and development work has been influenced by conceptual models that emphasize creative possibilities, then this greater anticipation of creative possibilities in the mind of the designer can reasonably be expected to result in an increased occurrence of innovative ideas. Moreover, this possibility holds whether one considers the various components of design found in the ADDIE framework or one moves to more flexible approaches to ID.

It is not difficult to imagine how more divergent thinking, insightful problem identification, or evaluative thinking can benefit the various aspects of instructional design and development as represented by the ADDIE framework. The iterative, largely non-linear process of design, even when conceptualized within a linear framework such as ADDIE, offers a series of choices to be made and alternatives to be proposed.

First, in analysis-related activities, an understanding of context, goals, tasks, the learners, and other aspects of the project must be developed. While these initial phases of the project deal substantially with gathering of essential information, it is here that the design problem is defined and the initial vision for the project evolves (Löwgren and Stolterman 2004). Designing is "the process by which we define the decision to be made, the ends to be achieved, the means which may be chosen" (Schön 1983, p. 40), and this is engaged through the analysis phase. Creative ways of looking at information and defining project characteristics can occur within the analysis phase. Here, the "problem-space" of the project is defined (Cross 1997; Gero 1996), describing the nature and extent of the work, and at the same time presenting the constraints that mold any client-driven work.

Projects typically come with budget constraints, logistical constraints, environmental constraints, learner-need constraints, and other limitations—all of which can be carefully analyzed and codified to form a prescribed 'box' into which the instruction must fit. Finding room for innovative ideas or for artistic finesse within these systematically identified parameters can be very challenging. Designers who are inclined to look for more creative possibilities in their work, who may chafe at times under the constraints of a given project, may find it helpful to view the boundaries of the systematic process as the crucible, the place of pressure that can cause ideas to interact with each other in new ways (Nelson and Stolterman 2003; Stokes 2006). Such a perspective may help to ensure that designers continue to seek creative ideas while respecting the systematic design process and remaining faithful to project goals. This, however, is the nature of design, to seek understanding of the problem space and to challenge and extend the *solution* space.

In the design phase, many decisions are made about materials and media, and how to deliver the instruction. This aspect of ID has perhaps the closest affinity to what has been called the 'artistic' or 'craft' approach, since designers can actually devise specific instructional strategies and make aesthetic decisions. Here there is a golden opportunity for divergent thinking, with many possible ways to conceive of the presentation of content. For example, how should the first event of instruction—gaining learner attention—be accomplished? Novelty is the quintessential device for gaining attention, and is part and parcel with creativity. Perhaps there is a metaphor, for example, that ties in with the theme of the instruction that can be used in some new and unexpected way.

In development activities, problem identification and divergent thinking can facilitate bringing the instructional materials to life. Many problems are typically encountered during development. The field of software development often employs a creative craft-like approach to project completion, recognizing the difficulty of completing complex projects from a pragmatically remote viewpoint (Wroblewski 1991). Context-driven adjustments to projects are often found to be necessary, requiring customization of the work. As one specific example, at the first author's university an instructional development team was planning to leave the skip-ahead button undefined in an entire instructional DVD product, simply because individual video clips were too short to need scene markers and were accessed separately through intervening menus. If there is no next scene, there is nothing to skip ahead to; users were forced to wait for each video to play in full, and team members viewed this as coming with the territory of DVD technology. The situation seemed on its way to becoming a feature of the final product until one team member thought of a simple way to trick the DVD system into doing what the user would want: developers placed a 'phantom' scene marker ten frames in advance of the end of each video clip. The result: the user clicks to skip ahead (if desired), the last frames of the current clip play unnoticed, and the end of the clip activates the function that calls up the appropriate menu. A problem specific to the development phase met its solution via an idea that was new to the team, to the benefit of end users.

Regarding implementation, one might think that all decisions have been made at this point, so no room for creativity is left. However, implementation of instruction is never without human input, whether in management of a Web-based self-study instructional system or in delivery of stand-up instruction. Decisions and designs must be made about how instruction is offered, how learners are recruited, whether or not the instruction should be bundled with other courseware, and how to manage the logistics of instruction. All of these choices have the potential to be enhanced by creative thinking. This is another point where the "craft" of instructional design comes into play, addressing as needed and in context the details of any implementation.

Finally, in evaluation, creativity may be employed to develop means to assess the overall effectiveness of instruction, track learner performance, and manage the assessment over time. There is a sense in which evaluation affords more freedom, because accomplishing instructional goals is the business of the other phases of the project. In many cases, evaluation is treated as an afterthought, with little impact on project success. However, when formative evaluation processes are integrated into the overall project, it is here that adjustments can be made to successfully conclude projects and an understanding can be developed to improve future work. Evaluation must be designed. Creatively assessing the impact of the design work can examine outcomes beyond simple learning imperatives such as retention, and could examine changes in teaching, learning, or behavior that have significant educational impact.

In more constructivist approaches to ID, the elements of analysis, design, development, implementation, and evaluation still occur in one or another form and have the same potential to benefit from an emphasis on creative thinking. However, since designers are called upon to take a more open-ended approach to all aspects of the process, they must adjust to greater levels of uncertainty. In the R2D2 model of Willis and Wright (2000), for example, it is considered a mistake to identify the instructional objectives early in the process. All aspects of analysis, framing of content, and design and development are approached as open sets of possibilities, subject to a recursive, reflective, and participatory process of consideration throughout the project. Such an approach may amplify the opportunities for creative ideas to emerge, as an element of the project that was mostly completed at point B remains open for reconsideration at point E after new perspectives and resources have had time to emerge. Perhaps, for instance, there is an idea for connecting with the target audience and obtaining better data on their needs, such as a particular way of using social networking tools, that had not emerged early in the project but could now help confirm the content delivery medium most likely to be effective. Even with more flexible approaches to ID, however, fostering an openness to creative ideas remains challenging because designers tend to become vested in the design decisions that have already been made and can be reluctant to change course.

Exploring the relationship: suggested research

Further study of professional instructional design practice

Studies of what professional instructional designers do have tended to focus on discreet roles and functions rather than on the creative energies devoted to solving complex design problems (Kenney et al. (2005)). Studies need to be conducted that could illuminate the role of creativity in the work of instructional designers and, if possible, provide evidence regarding the patterns of thought described in the DCL model. One aspect of the work of professionals that stands out clearly in the Visscher-Voerman and Gustafson (2004) study is that different designers work very differently. Also, the Visscher-Voerman and Gustafson study is notable in regard to creativity because the authors identify an 'artistic' paradigm or world-view that may lie behind the work of some professional designers. However, none of the 24 designers studied by Visscher-Voerman and Gustafson had adopted the artistic paradigm as described by the researchers. Further ethnographic studies might be conducted that seek out such 'artistic' instructional designers and describe the thought processes in their work. In addition to the 'artistic' mindset, the other roles proposed in the RBD model (Hokanson and Miller 2009)—architect, craftsperson, and engineer—could also be explored by this means. Current students and practitioners of instructional design need to be made aware that professional role models exist who recognize and move in these various roles.

Creative self-awareness

Ethnographic studies of professional designers could also include an examination of the degree to which instructional designers are self-conscious or self-confident about the creative aspect of their work. Self-efficacy theory (Bandura 1986) has been used as a frame of reference for studying creative self-awareness among gifted children (Schack 1989) as well as adults (Abbott 2010; Mathisen and Bronnick 2009). Research is also needed regarding creative self-awareness for students of instructional design, and about how these perceptions interact with their learning and performance on their projects. Further literature review and research could be conducted to apply a theory of creative self-efficacy to professional instructional design practice, and to evaluate ways that students with low creative self-efficacy can be best served in instructional design and development training programs.

Domain-specific training of instructional designers in creative thinking

The literature review of Scott et al. (2004) suggests that the most successful creativity training efforts are those that: (a) are specific to the domain of interest; and (b) teach specific creativity-related cognitive techniques. With these criteria in mind, studies could be devised that add creativity training to the experience of instructional design and development teams. Exercises could be conducted within the context of project work that promote a general openness to new ideas, explicate and foster discussion of the stages of creative thinking as represented in the DCL model, and train designers in cognitive skills such as problem identification, information gathering, conceptual combination, idea generation, and evaluative thinking. These exercises could be evaluated as to their effect on immediate creative output as well as on project outcomes. From the perspective of the DCL model, the desired effect of this training would be an increase in the number of the design problem loops that are allowed to metamorphose into creative loops, resulting in new ideas that prove useful to project goals. If successful, such a study could provide a basic level of validation for the model (though see Willis and Wright 2000, on the shortcomings of any expectation that an ID model can be “proven”).

Situated (group) creativity

Just as communities of practice foster social growth and skill acquisition, communities of practice can also foster creative work (Hooker et al. 2003). The same can be said of small circles of friends or professional associates. If all creative work is viewed as a product of the social context as much as the individual (Csikszentmihalyi 1996), the same ‘creativity envelope’ proposed above for individual designers—the mindset open to creativity—can surround not only training programs but also professional design teams. This openness paves the way not just for individual creativity within the group but also for the synergy of ‘situated creativity’ in which the flow of ideas of the whole team is enhanced beyond the sum of the individuals. This remains a broad area for future research; for example, Paulus and Nijstad (2003) urged an agenda to examine creativity within groups that included examinations of interactions between individuals, group dynamics, and the environment and conditions of group work.

A helpful step toward understanding group creativity among instructional design teams has been conducted in a dissertation study by West (2009; West and Hannafin 2010). Working from a framework for understanding innovation within communities (2009), he conducted four qualitative case studies within a graduate level “design studio” setting (Clinton and Rieber 2010). West documented the emergence of important design ideas within dynamic instructional design team interactions and found, among other findings, that individual autonomy and constructive, non-judgmental critiques were among the critical factors contributing to a sense of a community of innovation. However, many questions remained unanswered regarding issues such as group flow in relation to innovation, balance between individual autonomy and structure, and how knowledge and expertise are built up within a community of innovation. Further studies along these lines could address these and other group creativity questions that are specific to instructional design teams. For example, it would be helpful for project managers to know whether and how the use of a model of creative instructional design could foster creative output across all roles in the team, especially in view of the very different nature of the typical roles, including lead instructional designer, lead evaluator, lead graphic designer, lead programmer, and so forth.

Conclusion

Interest in creativity as a necessary component of instructional design has been gaining momentum. Creativity literature, instructional design literature, and literature from other design fields contribute to basic concepts of the role of creativity in instructional design. A visual model of creative instructional design such as the DCL model serves as a way of conceptualizing this role and fostering this understanding among both professional designers and students of instructional design. While there are many potential benefits of adopting such a model, more understanding is still needed, and there are several avenues of research that could contribute to this understanding.

As the field of instructional technology continues to grow and develop, it benefits from the advance of knowledge in all related fields. At the present day, studies of creativity appear to have finally moved into the mainstream of psychological study as well as educational theory and practice. Now is an opportune time for the field of instructional technology, and the profession of instructional design specifically, to fully embrace this emphasis on creativity. Creative work in instructional design and development projects is a positive force that can contribute to the success of instructional products and applications in the educational and corporate marketplace; more importantly, it can enhance the lives of learners.

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Gregory Clinton is a full-time lecturer and coordinator of Instructional Design and Development in the Learning, Design, and Technology program at the University of Georgia. His teaching duties encompass a variety of graduate courses in instructional design and development as well as school library media.

Brad Hokanson is Professor and Associate Dean for Research and Outreach in the College of Design at the University of Minnesota. He is also a Registered Architect in the State of Minnesota.