11

Role-Based Design

Editor's Note: Hokanson, B., & Miller, C. (2009). Role-Based Design: "A Contemporary Framework for Innovation and Creativity in Instructional Design". *Educational Technology, 49*(2), 21-28.
This is the first in a series of four articles presenting a new outlook on the process of instructional design. Along with offering an improvement to current practice, the goal is to stimulate discussion about the role of designers, and more importantly, about the nature of the process of instructional design. The authors present in this article a brief overview of current instructional design processes and an illustration of a contemporary framework for design created to foster innovation and creativity throughout the instructional design process.

Introduction

Current practice in instructional design is focused on generic descriptions of phases, rather than the nature of people and philosophical values (e.g., Hoadley & Cox, in press; Silber, 2007; Visscher-Voerman & Gustafson, 2004). Most design processes followed in the field are derivations of the same sequential models often referred to as "ADDIE"—Analysis, Design, Development, Implementation, Evaluation. These processes tend to concentrate on the completion of technological and pedagogical requirements rather than on the quality of the learning experience or innovation. We contend that much of the shorfall in advancing education with technology is due to a limiting design process that centers on *completing the work*, with only incremental increases in production and educational efficiency.

Although we do not necessarily share the unenthusiastic and somewhat pessimistic expectations about technology and education (Zemsky & Massy, 2004), we do believe that educational technology, as is currently used, would benefit from a substantial infusion of creative, innovative, and artistic ideas. Often restricted by rigorous and sequential design processes, the current practice of instructional design has experienced only limited improvement over the years. A change in process is needed from the early phases of conceptualization through the final steps of production and integration. This will require a reshaping of the processes and models of instructional design to challenge our philosophy and help shape our designs.

We propose the exploration of an idea that will help encourage substantial innovation in instructional design, a design process that focuses on context and design qualities, on aesthetics and creativity, and one which is based on the *roles* a designer must play, as part of a complete design process.

Design Processes, Methods, and Frameworks: A Brief Critique

Jonassen (2006) holds that instructional design is historically regarded as a linear series of steps and phases that constructs models and processes "based on principles that are applied uniformly to all contexts," leading to the conclusion explaining why "instructional design is so seldom successful" (p. 26). Ultimately, we agree. A design process that is linear, constrained, and separated from context is limited in its potential. In contrast, current educational theory urges new teachers to be holistic and creatively adjust to classroom and societal change; educational challenges are

urged to be authentic and innovative. In parallel, our instructional design process should employ these same values: creativity, innovativeness, and authenticity, as well as an understanding of the contemporary research ideas of the field.

Our concern centers on defining how the work of design is addressed: Is the work one of dealing with well-structured problems, those that can be simply and convergently answered through an algorithm or codified process? Or, is the work of (instructional) design focused on divergent problems,[1] those that are ill-structured, or wicked problems which seek solutions, but have no single answer? We contend the problems of instructional design are complex and are not well addressed by simple algorithmic processes.

Algorithms are valuable in that they are step-by-step means of reaching generally reproducible results. They are codified means of production, and, we argue, this is the essence of ADDIE in the design process. ADDIE, like most other algorithms, seeks an anticipated solution, a single answer that all designers can achieve, and one which is context and participant independent.

Algorithms do have value in a knowledge-based society: Moldoveanu & Martin (2008) describe the modern use of algorithms as one reason, combined with technological computing, for the advances in late 20th century thought:

> *The power of the algorithm lies precisely in the fact that it makes efficient the translation of knowledge into action. As knowledge structures progress in levels of precision and specificity, from pictures to heuristics to theories to models to algorithms, they also become more easily translatable into predictable, output oriented, behavioral patterns or routines. Not surprisingly, the development of algorithmic agents—both human and artificial—has been a natural outgrowth of the recognition of the power and use of the algorithm and a key driver of the decreasing marginal value of algorithmic tasks and skills. (p. 40)*

Heuristics, in contrast, are guidelines or "informal judgmental rules" (Lenat, 1983, p. 243). More complex tasks, particularly those described as 'ill-structured' or 'wicked,' cannot be addressed through a codified sequence of steps or sub-routines. Larger, more value-based guidelines or heuristics must be employed to analyze, understand, and resolve these problems. Heuristics are generalizable in their flexibility and recognition of the complexity of problems. Moreover, heuristics are often embedded in the values and experiences of designers as a tacit form of knowing (Cross, 1982; Lawson, 2004).

The ADDIE Paradigm

Within the field of instructional design, the term ADDIE is used to describe generally the design process and to structure formally the work of designers into a sequence of steps leading to a completed design. ADDIE, as noted above, consists of five phases (i.e., analysis, design, development, implementation, and evaluation) and appears to be a formalization of vernacular design practices in the field of instructional design, with a wide variety of minor variations to the process in existence (Molenda, 2003). It is comparable to a wide range of design processes in other fields; for example, Osborn's Creative Problem Solving model of 1953.

Over recent years, a wide variation in design processes has been documented in the field of instructional design. Many in-depth explorations of these design methods are readily available (cf., Becker, 2007; Jonassen, 2006; Visscher-Voerman & Gustafson, 2004). "At least a dozen authors have variations of this basic theme with 4-10 stages that portray design linearly as a progression from the less determined exploratory work to the more constrained final production of designs" (Hoadley *&* Cox, in press). It is not our intent here to re-evaluate the historic and current fluctuations of models and processes in our field. Rather, we begin by sharing a selection of frameworks that we believe provide fresh perspectives for designers fatigued from sifting through antiquated and weathered design processes that do little more than present the phases of ADDIE with creative new titles. Furthermore, it is important to note that it is not our attempt to build these models up for failure, casting them as strawmen in an attempt to illustrate prospective benefits of a contemporary design approach and supplant the existing landscape. Therefore, we will not disassemble and evaluate each process or model individually, but rather expand upon what we believe to be a general shortcoming in relation to fostering creativity and innovation in instructional design. Ultimately, we conclude, with Becker, that most instructional

design models "…are far from new, the processes have been given a 'new coat of paint' and formal names, and so are treated as new ideas" (2007, p. 88).

Jonassen's Iterative Model

Jonassen (2006) describes instructional design as "most often a cyclical process of decision-making based upon constraint satisfaction that is modified by personal or corporate beliefs and biases" (p. 26). In Jonassen's Iterative Design Model, after conceptualizing the initial constraints and functional specifications of the project, the designer embarks on repeated sets of decisions closing in on the design solution. During each phase of the process, the role of the designer is to satisfy emerging and dynamic constraints in order to advance holistic understanding of the problem and context. Hoadley and Cox (in press) characterize "good" design as iterative by definition, using a constant cycle of improvement and feedback. Likewise, Jonassen's process can be described as a convergent spiral toward a successful design solution.

To ensure successful design work, Jonassen argues that designers must "address the constraints imposed by the context" (p. 26) through employing an iterative, cyclical series of decision-making processes with the goal of design to *satisfice*[2] rather than optimize. This model, while it is rooted in the basic ADDIE structure, begins to dissolve some of the rigid, sequential steps of previous forms.

Kirschner's Six-Stage Model of Interaction Design

Kirschner's model of interaction design continues this interactive and reflective process through a series of phase-based questions. Interaction Design is a discipline focused on creating useful and engaging experiences that appeal to and benefit the user (Kirschner, Strijbos, Kreijns, & Beers, 2004) and is a framework specifically anchored in utility, usability, and aesthetics. Whereas utility is defined as the array of functions and features incorporated by a system (i.e., the tools present in the software that satisfy the outlined requirements), usability is concerned with the effectiveness, efficiency, and satisfaction with which learners can accomplish a set of tasks. Distinct from instructional design, the field of interaction design is also concerned with aesthetics and, more precisely, how the design appeals to and benefits users.

To foster acceptance of the utility, usability, and aesthetics equilibrium desired in interaction design, Kirschner *et al.* (2004) introduced the six-stage model of interaction design. Using this method, designers challenge themselves with a series of questions throughout the process to further understanding of the problem. Initially, designers must explore the realistic actions and needs of learners in order to identify areas of potential support and pinpoint constraints (i.e., physical, logical, and cultural) that will ultimately shape the final design. Once the design has been implemented, designers explore how the solution is perceived and used by learners in an authentic context. The process concludes with an investigation and description of what learning has actually been achieved through use of the design.

The process relies heavily on an integrated system of questions that apply values to a standardized design sequence. Similarly, Silber (2007) examined the instructional design process and advocated for a principle-based design process. Although we believe these efforts represent a fresh course for the field, we contend that the inherent values of the system should be more overt, and specifically integrated into the roles of the design participants, instead of simply part of their adopted activities; they must *become* designers.

Ten Faces of Innovation

In what we believe was a sizeable stride forward in this direction for creative processes, Kelley & Littman (2005) presented ten roles that designers and design teams can use to foster creativity and innovation. Their roles include the anthropologist, the experimenter, the cross-pollinator, the hurdler, the collaborator, the director, the experience architect, the set designer, the caregiver, and the storyteller. From contributing insights by observing human behavior (i.e., the *anthropologist),* to bringing people together to get the job done (i.e., the *collaborator),* to generating persuasive stories relative to context (i.e., the *storyteller),* Kelley & Littman's ten players illustrate a unique set of values, beliefs, characteristics, skills, and attributes that a design team should embrace when attempting to design innovative solutions

for the contemporary marketplace. Most importantly, their design framework focuses on the type of designers needed to harness a successful and innovative project, rather than a series of phases, processes, and models that describe how such a project might evolve; in essence, successful innovation stems from *people, not processes.*

Role-Based Design

We believe the process of instructional design is in need of foundational transformation, from one of following a codified algorithm to a new way of designing that uses specific roles to define project values, responsibilities, and activities. In our description of Role-Based Design, we present a series of archetypes, that is, a selection of real professions which are applicable perspectives for professional behavior in instructional design. We describe an instructional design process that includes the ***artist***, the ***architect***, the ***engineer***, and the ***craftsperson***. These are professions and descriptors that are well known to all in society.

As archetypes, these selected roles are exemplars of behavior and practice, personifications of value sets and philosophies, and are infused throughout a design project. "These values may not yield a specific chronological progression of stages, but instead may manifest in a stance that is taken in all the activities in design" (Hoadley & Cox, in press). 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 world view is the convergent and research based understanding of the engineer.

Each of the four roles (see Figure 1*)* will be presented here in the general order of a design process; each role, in turn, leading the project and applying their own values and expertise. For example, the artist explores creative ideas for a project; the architect examines the challenges and context of the problem from a systemic and strategic viewpoint; the engineer applies scientifically based logic to the development and integration of the solution; and the craftsperson invests fine attention to detail and aesthetic discipline to the execution and production of the design.

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. At the same time, each exemplar participates throughout the design process. Role-Based Design is both sequential and concurrent—the craftsman bringing the artist back to earth while understanding the creative nature of the work; the architect reminding the engineer of the broader and aesthetic needs of the project. Each role is constant and integrated into the entire process, not taking the lead all the time, but present and engaged throughout.

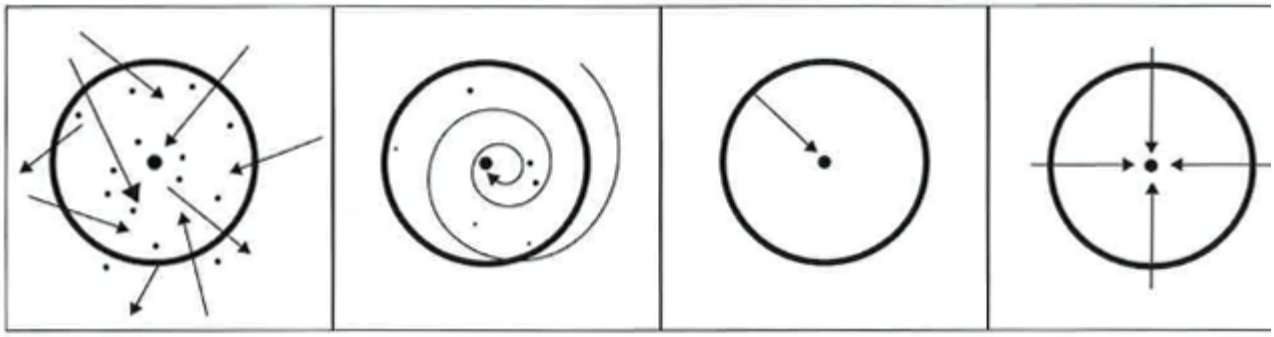

Figure 1. Role-Based Design: The four roles of Artist, Architect, Engineer, and Craftsperson are represented visually through a series of problem spaces (the outer circles) and potential solutions (the inner dots). The various arrow-tipped lines depict how each role explores the problem space to design and implements a solution (or solutions); these will be discussed in greater detail throughout the following sections and in subsequent articles in this series.

The Instructional Artist (Playful Experimentation)

In many design projects, under time or budget constraints, a single driving concept is selected very early in the process and essentially "passed down through the ranks." These preconceived, but well-tested, ideas are often built from experience and used without the rigor of a challenging design process.

We believe successful design processes require a dedicated period of experimentation, of development of divergent and unusual ideas, and the ability to embrace failure as a means to innovation. In short, the instructional designer must also work as an artist. A corporate credo of IDEO, a highly successful design firm, is "Fail early, fail often" (Kelley & Littman, 2005, p. 52). IDEO's corporate culture has embraced the role of the iconoclast artist in their work; creativity by definition differs from the norm.

Artists often begin their practice with a skill in their chosen medium, from drawing to painting to digital interactivity; similarly, many in the field of instructional design begin with a skillset in electronic media development. Artists are advocates for user/viewer experiences and aesthetics, both areas with vast potential for improvement in the field instructional design. Artists often have a high level of creativity, and in many cases work outside of mainstream society. Furthermore, artists embrace unexpected results, uniqueness, and, at times, the disturbance of the status quo. The goal is to advance the understanding and development of new ideas and not necessarily to complete a finished product. In most cases the artist works without a client or direct patron, independently advancing the work.

In Role-Based Design, the *instructional artist* (see Figure 2*)* is responsible for stimulating divergent thinking both at the beginning and throughout the project, for advocating aesthetic qualities on a continuous basis, and as the "what if" person on the design team. As an educational explorer, the artist uses instructional challenges as stimuli to explore media and their potential affordances. Self-criticism plays a significant role in the thought pattern of the instructional artist, hoping to better understand one's self and the design challenge. Within instructional design, this phase would allow for an exploration of ideas that could prove unsuccessful, but could also lead to innovative leaps. Accepting greater risk in the design process, the wager is to gain substantial increases in the value of design work.

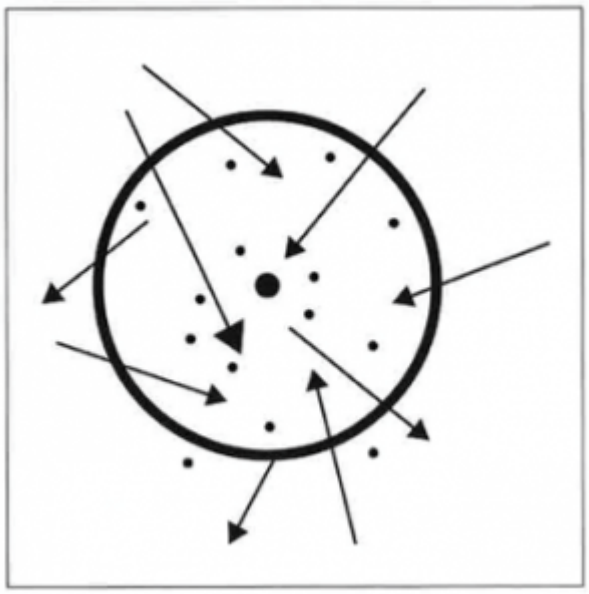

Figure 2. The artist explores all facets of the problem space by starting within and outside early problem specifications and context. Ultimately, many solutions, some potentially successful and some potentially detrimental, are explored and generated through an open-ended, dynamic process of playful experimentation.

Design projects often do not have extensive teams for the design of a project, and may be completed by a single individual. In this case, each of the roles of design is adopted in turn, repeatedly, throughout the project. Even at the conclusion of a project, the role of the artist must remain in evidence.

The Instructional Architect (Holistic Conceptualization)

Central to any design process is an understanding of the whole project, in other words, a view of the project in conceptual, theoretical, and contextual terms. Design processes must identify and recognize the assumptions of both the design problems and the designer, and to be truly effective, must question the nature of the design challenge in itself. The question that must be asked by the designer or design team is "What is the nature of *this* design problem?"

A balanced approach is needed in any design project, including those in instructional design; we call this broad role the *instructional architect* (see Figure 3). The instructional architect values aesthetics and user experiences, research-proven results, and technical capability. We view the architect role as one that

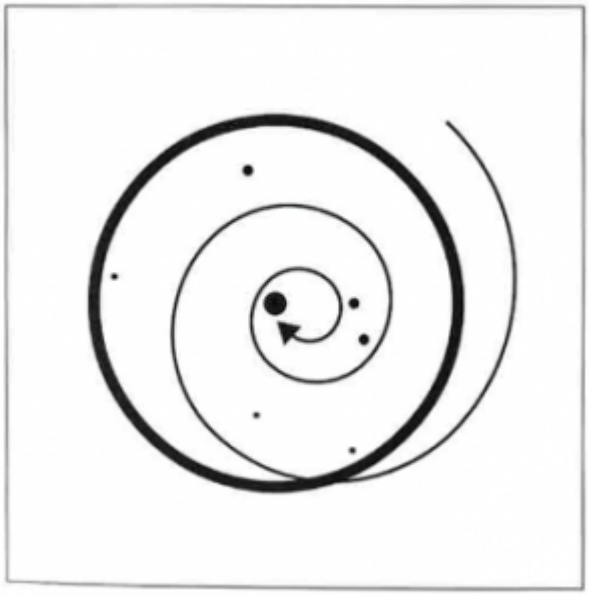

Figure 3. The architect explores the problem space through a holistic process of continuous context examination and discovery. Essentially responsible for creating 'place' out of 'space,' the architect represents a thorough conceptualization of both problem and user contexts.

Journeys beyond merely solving the problem to extending the boundaries of project resources past the technical and educational specifications of the project. The instructional architect seeks projects that transform the whole educational experience, having a long view of design and one which is not merely project centered.

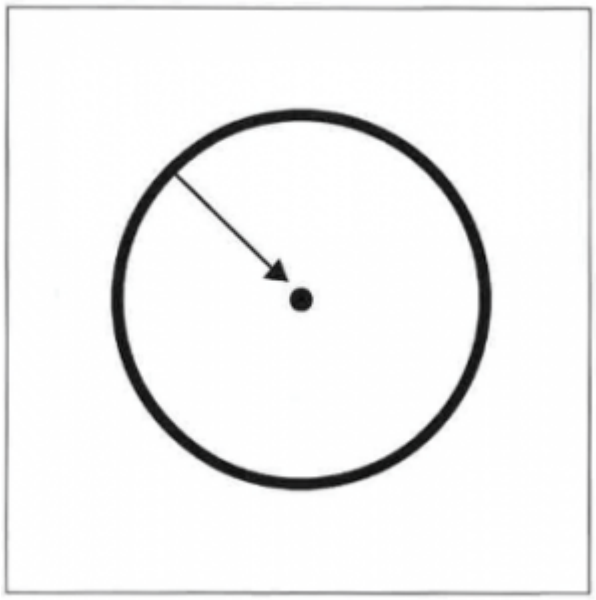

Figure 4. The engineer explores the problem space through a research-driven path that begins with initial problem specifications, ultimately zeroing in on the development of a single solution through application of scientific and theory-based methods.

The Instructional Engineer (Scientific Realization)

Much of the current practice of instructional design deals with the application of research-based principles and theories; these are used to organize, assemble, create, order, and work for the benefit of our society. Within this writing, we use the term *instructional engineer* (see Figure 4) to exemplify the most common perception of the main role in instructional design; the application of educational theory to develop materials, curriculum, and structures for learning through computers and related media.

> *The scientific method is employed to discover the nature of what exists, while design methods are employed to invent things which do not exist. Science is essentially analytic, and design is constructive (Rowland, 2005, p. 81).*

There are those in the field of instructional design that believe, explicitly or implicitly, that the field should be differently named: "Some object to the word 'design,' suggesting as it does a rather arty orientation, and insist that what we really need is 'instructional engineering' (Shepard, 2003). The argument is that this would lead to a more rational and systematized method of producing instructional materials; a strict, algorithmic process with guaranteed results. In contrast, however, as the design process is non-algorithmic and without guarantees, richer and more innovative results are produced out of apparent disorder.

Both within the field of instructional design and in the broader description of design, we value the work of engineers, as highly trained professionals with logical and empirical standards. Specifically, the engineering responsibilities within instructional design include product usability, audience understanding, and reaching educational goals. The theories and ideas of research drive the development of instructional materials through the role of the engineer, balanced with efficiency and technical soundness. We expect engineers, within instructional design or in alternate domains, to be logical, rational, inventive, and efficient. These are universal goals and are the essences of the engineer role.

Within the current practice of instructional design, most work initiated by the instructional engineer is completed by technicians with little input as to design ideas or values or change. The conceptualization, the planning, and the strategic view have all been completed, and the task of implementation and development must occur. During project production, however, there is a choice, between rote work and engagement, between craft and mere completion.

Unfortunately, we believe that most design work does not evolve during the implementation phase, as it is manufactured by others separated from ideas or aesthetics.

The Instructional Craftsperson (Experienced Evolution)

Instructional design materials are often produced by a *manufacturer* and not by an engineer. The manufacturer frequently is a technically skilled individual applying a pre-defined design template to solve an educational problem, delivering results as efficiently as possible. The solution to an educational problem is given or dictated to the manufacturer, whose responsibility is one of formatted production. Production consistency and stability are of primary value, resulting in products that are predicable and functional. As one expects a recipe from a cookbook to be predictably good but also what was intended, one should expect the results from a manufacturer to produce consistent, but not innovative, work.

We seek to replace the role and inherent perspective of the instructional manufacturer with that of an *instructional craftsperson* (see Figure 5).The values of the craftsperson are critical to the quality of the end artifact as part of the full design process. For the health of the design process and the participant designers, we argue that this portion of the work be positive, additive, generative, and ultimately forward thinking to ensure an ongoing improvement of quality in future designs.

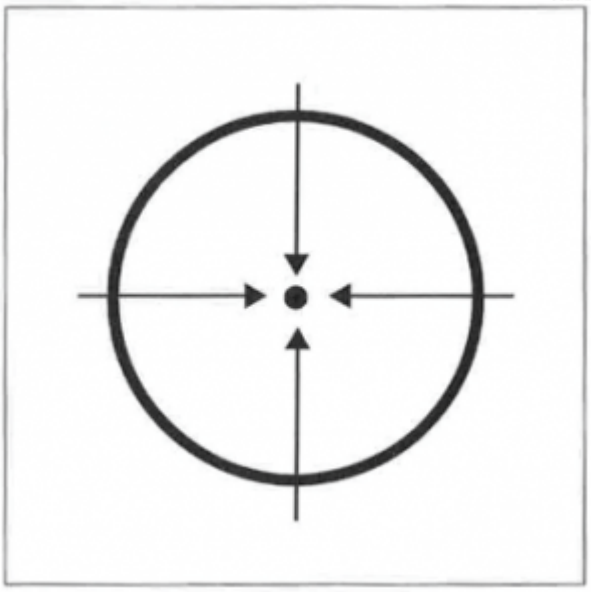

Figure 5. The craftsperson explores the problem space with experience, efficiency, and care for the quality of the final solution. Beginning outside the problem specifications to ensure no stone has been left unturned, the craftsperson develops and implements the solution with fine attention to detail from all angles of the problem.

We envision the instructional craftsperson as a designer with a high level of implicit knowledge gained through experience, and one who seeks quality both in aesthetic and technical terms. The instructional craftsperson may value the final product more than the client or user; analogously, furniture craftspersons may have a similar affection for their designs as well, earned through patience and calluses.

This is not a semantic change for the instructional design process, changing the terminology from “manufacturer” to “craftsperson,” although the characterization would be easy to. adopt. A mere change of title would not change the process nor the end product; there would be no design improvement. As with the late project use of a graphic artist to apply surface aesthetics to an interface, there is little to no value in the change. For the instructional craftsperson role

to be valid, for there to be a role of craft in the instructional design process, craft must be immersed within the entire design process. The craftsperson should have specific responsibility for completion, to be sure, but as with each of the other roles, remaining part of a fully integrated design methodology.

Many in the field may share the values of the crafts-person, but are still constrained by practice, economics, or choice. Our goal is to encourage thoughtful and engaged completion of instructional design projects; we want instructional design projects to be crafted, designed, and completed with engagement and care, which may be possible with a more formal designation of this role.

> *As a verb, 'to craft' seemingly means to participate skillfully in some small-scale process. This implies several things. First, it affirms that the results of involved work will still surpass the results of detached work. To craft is to care. Second, it suggests that partnerships with technology are better than autonomous technology. For example, personal mastery of open-ended software can take computers places that deterministic software code cannot. Third, to craft implies working at a personal scale—acting locally in reaction to anonymous, globalized, industrial production—hence its appeal in describing phenomena such as microbreweries. Finally, the usage of 'craft' as a verb evades the persistent stigma that has attached itself to the noun. (McCullough, 1998, p. 21)*

We share today, a modern view of the "craftsperson," a positive conception of a skilled worker creating quality work, an artisan. The concept was developed out of specialized guilds, and relied on quality standards and a mission of training the next generation. Picture a current-day craftsperson, an artisan baker, for example, and we understand the quality of their work. Although bread can be made through highly mechanized methods, the quality and the experience of the artisan loaf may be unmatched. The baker is personally engaged with the work, somewhat isolated from "the product as commodity," working at their own pace but still efficient, and the schedule is not of prime importance. Each bread rises at its own rate.

Practical Implementation for Design

As a means to structure the work of instructional design, Role-Based Design is meant to be flexible and easily applicable to most design situations. Role-Based Design can be used in a large team where members of the design team are assigned specific roles in the process.

Roles can be assigned to individuals or to sub-teams, for example, with one as the designated "artist" on a project, advocating for creative and novel solutions, or with one team being principally responsible for ongoing qualitative improvements at the completion of the project.

One challenge for implementing RBD in a traditional design team is that habitual procedures and processes would continue; time pressures still exist, research findings can dominate design ideas, and failure (the valuable byproduct of experimentation) is discouraged.

Alternatively, Role-Based Design can be effectively integrated within small groups or as part of the process of a single designer. In these cases, the roles would be assumed at various times in the design process, beginning with the artist and continuing to the craftsman. However, to be effective, the roles should reoccur and be integrated throughout the process; for example, the mental voice of the artist should always be present in the design process, advocating for more creativity and exploration.

Creativity is an important goal of Role-Based Design, and titling a role "artist" implies sole discretion for creativity and innovation. On the other hand, many engineers successfully go beyond the reductionist process of engineering in reaching a single solution. Each of the roles, architect and craftsman as well, has the responsibility to ensure creativity in the design project.

If creativity is solely the responsibility of one role, such as the artist, then the project will not benefit from the unique experience and vision of the other members of the team. To some extent, all designers, from artist to engineer, architect to craftsman, are creative. These roles are all involved in solving problems.

Through Role-Based Design, we seek to build in a role for creativity and aesthetics throughout the project, not simply as a tertiary addition to the end of a project. We seek to ensure that each phase of a project does not settle for "done," but rather continuously seeks to improve and innovate.

References

Becker, K. (2007). Wicked ID: A contemporary framework for considering instructional design as a wicked problem. *Canadian Journal of Learning and Technology,* 33(1), 85-108.

Cross, N. (1982). Designerly ways of knowing. *Design Studies,* 3(4), 221-227.

Hoadley, C., & Cox, C. (in press). What is design knowledge and how do we teach it? In W. DiGiano, S. Goldberg, & M. Chorost (Eds.), *Educating learning technology designers.* New York: Routledge.

Jonassen, D. H. (2006). A constructivist's perspective on functional contextual ism. *Educational Technology Research and Development,* 54(1), 43-47.

Kelley, T., & Littman, .J. (2005). *The ten faces of innovation: Ideo's strategies for beating the devil's advocate and driving creativity.* New York: Doubleday Business.

Kirschner, P., Strijbos, J., Kreijns, K., & Beers, P. (2004). Designing electronic collaborative learning environments. *Educational Technology Research and Development,* 52(3), 47-66.

Lawson, B. (2004). *What designers know.* Oxford, UK: Architectural Press.

Lenat, D. (1983). The role of heuristics in learning by discovery: Three case studies. In R. S. Michalski, J. G. Carbonell, & T. M. Mitchell (Eds.), *Machine learning: An artificial intelligence approach* (pp. 243-306). Palo Alto, Tioga.

McCullough, M. (1998). *Abstracting craft: The practiced digital hand.* Cambridge, MA: MIT Press.

Moldoveanu, M., & Martin, R. (2008). *The future of the MBA. New York: Oxford University Press.*

Molenda, M. (2003). In search of the elusive ADDIS model. Performance Improvement, 42(5), 34-36.

Nelson, H. G., & Stolterman, E. (2003). The design way: Intentional change in an unpredictable world: Foundations and fundamentals of design competence. Englewood Cliffs, NJ: Educational Technology Publications.

Osborn, A. (1953). Applied imagination: Principles and procedures of creative problem solving. New York: Charles Scribner's Sons.

Rittel, H., & Webber, M. (1973). Dilemmas in general theory of planning. Policy Sciences, 4, 155-169.

Rowland, G. (2005). Shall we dance? A design epistemology for organizational learning and performance. Educational Technology Research and Development, 52(1), 33-58.

Shepard, C. (2003). Engineering e-learning; http://www.fastrak-consulting.co.uk/tactix/features/engineer.htm .

Silber, K. (2007, Sept.—Oct.). A principle-based model of instructional design: A new way of thinking about and teaching ID. Educational Technology, 47(5), 5-19.

Simon, H. A. (1973). The structure of ill structured problems. Artificial Intelligence, 4(3), 181-201.

Visscher-Voerman, I., & Gustafson, K. (2004). Paradigms in the theory and practice of educational and training design. Educational Technology Research and Development, 52(2), 69-89.

Zemsky, R., & Massy, W. (2004). Thwarted innovation: What happened to e-learning and why; http://www.irhe.upenn.edu/Docs/Jun2004/ThwartedInnovation.pdf .

Brad Hokanson is Associate Professor of Graphic Design in the College of Design at the University of Minnesota and a Registered Architect in the State of Minnestoa.
Charles Miller is Assistant Professor of Learning Technologies in the College of Education and Human Development at the University of Minnesota.

---

1. Ill-structured problems are those with unclear problem and solution states. Wicked problems are similarly defined but in addition are contentious, contextual, subjective, and completion-critical (Becker, 2007; Nelson & Stolterman 2003; Rittel & Webber, 1973; Simon, 1973). ↵
2. Simon (1993) describes satisficing as "the process of finding alternatives by heuristic search with the use of a stop rule based on adjustable aspirations" (p. 46). ↵