

I Design; Therefore I Research: Revealing DBR through Personal Narrative

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ABSTRACT

Design Based Research (DBR) is a new and still-emerging approach to research about design, learning, and allied areas. This article reports one designer's experiences within a DBR project. Whereas most reports of DBR focus on the outcomes of the design itself, the current paper offers a hermeneutical perspective by focusing on the personal narrative of the designer. Using Edelson's (2002) categories of learning as a basis for the discussion, the author reports the development of his own domain theories, design frameworks, and design methodology. Implications for other designers who would consider using personal narrative and hermeneutics are offered.

Keywords

Design-based research, Rapid prototyping, Personal narrative, Computer-mediated bulletin boards, Theory development

Introduction

Because design-based research (DBR) is a relatively new and still-emerging methodology that is used by learning scientists, we have much to learn about its processes and resulting products. Most scholarship about design research has focused on the outcomes, such as the ontological innovations, that emerged from a DBR experiment (cf., diSessa & Cobb, 2004). This is as it should be since one of the main points of DBR is to improve educational practice (Collins, Joseph, & Bielaczyc, 2004). Design, however, can be a valuable learning experience in its own right (Edelson, 2002; Knowlton, 2004a; Nelson, 2003; Nelson & Knowlton, 2005; Wiggins & McTighe, 2005), and even when designers are not acting as researchers, per se, their own reflections on their efforts within a design project can be useful toward a more complete understanding of design-based research as a phenomenon of engagement. Therefore, designers should examine their experiences as designers and describe the ways that they find themselves situated within design scenarios. One way for designers to illustrate their own situatedness within various scenarios is through personal narratives. Personal narratives can capture the experiences of designers within specific contexts, and thus create a shift from curriculum and pedagogical development towards DBR, a shift described and justified by Edelson (2002). But this type of DBR focuses on the interactions between a designer and a design, rather than the outcomes of design. After all, as noted by Barab and Squire (2004), the way that designers are situated within a context can impact the research itself.

The purpose of this paper is to offer my personal narrative as a designer charged with prototyping strategies to support the use of a computer-mediated bulletin board among university students. In the first part of this paper, brief support for rapid prototyping as an appropriate design methodology within higher education is provided. In the second part of this paper, I describe the particular design efforts on which this paper is based. These first two parts of the paper serve as a contextual frame for supporting the third part of this paper, in which I offer a personal account of my design experiences. In the fourth part of this paper, my experiences are generalized in an effort to offer implications for other would-be designers who may find value in considering design scenarios through a personal narrative approach.

In its totality, this paper is based in the exploratory research tradition (Marshall & Rossman, 1995), in that this paper serves "to investigate little understood phenomena to identify/discover important variables to generate hypotheses for further research" (p. 41). It also is framed by hermeneutics in that it "establishes context and meaning" for human action (Edelson, 1988; Patton, 1990, p. 85), and it attempts to provide an understanding of the contextualized "lived experience" (O'Grady, Righy, & Van den Hengel, 1987, p. 94) of a designer.

Rapid Prototyping and Design Based Research

Formal instructional design often is too expensive of a process to be viable in the higher education classroom on a day-to-day basis; and carefully-designed learning environments require such detailed planning that it is unrealistic to expect college professors to enter each semester with a solid design that fully supports an inquiry-based or exploratory environment. Sometimes, then, the best a faculty member can do is to prototype an assignment—to design “something” as a part of a new course preparation and tweak it over time through iterative cycles of implementation and revision. Reiser (2001) notes that rapid prototyping is established as a widely-used process because it allows a designer to arrive at instructional products more quickly. In this respect, rapid prototyping is also appropriate as a basis for design research in that design research is based on “progressive refinement”—“putting a first version of a design into the world to see how it works” and then revising the design “until all the bugs are worked out” (Collins, Joseph, & Bielaczyc, 2004, p. 18). Thus, rapid prototyping has dual potential in that it can serve both as a practical approach to curriculum and pedagogical development and as a basis for scholarly inquiry.

In spite of this dual potential for productivity in higher education, the use of rapid prototyping in higher education is not well documented in academic literature. One explanation for this deficiency in the literature is that rapid prototyping is a process more closely associated with meeting goals that are indicative of business and industry (Stokes & Richey, 2000). Thus, higher education faculty members simply might overlook rapid prototyping as a viable design approach that is worthy of being documented. Even when those in higher education recognize rapid prototyping as a viable design approach, documentation efforts may be hindered because models of rapid prototyping are surprisingly complex (Stokes & Richey, 2000); and the sound execution of rapid prototyping often requires a support team, such as graduate assistants and experienced designers (cf., Lohr, Javeri, Mahoney, Gall, Li, & Strongin, 2003). The complexity of process and lack of available human capital to support such a process may cause faculty members to shy away from documenting their efforts.

Furthermore, within most disciplines, scholarship that deals with pedagogy, curriculum development, and allied areas is not valued as highly as discipline-based research. Even where valued, reporting ideas from implementing a design like rapid prototyping requires a reconsideration of research paradigms. As Barab and Squire (2004) note, DBR has a “pragmatic philosophical,” not positivist, underpinning (p. 6). Most professors are trained in a positivist research tradition. This view seems supported by Dede (2004), who notes that scholars trained in traditional research are likely to view a DBR approach as not very promising.

As I have pointed out, rapid prototyping may be a useful design approach within higher education, and rapid prototyping as a design methodology is congruent with DBR; yet, little literature documents the experiences of professors as they prototype materials and processes. This paper begins filling this void in the literature.

The Design Context and Events

In this section, I provide an overview of one experience where I used rapid prototyping as a methodology for developing instructional strategies in the context of higher education. My purpose here is not to offer a full treatment of the processes and products of this design, as this information has been reported elsewhere (e.g., Knowlton, 2006; Knowlton 2004b; Knowlton 2004c). Rather, my purpose is to provide a context for the personal narrative that is offered in the next section of this paper. In this section, I describe the context in which my design activities occurred, and I describe the prototyping of the assignment across three phases of implementation. Within the discussion of each phase, I describe the ways that the evolving context influenced design decisions and how each phase was evaluated.

Context in which Rapid Prototyping Design Occurred

Barab and Squire (2004) note the importance of considering the broader context in which a design is developed and implemented. Furthermore, Collins, Joseph, and Bielaczyc (2004) note that “setting” is a critical variable for characterization when reporting DBR efforts. In this case, the macro context in which the design was implemented played a large factor in the progression of the designs and, more to the exact point of this paper, in the ways that I found myself situated within the design process.

Rapid prototyping was used in the context of a two-year, field-based teacher-certification program that was designed to prepare undergraduate students for careers as public school teachers. These preservice teachers were assigned to K-12 classrooms in partnership schools. During the first year of the two-year program, the preservice teachers often served as paraprofessionals or aides. During the second year, though, the preservice teachers became more centrally involved in teaching and learning activity.

Throughout the two years, a team of university faculty supervised weekly content seminars, which largely resembled “traditional” college classrooms. I was responsible for teaching educational psychology within the seminar. In principle, though, “courses” were non-existent. Instead, each courses’ content was integrated into seminar activities and discussions. Rapid prototyping was used to design strategies to support the effective use of computer-mediated bulletin board (CMBB) discussion. The rapid prototyping of strategies as a means of promoting learning is common (Stokes & Richey, 2000).

Phases of Design and Implementation

Table 1 provides an overview of the factors that influenced the initial, intermediate, and refined versions of design and the characteristics of each design. Each version corresponds to a school semester. Also shown in Table 1 is a summary of the evaluation findings that provided a source on which to base the subsequent iterations of design.

Table 1. Overview of three prototypes of CMBB discussion guidelines

Initial Version	Intermediate Version	Refined Version
<p>Factors Influencing Design</p> <ul style="list-style-type: none"> • Need for flexible and efficient communication tool • Emerging nature of the field experience • Lack of information about the participants’ knowledge and skills • Need for basic content principles 	<p>Factors Influencing Redesign</p> <ul style="list-style-type: none"> • Initial version was ineffectual • Shifting Responsibilities of preservice teachers • Changes to the use of seminar time 	<p>Factors Influencing Redesign</p> <ul style="list-style-type: none"> • Evaluation of intermediate version • Elimination of seminar time for educational psychology
<p>Initial Design Characteristics:</p> <ul style="list-style-type: none"> • Laissez-faire • Preservice teachers were simply made aware that discussion board existed. 	<p>Characteristics of Design:</p> <ul style="list-style-type: none"> • Preservice Teachers assigned to two groups • Discussion based on three-week cycles • Discussion centered on student-initiated problems and proposals for practical solutions 	<p>Characteristics of Redesign:</p> <ul style="list-style-type: none"> • Addition of a Privacy Statement and job aid of CMC conventions • Additional direction to govern discussion contributions (e.g. focus on “instructional problems” only; more scaffolding of what constitutes a “good” contribution) • Addition of the self report form
<p>Evaluation of Initial</p> <ul style="list-style-type: none"> • Ineffectual and rare use • Preservice teachers reported that they didn’t see practical value of using CMC 	<p>Evaluation of Intermediate</p> <ul style="list-style-type: none"> • Problems were narrow in scope • Interaction among the preservice teachers was limited • Grading was cumbersome • Perservice Teachers noted workload was heavy and contrived 	<p>Evaluation of Refined</p> <ul style="list-style-type: none"> • Reducing the number of required contributions was helpful in terms of the usability of the assignment • Scaffolding questions were useful in helping the preservice teachers think more broadly about applications of educational psychology

Initial Design

Because the field-based program was new, the context of the field experience emerged as implementation progressed. This symbiosis between context and implementation influenced the ways the bulletin board might be used. Beyond the newness of the field program, two other contextual factors influenced design:

- I had no knowledge of the computer skills of the learner for which I was designing. Had they used a CMBB before? Did they even have skills to find the bulletin board and log on?
- The preservice teachers had never before taken educational psychology. Certification tests that the preservice teachers would need to pass suggested the need for the preservice teachers to obtain a basic understanding of educational psychology concepts and principles.

Because of these contextual factors, no specific strategies were designed to support the CMBB discussion. The faculty team simply made the preservice teachers aware that WebCT (the university's course management tool) had a discussion board for asynchronous sharing of ideas. This laissez-faire approach resulted in virtually no use of the bulletin board. Some preservice teachers suggested that it was nice to know the bulletin board was available, but they did not see how sharing ideas on the bulletin board would help them prepare for working in their classrooms.

Intermediate Design

Beyond the obvious inadequacies of the initial use of the electronic bulletin board, a conflict between the emerging role of preservice teachers and a decision made by university personnel necessitated formalized guidelines to support the use of the bulletin board as an educational tool. The preservice teachers were moving from serving as paraprofessionals who assisted the teacher to professionals who were responsible for designing and implementing lesson plans. As they grew into these professional roles, they needed to experience a shift from knowing theory as described in textbooks to using theory as a basis of their problem-solving efforts. CMBBs are appropriate tools for supporting problem-solving within field experiences (Beckett & Grant, 2003). In spite of the preservice teachers becoming more authentically situated, the team of faculty members who supervised the weekly seminars decided that seminar time should be divided among content areas—"Today is an Educational Psychology seminar; next week will be a reading methods seminar." Such a decision mitigates against the authenticity of a field experience. Designing strategies to support the use of the CMBB could facilitate continued integrated connections, even though seminar time was less integrated.

I designed instructional strategies in the form of formal assignment guidelines that were similar to those already existing in the literature (cf., Knowlton, 2002). Participants were divided into two groups and the discussion was based on a three-week cycle of sharing and response. At the end of each cycle, roles were reversed so that preservice teachers in group one performed the responsibilities of the preservice teachers in group two and vice versa.

During the first week of the discussion cycle, preservice teachers in group one were responsible for defining a professional problem that they were experiencing within their partnership school. During the second week of the discussion cycle, the preservice teachers in group two were responsible for using the textbook as a learning-on-demand resource to theoretically frame the problems that their colleagues had shared during week one of the cycle. During the third week of the discussion cycle, all the preservice teachers were responsible for three contributions to the bulletin board discussion. To build in reflection time for the preservice teachers, the assignment guidelines dictated that not all three contributions should be posted on the same day of the week. Because I wanted the preservice teachers focusing on dialogue, not earning a grade, I loosely structured assessment criteria, allowing them to receive most credit by participating in the discussion.

My assessment of students' efforts served as one basis for determining additional changes that could improve the efficacy of the CMBB assignment: "[O]nly the integration of assessment [with] evaluation can produce a clear picture of an online discussion's educational viability" (Knowlton, 2001, p. 164). Through the synthesis of evaluation and assessment, several findings emerged:

- The problems shared by the preservice teachers were extremely narrow in scope, with over 90% focusing on classroom discipline.
- Most contributions during week three of the discussion were replies to the original problem posted during week one. In other words, the preservice teachers were not discussing the problems by interacting; they merely

continued to offer solutions to the original problem. Furthermore, the ideas across solutions were highly redundant.

- Grading overshadowed other activities that are related to assessment but more productive toward creating continued learning among students, such as my reacting to their discussion contributions, highlighting common themes among their interactions, and offering contributions to the discussion as an authentic participant. Certainly, grading is within the instructor's purview, but it should not dominate assessment processes (Bauer & Anderson, 2000).

Also, through formal written and oral feedback from the preservice teachers, I determined that numerous aspects of the discussion assignment should be modified:

- The number of required contributions in both weeks two and three needed to be reduced. The preservice teachers indicated that the workload was simply too demanding.
- Criteria that specified on what days of the week participation could occur needed to be eliminated. Several preservice teachers noted that they were printing out discussion contributions and sometimes even entire threads of discussion and reading them. So, while their actual contributions might come on a single day of the week, they were considering the discussion across time.
- A "privacy policy" needed to be added. Some of the preservice teachers were concerned that the content of the online discussion might somehow "get back to" their mentor teachers, administrators, or even students and parents. Given the nature of some of the problems that were being shared, this could be embarrassing.

Refined Design

The evaluation of the intermediate implementation of the strategies contributed to the development of the refined design, but a change to the weekly seminars contributed, as well. It was determined that certain content areas—educational psychology being one such area—would not be given *any* formal emphasis during seminars. I was still accountable for assessing the preservice teachers and giving an Educational Psychology grade to each of them at semester's end, yet I was afforded no formal seminar time to assess them. Continuing to use the CMBB seemed to be a choice that could help me overcome this dilemma.

Three minor adjustments were made to the assignment guidelines in an effort to overcome some of the administrative problems discovered during the evaluation of the intermediate version. First, in the assignment guidelines I suggested the need to respect the privacy of all discussion participants by not sharing conversations from the bulletin board with others, such as school personnel. Second, in an effort to help the preservice teachers better consider the conventions of bulletin board discussion, I created a job aid that discussed some of these conventions, such as double spacing between paragraphs and using meaningful subject lines. Third, I developed a self-report form, which allowed the preservice teachers to report factual information to me about the frequency and scope of their participation. This form was not a self-assessment as much as it was a productivity report; it provided me with a list of threads in which I could find their contributions. This made the process of "grading" less time consuming.

Beyond these administrative adjustments, though, three larger changes were made to the refined version of the assignment.

- All problems contributed during week one of the discussion cycle must be "instructional problems"—as opposed to the type of behavior and discipline problems that dominated the intermediate version of the assignment.
- The number of required contributions during week two of each cycle was reduced from three to two.
- Week three contributions had to be replies to week two contributions, not replies to the original problem discussed during week one of each cycle. This change was designed to promote deeper analysis of the issues embedded within the problems, not just continued (and often redundant) "solutions" to the original problem.
- A list of possible strategies that students might use as they offered a week three contribution was developed. See table 2 for a list of these strategies.

The evaluation of the refined design was based on an open-ended survey completed by the preservice teachers. The survey was designed to capture the preservice teachers' views of the strategies used to create participation. I focus here on feedback from the preservice teachers that directly relates to changes that I made in designing the refined version. The preservice teachers reported that

- reducing the number of required contributions to the discussion was helpful in making the discussion more manageable.
- focusing on instructional problems, as opposed to behavioral problems, was difficult, but the refocusing of their thinking did help them see broader applications of educational psychology.
- the scaffolding questions shown in table 2 were somewhat useful in promoting discussion, but those same scaffolding questions seemed to limit the direction of the conversations too much.

Table 2. Discussion prompts for week three contributions

<ul style="list-style-type: none"> • Pick two replies to the same problem and discuss why you think one would work better than the other. • Pick a reply to a problem and discuss the strengths and weaknesses of the proposed solution • Pick a theory that someone mentioned as a help to understanding week #2 and apply that theory differently (or more thoroughly). • Discuss your experiences with how a solution has/has not worked in the classroom. • Write a summary of responses to your own problem and describe what the biggest things that you are taking away from your problem are.
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A Personal Account of Theory Development through Design

Edelson (2002) has suggested that design research is different from design, and he points to the notion that “design research explicitly exploits the design process as an opportunity to advance the researchers (*sic*) understanding of teaching, learning, and educational systems” (p. 107). In the remainder of this paper, this exploitation comes in the form of a personal narrative—an exploitation of “the phenomenon of experience” (Clandinin & Connelly, 2000, p. 128). Indeed, the personal self does not operate apart from the professional self (Knowlton, 1995), and including a synthesis of the two can broaden the perspectives from which DBR is considered. In this respect, the remainder of this paper takes the “hermeneutical turn” (O’Grady, Righy, & Van den Hengel, 1987, p. 94), whereby I do not offer a definitive truth about design but an interpretation of my design experiences. Edelson notes that several types of theories can be created through participation in design research; this section is organized around each type of theory, with personal narrative integrated into each section. Admittedly, there is overlap among these three sections. Table three offers an overview of the coming discussion.

Table 3. Learning through design within the context of the current project

Domain Theories	Design Frameworks	Design Methodologies
<ul style="list-style-type: none"> • The ill-structured nature of a field experience may hinder learning unless designers account for the lack of structure through their design decisions • A context for learning may not influence desirable outcomes as much as the learner’s perceptions of the context influences outcomes 	<ul style="list-style-type: none"> • Balance between instructional prescription and the natural benefits of social learning is difficult to achieve • Tension exists between a designer attempting to guide learners through prescriptive processes and teaching those processes as a generalized cognitive tool. • Balance must be struck between the role of designers and role of facilitators 	<ul style="list-style-type: none"> • Structural revision is often necessary in order to bring a design to full fruition • Rapid prototyping allows for a stronger co-dependence between theory and practice.

Domain Theories

Domain theories, Edelson (2002) notes, are “theor[ies] about the world, not [theories] about design per se.” One type of domain theory is the context theory, which deals with “the challenges and opportunities” presented by the context in which the educational intervention was applied (p. 113). Because my point is to consider the way that I encountered this design project as a situated phenomenon (i.e., design within context), I emphasize context theories;

but from these context theories, I make connections to outcome domain theories, which are both the “desired” and “undesirable” outcomes that are “associated with some intervention” (p. 113). Specifically, I examine the influence of the field-based context on my ability to promote the sound use of the CMBB. Then, I consider the CMBB itself as a context for problem solving.

Field-based Context

Field-based programs can be educationally valuable, but this was only the second implementation of this field-based certification program, and much of the context supporting the program was still developing. Administration included no clear plan—what Edelson (2002) calls a “sequence of design” (p. 114)—that would help fulfill the conceptual purpose of the field-based program. Furthermore, the various faculty members who were working in the field-based program each had individual visions of the program’s intended conceptual outcomes. Both the lack of administrative leadership and the absence of a shared vision among faculty members made it difficult to teach and facilitate learning in such a way as to support the very point of a field-based program—that content should be integrated and directly based on the preservice teachers’ field experiences (cf., Bell, 1995; Scanlon & Ford, 1998; Weber, 1996). My design activities within this nebulous field-based context lead me to a domain theory, and it can be stated as follows: In theory, the authenticity of a field-based context provides a unique environment that can allow learning to flourish in ways not possible in artificial environments; in practice, however, people may unknowingly undermine the benefits of being in an authentic context by attempting to bring a sense of familiar and artificial classroom structure to alleviate the dissonance created by the authentic and ill-structured field-based environment.

In this case, it was not the learners who wanted the type of clear-cut processes and direct answers that would be indicative of an artificial environment. Rather, it was the faculty team that tried to bring too much structure—to enclose and box the phenomenon of experience. For learning to flourish within a field experience, designers must aim for an approach that accounts for the unpredictable and nebulous milieu, which would require them to accept the act of design as a complex phenomenon. Instead, this design team of which I was a part viewed the emerging context of the field-based program as a barrier to learning and imposed an artificial structure on learning processes.

How did this artificial structure manifest itself? The faculty team regressed toward the expedient, familiar, and comfortable, not towards the educationally sound. Why did the faculty team, for example, keep changing the purpose, intent, and function of the weekly seminars? Was it in an effort to improve learning within the authentic context, or was it a type of “giving up” on the true benefits of a field-based context? I may seem to be arguing towards an indictment of the faculty team on which I served, but as I reflect on my own design decisions, I see a similar pattern of craving the familiarity of a traditional and familiar classroom environment and thus undermining the natural benefits of authenticity within a field-based context. What was my purpose in adding the self-report form in the refined design? Did such a form add to the preservice teachers’ educational experience? It did not, in my view. I was more concerned with administrative ease than with focusing on the preservice teachers’ learning. To put this in the language of an outcomes theory, the “sequence of design and implementation [of] cycles” (Edelson, 2002, p. 114) must be congruent with the learning context; without such congruence, “desirable outcomes” (p. 114) will not be realized.

CMBB as Context for Problem Solving

As I have noted, Edelson (2002) points to two types of domain theories, a context domain theory and an outcome domain theory. What is the relationship between a CMBB as context and the intended outcome of problem solving? Jonassen (2001) points out that different types of problems require different types of representations; thus a question about CMBB as an appropriate medium (i.e., context) for solving problems (i.e., the outcomes) is begged: Did the CMBB support representations that allowed the preservice teachers to move toward solutions?

Contextually, a CMBB may seem to remove cues that contribute to a communicative environment. As Weiss (2000) notes, some of these cues—gestures, facial expressions, and other physical elements, for example—can “contribute subtle (and sometimes not so subtle) meanings or attitudes” (p. 48). So, an argument can be made that CMBB as a context for problem solving can, in fact, impede communication, and thus hinder the potential for learning through problem solving. During all phases of implementation, the preservice teachers did communicate to me informally

that they felt this hindrance; I felt it, too. For example, recall that in the intermediate design I struggled to see a developing conversation. I observed static contributions to the discussion that offered solutions to the original problem without considering other contributions to the same thread of discussion. Yet, during the face-to-face seminars, conversations about the problems shared in the bulletin board were lively and highly interactive.

Through my role in this project, however, I did come to see an opposing view of CMBBs as a context for problem solving. The absence of visual and audible cues, in fact, removed various elements that traditionally have lead to bias and disenfranchisement. Because a CMBB is a text-based environment, hidden were oral communication idiosyncrasies, such as regional accents, speech impediments, or a general lack of verbal eloquence. I, myself, came to this Midwestern university from my native Mississippi, and students do occasionally point to my distinct southern accent, which begrudgingly admitted influences my face-to-face interactions. As another example, one preservice teacher in particular had some interesting ideas but struggled mightily to formulate those ideas and articulate them when called upon to do so during the face-to-face seminars. His struggles manifested themselves in stream of conscious soliloquies that often seemed off topic; his body language seemed to indicate that he was aware of his inability to join the flow of the discussion. His struggles and physical manifestations of those struggles were clearly recognized by other preservice teachers many of whom hesitated to respond to his ideas during the seminar for fear of exacerbating his communication difficulties. This same preservice teacher, though, was better able to take advantage of the CMBB context and more carefully articulate his viewpoints in writing. As a result, this preservice teacher and others who responded to him were less “put on the spot” to immediately interact in productive ways. More substantively, race and sometimes gender were removed as influences that may have tainted the way the preservice teachers received messages from each other. The “pseudo-anonymity” of CMBBs (Kemp, 1998, p. 140) in some cases, then, promoted more comfortable interaction among the preservice teachers, which allowed the online experience to become more fully humanized. Paradoxically, by removing the familiarity of interacting through simplistic elements of voice, demeanor, and appearance, the preservice teachers’ very existence became inherently intertwined with their ideas.

Above, I have described computer-mediated bulletin boards in terms of my realizations of them as a paradoxical context for communication. This context influences outcomes. These preservice teachers were in a context that was not familiar to them; thus the way that the context held potential for mediating their learning was uncomfortable for them. For positive outcomes to occur, then, the preservice teachers would need to see this paradox and come to shift their perceptions of the CMBB context. This point can be stated directly as a domain theory: Perhaps it is not a learning context as much as it is learners’ perceptions of (and comfort with) that context that determines whether desirable outcomes can be achieved.

Particularly during the last semester of this project, the preservice teachers did informally note an understanding of this shift; though, as a practical matter, little evidence supported such an understanding. In terms of evidence, the resituating of the self as a result of the context may actually force a stronger awareness of sensory reactions. Facial expressions, for example, can only be represented as metalinguistic cues, such as emoticons. When traditional sensory cues that we often take for granted become abstract representations, participants must consciously search for opportunities to insert them into CMBB discussions. Admittedly, I did not see such a use of emoticons or other metalinguistics. This section does serve to suggest, though, a paradox regarding CMBBs as context. Furthermore, it offers a broad consideration of somewhat non-indigenous discussants within that context.

Design Frameworks

The domain-based considerations that were described in the previous section of this paper influenced my perceptions of both design frameworks, which are discussed in this section of the paper, and design methodologies, which are discussed in the next section of the paper. Edelson (2002) notes that a design framework is a “generalized design solution.” Design frameworks “describe the characteristics that a designed artifact must have [in order] to achieve a particular set of goals [with]in a particular context” (p. 114). The artifact was my articulation of the assignment guidelines to the extent that I shaped the assignment into a PBL and asynchronous discussion assignment. In this section, I discuss the shaping of the guidelines as both a problem-based learning artifact and an asynchronous discussion artifact. In considering both, I have come to learn that balance between two extremes is difficult to find. On one extreme is the careful design of strategies to promote learning; on the other extreme is the designer having a trust in students’ initiative and curiosity as a motivating impetus towards learning.

Problem-based learning

Designers must strike an important balance between allowing autonomy for students as problem-solvers and providing needed scaffolding to the same students, who can only be described as nascent in their problem-solving abilities. Within this project, a shift from complete autonomy (the initial design) towards strong scaffolding (the refined design) can be seen. At each extreme of this shift, I was taxed by questions about the educational viability of my design. As I embraced the *laissez-faire* approach of the initial design, I recognized that the preservice teachers may not know how to solve problems. Would they understand, for example, that articulating the problem is more important than offering solutions, a commonly-accepted principle of problem solving (cf., Abel, 2003)? Would they intuitively understand the inefficiency of rushing toward a solution without collaboratively exploring and analyzing alternatives based on their individual experiences (cf., Beckett & Grant, 2003)? Based on their use (or, better said, “the lack of use”) of the CMBB, I saw no evidence of positive answers to such questions—thus, the need for the intermediate design.

As I began adjusting the assignment guidelines to better allow the preservice teachers to methodically solve problems, I felt that I perhaps was not doing justice to the potential of problem-based learning as a design framework. By articulating strategies, for example, was I not forcing a narrow view—my view—of how to articulate the problem space? Was I allowing the power of social interaction as a natural phenomenon to emerge, or was I creating something contrived that forced an artificial codependence among the preservice teachers?

This tension can be framed more theoretically. Some constructivists claim that learning is “internally controlled and mediated by the learner” (Jonassen, 1991, p. 12). Yet, pedagogically, constructivists seem to focus on tools, environments, and interaction with others—all of which are external. To what extent within a PBL framework can a designer dictate the external requirements that will result in internal learning? Throughout this project, I felt dissonance regarding the balance between activity that was based on a teacher-centered design and activity motivated by the preservice teachers’ true cognitive dissonance that compelled them to pursue a consistent understanding of content.

Have I set up a false dichotomy here by pointing to, on the one hand, a teacher-centered design and, on the other hand, student initiative? Perhaps I should have taught the preservice teachers a problem-solving methodology. Perhaps it was not an unwillingness to alleviate their own cognitive dissonance, as much as it was a lack of understanding about how to achieve this alleviation. As a design framework, problem solving does seem to be robust, but designers would do well to consider whether the robustness lies in guiding learners through the design process or teaching the problem-solving process as a generalized cognitive tool.

Asynchronous discussion

As one of my most prominent co-authors lives some five states away, I understand purposeful use of computer-based communication and the power that it has in representing ideas. Designing an artifact to help others see the power can be difficult, however. The power lies in one’s desire to engage in a collaborative dialogue; true “dialogical participation” is a higher-order type of learning through asynchronous discussion. It transcends the type of “generative participation” that can simply shape one’s individual thinking; dialogical participation moves asynchronous discussion participants toward principles of distributed learning (Knowlton, 2005).

The initial design depended on the tool simply being available, which did not produce viable results. It is only when instructional strategies were added (in the intermediate design) and revised (in the refined design) that more participation and evidence of engagement began to appear. My experiences here seem to confirm Clark (1983, 1994a, 1994b) and others’ assumption that computers do not create learning. Rather, it is the careful design of strategy that creates learning.

There was a contradiction within asynchronous discussion as a design framework that I needed to reconcile. Designing strategies to “force” dialogue seemed necessary for promoting learning, yet I was committed to the idea that there must be some commitment on the part of the preservice teachers to want to engage in an academic discussion. Do the design of strategies mitigate against helping students see the need for dialogue? As I added the necessary characteristics that would allow asynchronous discussion as a framework to “achieve a particular set of

goals” (Edelson, 2002, p. 114) was I not further usurping students’ authority? Consider the discussion prompts described earlier and shown in table 2. Does such a list of strategies send the message to the preservice teachers that week three contributions should involve close-ended and narrow responses, not attempts to contribute to an authentic conversation?

I infer from the experiences that I had within this design project that one necessary characteristic of asynchronous discussion as a framework is an impetus to promote both initial contributions and replies. Thus, the designed artifact required both. The problem with these strategies is that they were discrete and perhaps aimed in the wrong direction. Perhaps appropriate design would have occurred more in my role as facilitator of a discussion, as opposed to designer of the guidelines. If I had facilitated the preservice teachers’ efforts to engage in dialogue, as opposed to “demanding” dialogue through the written assignment guidelines, then perhaps the preservice teachers would better have come to understand the benefits of peer-to-peer sharing of ideas.

Design Methodologies

Design methodologies refer to the “process for achieving a class of designs” (Edelson, 2002, p. 115). Edelson points to instructional systems design and human-computer interaction as examples of classes of design. Earlier in this paper, rapid prototyping was defined through existing literature, but the differences between encountering rapid prototyping through literature and personally experiencing it through an act of design are vast. Indeed, numerous variables specific to the project described in this paper have led to my understanding of rapid prototyping as a “system” of contextual inputs and student outputs. These inputs and outputs include contextual influences on my design decisions and the evaluation of each implementation as summarized in table 1. Also, though, my domain theories as they emerged throughout this project and the design frameworks described in the previous section of this paper shaped my understanding of rapid prototyping. If design—even the design of instructional strategies—is problem solving, then the representation of inputs, outputs, and change in designer thinking is consequential; as Jonassen (2003) notes, problem solving necessitates representation. This seems congruent with Edelson’s (2002) point that design can sometimes only be understood reflectively, *after* design has occurred. In the abstract, the system of inputs and outputs is shown in figure 1.

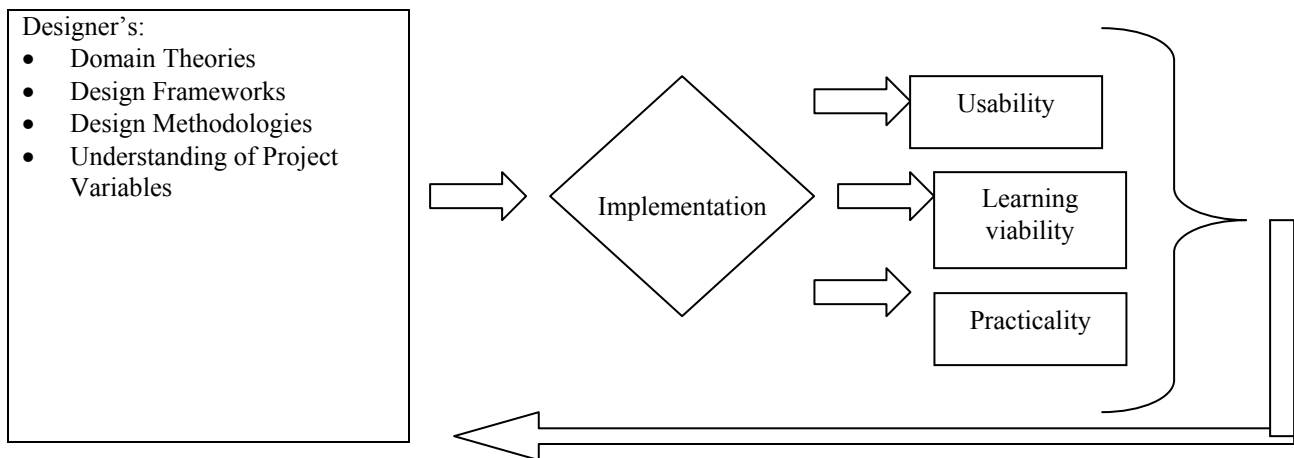


Figure 1. Representation of rapid prototyping

As figure 1 suggests, a designer’s existing domain theories, design frameworks, and understanding of design methodologies as well as the designer’s existing understanding of project variables may contribute to the prototyping and implementation of a design. Emerging from this implementation are at least three types of outputs: *Usability*, as defined by the learner; *learning viability*, as determined by a course instructor or evaluation personnel; and *practicality* given the constraints of a design scenario, as determined by administration or other stakeholders on the design team or within a context. Strikingly, only one of these three is directly concerned with learning, as neither usability nor practicality are necessarily related to learning processes. These outputs from the implementation are

considered by a designer (or a design team) and become a type of input that shapes the designer's continued thinking about theories, frameworks, methodologies, and project variables.

When presented in this way, rapid prototyping can be seen as cyclical and can allow for infinite revisions across time. Such a representation begs two questions that should be explored to construct a fuller understanding of this conception of rapid prototyping methodology. The first relates to developing a true understanding of notions of "revision." The second relates to the codependent interactions between theory and practice.

What is the Nature of Revision?

Design as process is not something to be tolerated; rather, it is something to be embraced. Largely absent from figure 1 and the description is a more nuanced consideration of design's subphases. I note, for example, that I drafted assignment guidelines in preparation for implementing the intermediate design. But, the creation of those assignment guidelines required multiple drafts characterized by structural revision. For example, in one draft of the intermediate guidelines, the preservice teachers were going to be divided into three groups of sharing problems and responding, not the two groups that I ultimately implemented. As I drafted a particular approach to a strategy, I felt tension among learner usability, practicality, and my primary directive of promoting learning among the preservice teachers. As a result of this tension, both the intermediate and refined drafts of the assignment guidelines were drafted into many different permutations. When a certain permutation didn't "feel right" to me as the designer, I kept drafting to see where the design process would "take me." This point may, in some ways, seem to be a statement of the obvious, but on average have those who engage in design based-research and curriculum development been trained in what it means to do more than "tolerate" the need for revision of a framework in an attempt to fully execute the methodology? Notions of "learning by design" as described by Edelson (2002) and others (e.g., Knowlton, 2004; Nelson, 2003; Nelson & Knowlton, 2005) require an understanding of documenting design efforts as a means of coming to understand the design that is attempting to emerge.

How Do Theory and Practice Depend on Each Other?

Through this project, I discovered a non-linear and co-dependent relationship between theory and practice within a rapid prototyping methodology. This non-linear relationship is particularly pronounced when rapid prototyping is compared with more traditional instructional design. In traditional instructional systems design, instructional theory guides and shapes design decisions (Morrison, Ross, & Kemp, 2004). The flow of thinking runs from instructional theory into a functional model (e.g., Morrison, Ross, & Kemp, 2004; Dick & Carey, 1990), which helps a designer make decisions. By the time implementation occurs a theoretical frame supporting practice has been solidified. In rapid prototyping, however, iterations and cycles of design and action occur more rapidly—the very essence of rapid prototyping. Thus, not only does theory shape design but also learner activity itself shapes future design decisions. Sometimes learner activity changes as a direct result of the implementation of a design. But, sometimes learner activity changes as the result of an evolution of the context in which learners are active. Regardless of the impetus for change, subsequent design decisions are affected by the change. I am not arguing that such a symbiotic relationship between theory and practice does not exist within traditional design; I merely am arguing that the relationship is more pronounced in rapid prototyping and designers need to be more aware of the relationship.

Two examples from the current project might be illustrative. The first example illustrates changes as a result of a design decision, but the design decision was a response to learner activity. Consider the influence of strategies for enhancing social interaction that I added in the intermediate design. The design decisions to "force" interaction created a shift from individual cognition to a distributed view of cognition. This design decision was a direct response to the preservice teachers' unwillingness (or inability) to collaborate without a sense of being "forced" to interact. This forced interaction, though, changed my thinking as a designer. Thus, in the refined design, I tweaked the interaction through additional design decisions. Namely, as described earlier, I placed criteria for success on their week three contributions to the discussion.

A second example illustrates how design decisions can be a response to the ever-shifting context in which learners are engaged in learning activities. As I described earlier in this paper, as the field experience progressed, the preservice teachers became more authentically situated within the context of their classrooms; that is, they moved

more and more from the periphery of classroom activity to the center of teaching and learning. In authentic cases, this is a natural progression that is justifiable (Lave & Wenger, 1991), but the point is that design decisions needed to be responsive to this shift. Specifying that problems worthy of discussion were to be instructional problems, not classroom discipline problems, was a design decision that I made in the refined version of the assignment. This design decision was purposeful toward the goal of broadening the preservice teachers' thinking regarding what constitutes a classroom problem that is worthy of analysis. It was necessary to broaden the preservice teachers' thinking because their shift in responsibilities was a broadening of the scope of things that fell under their purview. The strategies had to respond to the ever-evolving context in which the preservice teachers were engaged.

Design decisions, then, serve the purpose not only of rectifying design problems through a reconsideration of theoretically-derived prescriptions but also of realigning learner practices within an ever-shifting context in which learning occurs and, as a direct result of that shifting context, the theoretical thinking of the designer. I have described some of these shifts in theoretical thinking—whether to err on the side of student initiative or to place more faith in strategies, for example—in the previous part of this paper. This conflict regarding on which side I should err was a direct result of observing my designs as they influenced the preservice teachers operating within an ever-evolving learning context.

Implications

In this paper, I have offered my experiences as a designer within a specific scenario. I have tried to offer this perspective from a “personal” viewpoint, but I have tried to shape the narrative provided here around what Edelson (2002) says a designer should “learn” (ie., what theories a designer should develop) as design is occurring. The narrative, in its own right, provides insights about DBR as a mode of inquiry and insights about notions of rapid prototyping. In one respect, I am simply pointing to a practical operationalization of Edelson's (2002) view that the problem or possibility that leads to design often develops hand-in-hand with the design itself. In a larger respect, I am pointing to the idea that there is value, simply, in designers coming to understand the multi-faceted influences on design decisions. In what follows, I provide heuristical questions for would-be designers. The heuristical questions might be useful in the confines of faculty development initiatives in which faculty are engaged in design (e.g., Nelson & Knowlton, 2005). Through these questions, I am not suggesting the need for quantitative empiricism; rather, I am advocating a deeper excursion into hermeneutic approaches for understanding DBR.

What is the relationship between designer training and perceptions of a design scenario?

I am trained in the neo-classical tradition of instructional systems design. Would someone trained in a different tradition—say, in user-engineering or constructivist environment design—have seen this design scenario from a different perspective? Certainly, they would have, but research needs to be done in how a designer's formal or experiential training influences that designer's understanding of a design scenario. Designers who report their efforts through personal narratives should share their biases and assumptions about design in order to unveil the perspective from which the designer is coming.

How does context itself influence designer's perceptions?

Like many scenarios described in the literature, I was operating here in the context of teacher-education. What if my experiences were based in a similar task (i.e., designing strategies to support the educational use of CMBB) but in a different context (e.g., in corporate management training)? Certainly there are cultural differences among teacher education, corporate education, and other contexts in which formal learning activities must be designed. How do those macro-context cultures influence designers' perceptions of their tasks? Consider, for example, the stark differences between a designer in a corporate setting and a college professor acting as designer. Likely, the corporate designer will not also be facilitating the implementation of design. Yet, in the context of higher education, the designer is often the same person who implements the designs. Designers in a variety of settings should offer their personal perceptions of design tasks and scenarios. Through these perceptions, a variety of contexts for personal narratives would be present in the literature.

How would one of the Preservice Teacher's Narratives Align with the Narrative Presented here?

Often in considering a learning scenario, the perceptions of the professor (acting as both designer and facilitator of learning) may be markedly different from the perceptions of students who experienced the learning side of design (cf., Knowlton, Eschmann, Fish, Heffren, & Voss, 2004). Admittedly, this paper has focused on the hermeneutical perspective of a single individual. The perspective provided by personal narrative is powerful, but admittedly, accompanying perspectives would add research robustness. It would be interesting to see a parallel discussion from one of the preservice teachers involved in this project. Designers might consider structuring their personal narratives and setting them against a frame of learner narratives. Such an approach would better allow multiple data sources (albeit still ones based in hermeneutics and personal narrative) to be considered.

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