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## ACCEPTANCE

This dissertation, EXAMINING THE EFFECTS OF SELECTED COMPUTER-BASED SCAFFOLDS ON PRESERVICE TEACHERS' LEVELS OF REFLECTION AS EVIDENCED IN THEIR ONLINE JOURNAL WRITING, by GUOLIN LAI, was prepared under the direction of the candidate's Dissertation Advisory Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree Doctor of Philosophy in the College of Education, Georgia State University.

The Dissertation Advisory Committee and the student's Department Chair, as representatives of the faculty, certify that this dissertation has met all standards of excellence and scholarship as determined by the faculty. The Dean of the College of Education concurs.

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## ABSTRACT

### EXAMINING THE EFFECTS OF SELECTED COMPUTER-BASED SCAFFOLDS ON PRESERVICE TEACHERS' LEVELS OF REFLECTION AS EVIDENCED IN THEIR ONLINE JOURNAL WRITING

by  
Guolin Lai

This study used explanatory mixed methods to examine the effects of two computer-based reflection writing scaffolds, question prompts and writing process display, on preservice teachers' levels of reflection in their online reflective journal writing. The scaffolds were embedded in a system simulating the Professional Accountability Support System Using a Portal Approach (PASS-PORT). The outcome measure was the level of reflection achieved in participants' writing. The researcher collected data at the College of Education of a major southern university in the United States. Participants were undergraduate students enrolled in a technology integration course in fall 2007. Sixty-five preservice teachers participated in quantitative phase of the study; sixteen out of the 65 preservice teachers were purposefully selected to participate in qualitative phase of the study. The majority of the preservice teachers were white females between the ages of 20-29 in their junior year.

During the quantitative phase of the study, participants in control group and two treatment groups were randomly and evenly assigned to one of three different Web pages associated with their treatment conditions. The participants reflected on a critical incident that happened during their practical teaching. Two raters, blind to the participants' treatment conditions, coded the highest level of reflection achieved in their writing

samples using the reflection rubric developed by Ward and McCotter (2004). The researcher employed ANOVA to assess the group differences in the highest level of reflection reached and in the length of the reflective writing in the number of words. The alpha level was set at .05 for all analyses. During the qualitative phase, the researcher conducted open-ended interviews with the participants as a follow-up to their reflection writing. The participants' reflection writings and interviews served as data sources. Miles and Huberman's (1994) data analysis procedures guided the qualitative data analysis.

The quantitative results indicated that computer-based scaffolds significantly enhanced preservice teachers' levels of reflection in their online journal writing. Preservice teachers who used the scaffolds wrote longer reflection than those in the control group. Correlation analysis revealed that there was a positive relationship between the level of reflection and the length of journal writing. Three overarching factors emerged from the qualitative data analysis that explained how and why the computer-based scaffolds enhanced their reflective journal writing. The factors included (a) the specific requirements conveyed in the scaffolds; (b) the structure of the scaffolds; and (c) the use of the critical incidents to anchor reflective journal writing.

How to improve preservice teachers' critical reflection capability and skills remains an actively debated topic. Recent years have witnessed an emergence of research and development in Web-based educational systems to help prepare highly qualified teacher candidates. However, the articulative/reflective attribute of meaningful learning does not seem to be evident in most of these systems. Although there is considerable research on the potential for embedding scaffolds in technology-enhanced learning environments, mechanisms intended to facilitate reflective practice in such environments

also seems to be lacking. In order to help fill this gap, it is hoped that the analyses and results of the current study can be used as a building block for research on how to leverage the affordances of computer-based scaffolds to enhance preservice teachers' reflective practice in technology-enhanced educational systems.

EXAMINING THE EFFECTS OF SELECTED COMPUTER-BASED SCAFFOLDS  
ON PRESERVICE TEACHERS' LEVELS OF REFLECTION  
AS EVIDENCED IN THEIR ONLINE  
JOURNAL WRITING

by  
Guolin Lai

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in  
Instructional Technology  
in  
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in  
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2008

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## ABBREVIATIONS

NCATE	National Council of Accreditation of Teacher Education
PASS-PORT	Professional Accountability Support System Using a Portal Approach
URL	Universal Resource Locator
ZPD	Zone of Proximal Development

## CHAPTER 1

### INTRODUCTION

#### The Problem

Educational theorists have long recognized the importance of reflective practice in teacher education (Dewey, 1933; Schön, 1987; Shulman, 1987). “The goal, in short, has been the development of teachers who will engage in reflective practice as an integral and continuous component of their teaching.” (Reagan, 1993, p. 189) In recent years, teacher professionalization has become one of the agendas that drive reforms in teacher education at national and/or state levels. The professionalization agenda for reforming teacher education endeavors to establish a professional knowledge base for teaching and teacher education (Cochran-Smith, 2001). Preservice teachers’ ability to reflect is deemed an integral part of the professionalization agenda, and the National Council of Accreditation of Teacher Education (NCATE) (2006) has established standards that call for teacher candidates to be reflective practitioners, and demonstrate the ability to reflect.

Reflective journal writing has the potential to develop preservice teachers’ reflective thinking habits, and is widely adopted by teacher education programs (Calderhead, 1991; Griffin, 2003; Hatton & Smith, 1995; Pultorak, 1996; Putnam, 1991; Roland, 1995). Currently, numerous rubrics exist in the literature that evaluate preservice teachers’ levels of reflective thinking (e.g., Bain, Ballantyne, Packer, & Mills, 1999; Hatton & Smith, 1995; Lee, 2005; Mezirow, 1981; Sparks-Langer, Simmons, Pasch,

Colton, & Starko, 1990; Valli, 1992; van Manen, 1977; Ward & McCotter, 2004). These rubrics generally follow the hierarchical classification van Manen (1977) developed. van Manen's model classifies three levels of reflection: technical reflection, practical reflection, and critical reflection. The three levels of reflection parallel the development path of an individual teacher from novice to expert or master teacher (Reagan, 1993).

*The context of the study.* The Professional Accountability Support System Using a Portal Approach (PASS-PORT) (2002) was funded by the state of Louisiana's Board of Regents for Innovative Teaching & Learning. PASS-PORT is a Web-based educational system. It provides preservice teachers, university faculty and administrative staff in 21 teacher education programs in the state of Louisiana a tool to gather, demonstrate and evaluate the performance data on preservice teachers during their teacher education program and inservice teachers during the first three years of their service after graduation. Portfolio building is an integral component of preservice teachers' use of the system. During the portfolio building process, PASS-PORT requires preservice teachers to write online reflective journals about their professional and academic experiences (i.e., their field experience classroom observations). Despite the growing success of PASS-PORT, conversations with teacher educators who worked with PASS-PORT at a major southern university in the United States and an ensuing qualitative study both revealed that preservice teachers' reflective journal writings in PASS-PORT were primarily descriptive, technical, shallow, unfocused, and pointless, rather than critical/transformational (Lai & Calandra, 2007). Related studies on preservice teachers' reflective writing have provided similar results (e.g., Hatton & Smith, 1995; Pultorak, 1996; Risko, Roskos, & Vukelich, 1999).



Critical reflection is a distinguishing attribute of reflective practitioners (Larrivee, 2000). Researchers suggest that a particular emphasis be placed on developing preservice teachers' critical reflection skills, because reflection is effective only when it incorporates moral, political, social, and ethical criteria into the discourse about their practical actions in education (Howard, 2003; Sparks-Langer & Colton, 1991; van Manen, 1977; Zeichner & Liston, 1987). Research has also demonstrated that preservice teachers' higher levels of reflection can be developed (Hatton & Smith, 1995; Pultorak, 1996) if certain conditions are met (Snow, 2001; Yost, Sentner, & Forlenza-Bailey, 2000). According to Yost, Sentner, and Forlenza-Bailey (2000), preservice teachers' ability to develop critical reflection is dependent on two conditions, (a) "supervised practical experiences" and (b) "personally meaningful knowledge base in pedagogy, theories of learning, as well as social, political, and historical foundation to which they can connect their experiences." (p. 47) However, the existence of these two conditions in preservice teachers' reflective practice will not guarantee their development of critical reflection capability. Lai and Calandra (2007) found that one of the factors contributing to preservice teachers' poor reflection was the disconnection between theories and concrete classroom experiences. Scaffolding is needed to help them make the connection. However, PASS-PORT does not provide any scaffolding to guide preservice teachers' journal writing in the system.

### The Proposed Solution

Jonassen, Howland, Moore, and Marra (2003) suggest that technologies can be used as "engagers and facilitators of thinking and knowledge construction." (p. 12) The United States Department of Education (2000) claims that electronic networks, digital resources, and computer technology can not only help create stronger connections

between teacher candidates, university faculty and mentor teachers, but also provide valuable resources as teacher candidates develop professionally through their student teaching and induction phases. Recent years have witnessed a sustained emergence of research on and development of computer-based educational systems tailored for teacher education and teachers' professional development. Some of these systems include Knowledge Loom by Brown University, Inquiry Learning Forum (ILF) at Indiana University, and the STAR Legacy program at Vanderbilt University. Within these systems, a variety of electronic tools are integrated to promote preservice teachers' reflective practice. Some common examples of electronic tools that can promote preservice teachers' individual reflective practice are: E-journals, Web logs (blogs), and digital video. Some common examples of electronic tools that can support preservice teachers' social reflective practice include: bulletin boards, chat rooms, listservs, blogs, and digital video (Calandra & Lai, 2005).

In recent years, the scaffolding metaphor has been used by researchers to describe features and functionality of educational software that support users in completing certain tasks (Lin, Hmelo, Kinzer, & Secules, 1999; Sherin, Reiser, & Edelson, 2004). Research has also demonstrated that computer-based scaffolding mechanisms can be embedded in electronic tools to enhance preservice teachers' reflective practice. For example, in their literature review, Lin, Hmelo, Kinzer, and Secules (1999) identified four types of scaffolding strategies that can support preservice teachers' reflective practice in technology-enhanced environments including (1) process prompts, the technology-based prompts that help students organize, interpret, and externalize thinking while learning is in action; (2) process displays, the use of technology to display problem-solving and

thinking process they have engaged in; (3) process modeling, the use of expert thinking processes as a model for learning; and (4) reflective social discourse, the technology- and community-based discourse to multiple perspectives and feedback with peers and instructors.

The researcher conducted a preliminary qualitative study to explore the difficulties preservice teachers had in their journal writing in PASS-PORT, in order to identify what computer-based scaffolding tools could be integrated in PASS-PORT to enhance their online journal writing (Lai & Calandra, 2007). Lai and Calandra found that, among the five computer-based scaffolding tools including question prompts, templates, writing process display, modeling, and digital resources, teacher educators and preservice teachers preferred question prompts and writing process display. See Chapter Three for a more detailed description of the study.

### Purposes of the Study

Despite apparent enthusiasm about using computer-based scaffolding tools to support preservice teachers' reflective practice, there is a lack of empirical research, especially quantitative research, which examines how such tools may impact preservice teachers' reflective development. Clark and Estes (1998) claim that supporting evidence is needed to validate any educational technology solutions. However, for many dramatic educational technology applications that exist today, little empirical research is being conducted with regard to their effects on student learning (Spector, 2001), and relatively few studies are being conducted to justify the costs of integrating technology-based methods (Roblyer & Knezek, 2003). Moreover, after criticizing research in instructional technology as characterized by pseudoscience and social irrelevance, Reeves (2000b)

calls for the validity and social relevance of research in the field of instructional technology. In part as an answer to these dilemmas as described in the literature, the initial goal of the current study was to examine whether the two selected computer-based scaffolding tools embedded in PASSPORT, question prompts and writing process display (Lai & Calandra, 2007), enhanced preservice teachers' levels of reflection in their online journal writing. The dependent variable was the highest level of reflection reached in their journal writing. The independent variable, computer-based scaffolding tools, had three types: no scaffold, question prompts scaffold, and writing process display scaffold. The second goal of the study was to explore how and why the computer-based scaffolding tools enhanced or failed to enhance preservice teachers' levels of reflection in their journal writing. Quantitative and qualitative findings from the study can provide the much-needed justification on whether the selected computer-based scaffolding tools (i.e., question prompts and writing process display) should be integrated into Web-based educational systems such as PASS-PORT to support preservice teachers' development as reflective practitioners, but more specifically how the tools can enhance their reflective journaling.

## Research Questions

### *Quantitative Questions*

1. Will preservice teachers, who are exposed to computer-based question prompts while writing their online reflective journals, demonstrate a higher level of reflection in their writing than those in the control group?

2. Will preservice teachers, who are exposed to computer-based writing process display while writing their online reflective journals, demonstrate a higher level of reflection in their writing than those in the control group?
3. Will preservice teachers, who are exposed to computer-based question prompts while writing their online reflective journals, write longer reflections than those in the control group?
4. Will preservice teachers, who are exposed to computer-based writing process display while writing their online reflective journals, write longer reflections than those in the control group?
5. Are there any correlations between the highest level of reflection achieved and the length of reflection writing?

#### *Qualitative Question*

6. How and why do the selected computer-based scaffolding tools (i.e., question prompts and writing process display) affect or fail to affect preservice teachers' reflective journal writing?

#### Terms and Definitions

Terms related to the study are defined as follows:

*Reflection* – Reflection is an “active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it leads.” (Dewey, 1933, p. 9) Reflection concerns thinking about problems during and after the event(s) (Schön, 1983, 1987), and what needs to be

done for the future (Killion & Todnem, 1991). Rodgers (2002) summarized four criteria that characterize the concept of reflection and the purposes it serves:

- Reflection is a meaning-making process that moves a learner from one experience into the next with deeper understanding of its relationships with and connections to other experiences and ideas. It is the thread that makes continuity of learning possible, and ensures the progress of the individual and, ultimately, society. It is a means to essentially moral ends.
- Reflection is a systematic, rigorous, disciplined way of thinking, with its roots in scientific inquiry.
- Reflection needs to happen in community, in interaction with others.
- Reflection requires attitudes that value the personal and intellectual growth of oneself and of others. (p. 845)

*Reflective Thinking* – Reflective thinking is the systematic and disciplined meaning-making process characterized by its educational aim. Dewey (1933) conceptualized five phases of reflective thinking:

- Suggestions – in which the mind leaps forward to a possible solution
- Intellectualization of the difficulty or perplexity that has been felt (directly experienced) into a problem to be solved, a question for which the answer must be sought
- The use of one suggestion after another as a leading idea, or hypothesis, to initiate and guide observation and other operations in collection of factual material

- Reasoning - the mental elaboration of the idea or supposition as an idea or supposition
- Testing the hypothesis by overt or imaginative action (p. 107)

*Reflective Practice* – Reflective practice is a concept introduced by Schön (1983; 1987). Reflective practice involves thoughtfully considering one's own past experiences in applying knowledge to practice while being mentored and coached by experts or masters in the profession. In education, it refers to the different activities/practices that teacher educators adopt to develop pre- and inservice teachers' reflective thinking capability. Various means/approaches of reflective practice have been adopted to develop teachers' reflectivity, including classroom discussions, journal writing, portfolio construction, online discussion boards, chatrooms, listservs, weblogs, and digital video reflection.

*Levels of Reflection* – Levels of reflection refer to the hierarchical level used to identify the different domains of reflective thinking as evidenced in reflective practice. Teacher educators generally use the terms practical/technical, contextual/deliberative/conceptual, and critical/dialectical/transformational to identify the different domains of reflection (Lee, 2005). The progressing levels of reflection parallel the development path of an individual teacher from a novice to an expert or a master teacher (Reagan, 1993).

*Critical Reflection* – Critical reflection is a distinguishing attribute of reflective practitioners (Larrivee, 2000). "Critical reflection is deliberation about wider social, historical, political, and cultural contexts of education, and/or deliberation about

relationships between educational practice and the construction of a more equitable, just, and democratic society.”(Dinkelman, 2000, p. 199)

*Reflective/Analytic Teacher –*

A reflective/analytic teacher is one who makes teaching decisions on the basis of a conscious awareness and careful consideration of (1) the assumptions on which the decisions are based and (2) the technical, educational, and ethical consequences of those decisions. These decisions are made before, during and after teaching actions. In order to make these decisions, the reflective/analytic teacher must have an extensive knowledge of the content to be taught, pedagogical and theoretical options, characteristics of individual students, and the situational constraints in the classroom, school and society in which they work (Irwin, as quoted in Reagan, 1993, p. 191).

A reflective/analytic teacher should enjoy four attributes: efficacy, flexibility, social responsibility, and consciousness (Colton & Sparks-Langer, 1993).

*Journal Writing –* As a learning technique, journal writing is both an art and science. “As an art, a journal is a product or expression of what is more than ordinary experience; it is a creative and imaginative way of describing one’s thoughts, feelings, and actions. As a science, a journal helps the writer to engage in reflection intentionally and systematically.” (English, 2001, p. 2) There are different types of journal writing, including reader response journal, dialogue journal, learning log, research journal, reflective journal, and electronic journal. The current study focuses on preservice teachers’ online journal writing.



*Scaffolding* – Initiated by Vygotsky, scaffolding is a learner-centered strategy specifically engineered to assist learners to achieve the learning goals or performance which would be beyond their unassisted efforts (Wood, Bruner, & Ross, 1976). Four attributes are usually associated with scaffolding, including diagnosis, calibrated support, fading, and individualization (Azevedo & Hadwin, 2005).

*Computer-Based Scaffolds* – Computer-based scaffolds refer to the features and functionality rendered possible by computer technology to help users to complete certain tasks (Sherin et al., 2004; Winograd, 2002).

### Framework of the Dissertation

This dissertation consists of seven chapters. This chapter provides an introduction to the research problem, the solution to the problem, and the research questions. Chapter 2 reviews the related literature to offer support for the study and to inform the research methodology. Chapter 3 presents the preliminary qualitative study, the prelude to the dissertation. Chapter 4 justifies and describes the use of explanatory mixed-methods research design employed in the dissertation. Chapter 5 examines whether the two selected computer-based scaffolding tools, question prompts and writing process display, enhanced preservice teachers' higher levels of reflection in their online journal writing. Chapter 6 explores how and why the selected computer-based scaffolding tools enhanced preservice teachers' higher levels of reflection in the current study. Chapter 7 answers the research questions, discusses the findings in the context of the literature, and provides suggestions for future research.

## Summary

Preservice teachers' reflective journal writing in PASS-PORT has been primarily descriptive, technical, shallow, unfocused, and pointless, rather than critical/transformational or a combination thereof. Researchers suggest that a particular emphasis be placed on developing preservice teachers' critical reflection skills, the distinguishing attribute of a reflective practitioner. Literature indicates that preservice teachers' higher levels of reflection can be developed if certain conditions are met, coupled with appropriate reflection scaffolds. Computer technology renders it possible to design and develop computer-based scaffolding tools to enhance preservice teachers' reflective practice. The current PASS-PORT lacks any embedded scaffolding mechanisms to support preservice teachers' online journal writing. A preliminary study uncovered two types of computer based scaffolds that preservice teachers and teacher educators thought may enhance reflective journal writing. This study examined whether these two computer-based scaffolding tools, if embedded in the PASS-PORT environment, can significantly enhance preservice teachers' levels of reflection in their journal writing, and if so, how and why?

## CHAPTER 2

### REVIEW OF THE LITERATURE

The literature review serves the purpose of finding theoretical and empirical support for the study and informing the research methodology. A need for the current study has been substantiated in part through careful review of relevant literature. This chapter reviews how experience, reflection, and learning are interconnected, followed by an examination of the theoretical nature of reflective practice and how reflective practice is applied in teacher education. Because teacher education programs widely use journal writing as an instructional means to promote preservice teachers' reflective thinking, issues related to preservice teachers' journal writing, and factors contributing to these issues are examined.

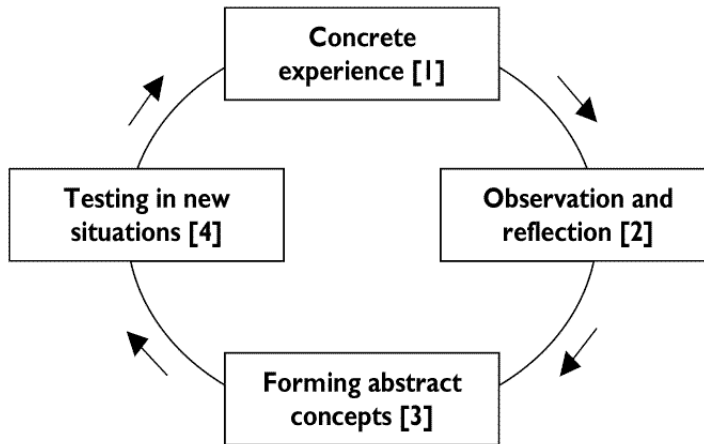
Computer-based scaffolding originated from the traditional scaffolding characterized by tutor-student interactions. The chapter will also review how scaffolding was initiated in education, and how computer-based scaffolding tools can enhance preservice teachers' reflective practice, especially their online journal writing.

To summarize, seven main areas of literature are examined: *Experience, Reflection and Learning; Nature of Reflective Practice; Reflective Practice in Teacher Education; Journal Writing as Reflective Practice; Scaffolding in Reflective Journal Writing; Computer-based Scaffolding; and Summary.*

### Experience, Reflection and Learning

People can learn from their experiences (Boud & Walker, 1990; Kolb, 1984; Shulman, 1987). It is reflection about one's experiences that leads to learning (Dewey, 1933; Mezirow, 1981). Shulman (1987) claims that reflection is a key process during which a teacher "looks back at the teaching and learning that has occurred, and reconstructs, reenacts, and/or recaptures the events, the emotions, and the accomplishments. It is that set of processes through which a professional learns from experiences." (p. 19) Human learning is thus a process that involves not only absorbing one's new experiences, but also constantly bringing about his/her reflection in cognitive, affective, and behavioral aspects and relating the reflection to his/her existing knowledge base (Boud, Keogh, & Walker, 1985; Kolb, 1984; Moon, 1999). As noted by Dewey (1933), the experience a teacher has is a dynamic continuum because each experience s/he has can impact the quality of his/her future experiences.

For Kolb (1984), learning is the process whereby knowledge is created through the transformation of one's past experiences. During the transformation, reflection plays a crucial role. Kolb used a cycle (see Figure 1) to represent the sequences in experiential learning. In the cycle, one's immediate or concrete experiences lead to his/her reflective observations. These reflections are then assimilated into his/her abstract concepts with implications for action. One can then actively test and experiment with the newly assimilated abstract concepts. From the test and experiment results, one creates his/her new concrete experiences. The cycle of experiencing, reflecting, thinking, and acting goes on and on.



*Figure 1.* Kolb's experiential learning cycle.

Similarly, Moon (1999) considers learning a cycle. In the cycle, learners take notice of new information, make sense, make meaning, and work with meaning until they achieve transformative learning (see Table 1). As noted by Moon, it is through reflection that the learners make their learning meaningful and well-structured. When the learners are involved in surface learning, they simply reproduce ideas that are not well linked, and are mostly assimilating information to build a cognitive structure in their minds. As the learners assimilate more information, they constantly modify their cognitive structures through reflection to make meaning of the information. Eventually, through reflection the learners reorganize their cognitive structures until they are meaningful and well integrated.

Table 1

*A map of learning and the representation of learning*

Stages of Learning	Online Teaching Experience
Transform learning	Meaningful, reflective, restructured by learner – idiosyncratic or creative
Work with meaning	Meaningful, reflective, well structured
Make meaning	Meaningful, well integrated, ideas linked
Make sense	Reproduction of ideas, ideas not well linked
Notice	Memorize representation

Teaching is a learned profession, and reflection plays a crucial role during a teacher's learning process (Shulman, 1987). Shulman prescribed seven categories of knowledge base with which competent teachers need to be equipped and by which the education and performance of teachers can be judged. These categories of knowledge base include:

- Content knowledge;
- General pedagogical knowledge, with special reference to those broad principles and strategies of classroom management and organization that appear to transcend subject matter;
- Curriculum knowledge, with particular grasp of the materials and programs that serve as “tools of the trade” for teachers;

- Pedagogical content knowledge, that special amalgam of content and pedagogy that is uniquely the province of teachers, their own special form of professional understanding;
- Knowledge of learners and their characteristics;
- Knowledge of educational contexts, ranging from the workings of the group or classroom, the governance and financing of school districts, to the character of communities and cultures; and
- Knowledge of educational ends, purposes, and values, and their philosophical and historical grounds. (p. 8)

Among these categories, pedagogical content knowledge is of special interest to teachers because “it represents the blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organized, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction.” (Shulman, 1987, p. 8) To specifically improve teachers’ pedagogical content knowledge, Shulman developed a model of pedagogical reasoning and action. The model cycles through the activities of comprehension, transformation, instruction, evaluation, reflection, and new comprehension. Reflection serves as a catalyst phase in the model because it helps ground teachers’ knowledge construction on their past experiences. During the reflection phase, a teacher reviews, reconstructs, reenacts and critically analyzes his/her own and the class’s performance, and grounds his/her explanations in evidence.

As demonstrated earlier, teachers can become reflective through meaningful experiences. More explicitly, teachers’ schemata of classroom decision making do not

automatically appear in their minds but are constructed through their daily meaningful experiences (Lasley, 1989; Sparks-Langer & Colton, 1991). Through comparisons of novice and expert teachers' interpretations of classroom events, Leinhardt and Greeno (1986) discovered that "experts have deeper, richly connected schemata to draw upon when making a decision. In contrast, novices tend to have leaner, less developed schemata, presumably because of lack of experience." (as cited in Sparks-Langer & Colton, 1991, p. 38) It is through the meaningful experiences that teachers reinforce and expand the categories of knowledge base identified by Shulman (1987). Consequently, their pedagogical schemata become more formed and informed so as to be able to achieve automaticity – "certain routines (sequences of responses) are automatically stimulated by a situation and put into action with little conscious attention by the teacher." (Sparks-Langer & Colton, 1991, p. 38)

#### Nature of Reflective Practice

Dewey (1933) regards reflection as "active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it leads constitutes reflective thought." (p. 9)

According to Dewey, reflective thinking must serve an educational aim:

In the first place, it emancipates us from merely impulsive and merely routine activity. Put in positive terms, thinking enables us to direct our activities with foresight and to plan according to ends-in-view, or purposes of which we are aware. It enables us to act in deliberate and intentional fashion to attain future objects or to come into command of what is now distant and lacking. By putting the consequences of different ways and lines of action before the mind, it enables



us to know what we are about when we act. It converts action that is merely appetitive, blind, and impulsive into intelligent action. (p. 17)

Reflective thinking is a systematic and disciplined meaning-making process.

Dewey (1933) conceptualized five phases of reflective thinking including (1) solution suggestions; (2) intellectualization of the existing difficulty or perplexity into a problem to be solved; (3) the use of hypothesis to initiate and guide data collection; (4) reasoning; and (5) hypothesis testing by overt or imaginative action. He also identified three forms of attitudes that need to be cultivated to secure adoption and use of reflective thinking: open-mindedness (the ability to understand and take multiple perspectives), wholeheartedness (the ability to identify and address the limitations in one's assumptions about authority and understand the complexity and ambiguity of issues), and responsibility (the ability to consider the moral and ethical consequences of choices and actions on self, others, and the broader society).

From the synthesis of Dewey's work, Rodgers (2002) summarized four criteria that characterize Dewey's concept of reflection and the purposes reflection serves:

- Reflection is a meaning-making process that moves a learner from one experience into the next with deeper understanding of its relationships with and connections to other experiences and ideas. It is the thread that makes continuity of learning possible, and ensures the progress of the individual and, ultimately, society. It is a means to essentially moral ends.
- Reflection is a systematic, rigorous, disciplined way of thinking, with its roots in scientific inquiry.
- Reflection needs to happen in community, in interaction with others.

- Reflection requires attitudes that value the personal and intellectual growth of oneself and of others. (p. 845)

Schön (1983; 1987) introduced the concept of reflective practitioner. He identified two types of reflection: reflection-in-action and reflection-on-action, both reactive in nature and distinguishable by when reflection takes place. Reflection-in-action occurs during the event. It involves thinking about the current experiences, examining the feelings incurred, and evaluating the theories in use. Reflection-in-action is deemed as the most demanding reflection upon one's practice, because it "goes beyond storable rules - not only by devising new methods of reasoning, but also by constructing new methods of understanding, strategies of actions, and ways of framing problems." (Schön, 1987, p. 39) Reflection-on-action refers to retrospective thinking after the event takes place. This is when the practitioner explores what happened during the event, and what were their motivations and rationale for acting in a certain manner. Killian and Todnem (1991) came up with a third type of reflection, reflection-for-action, which is:

the desired outcome of both previous types of reflection. We undertake reflection, not so much to revisit the past or to become aware of the metacognitive process one is experiencing (both noble reasons in themselves), but to guide future action (the more practical purpose). (p. 15)

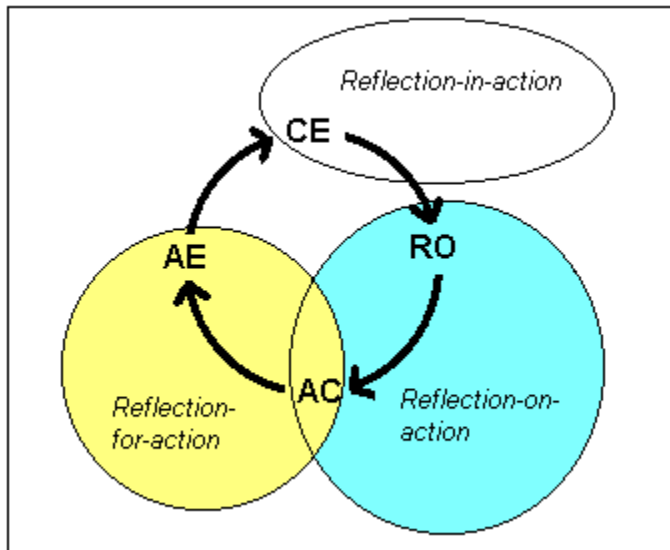
Reflection-for-action is thus more proactive in nature. The continuum of reflection-in-action, reflection-on-action, and reflection-for-action makes reflection "a process that encompasses all time designations, past, present, and future simultaneously." (Killian & Todnem, 1991, p. 15) Similarly, van Manen (1995) distinguished three forms that reflection can take: retrospective reflection based on past actions (compatible to Schön's

reflection-on-action), contemporaneous reflections (compatible to Schön's reflection-in-action), and anticipatory reflections devoted to future actions (compatible to Killion and Todnem's reflection-for-action). Reflection thus is a "temporally distributed phenomenon involving the pre-active, interactive and post-active phases of teaching." (Conway, 2001, p. 90)

The three types/forms of reflection can be mapped onto Kolb's experiential learning cycle as shown in Figure 2 (T. King, 2002). Schön's concepts of reflection-in-action can be included within Kolb's *Concrete Experience* stage of learning in that reflection only intends to "express our use of tacit knowledge as we act to carry an experience forward or to conclusion." (p. 4) Schön's reflection-on-action can happen in Kolb's *Reflective Observation* and *Abstract Conceptualization* stages of learning where the significance of an experience is noticed, problems or questions arising out of the experienced are figured out, and usable concepts or hypotheses are generated. Killion and Todnem's reflection-for-action happens in Kolb's *Active Experimentation* stage of learning where the implications of the concepts or hypotheses are tested.

van Manen (1977) developed a hierarchical model to classify levels of reflection as evidenced in reflective practice: technical rationality, deliberative rationality, and critical rationality. The first level, technical rationality, is concerned with the application of educational knowledge to attain ends accepted as given. At this level, neither the ends nor the educational contexts are treated as problematic. In the deliberative rationality level, every action is seen as linked to particular value commitments. The actor interprets his/her individual and cultural experiences, meanings, perceptions, assumptions, prejudgments and presuppositions to better understand nature and quality of the

educational experience. In the last level of critical rationality, both teaching and the contexts of teaching are viewed as problematic as the actor tries to incorporate the consideration of political, moral, social, and ethical criteria to evaluate his/her experiences. The three levels of reflection parallel the development path of an individual teacher from novice to expert or master teacher (Reagan, 1993).



*Figure 2.* Assigning types of reflection to Kolb's Experiential Learning Cycle.

Sparks-Langer and Colton (1991) took a different approach to conceptualize reflective practice. Instead of using a hierarchical structure, they focused on elements that play significant roles in teachers' reflective thinking, including cognitive element, critical element, and narrative element. First, the cognitive element of reflective thinking is concerned with the various categories of knowledge base (Shulman, 1987) that professional teachers need to master to succeed in the classroom. The schemata (organized networks of acts, concepts, generalizations, and experiences) for novice and expert teachers are different in that expert teachers are quicker to make sense of a situation, and are more ready and successful in dealing with the problems at hand

“because (1) many of the routines and the content were available in memory as automatic scripts and (2) their rich schemata allowed the experts to quickly consider cues in the environment and access appropriate strategies.” (p. 38) Though automaticity of schemata is constructed naturally over time, their development can be enhanced by reflective practice. Second, the critical element of reflective thinking is concerned with “the moral and ethical aspects of social compassion and justice.” (p. 38) Sparks-Langer and Colton (1991) suggested the use of different techniques to promote the development of reflective thinking. The techniques might include “structured journal writing, critical dialog, examination of multiple perspectives, field experiences, and action research.” (p. 41) Third, the narrative element of reflective thinking focuses on how teachers interpret their professional decisions through “narratives or stories, with settings, plots, and characters.” (p. 42) The most valuable benefit of teachers’ narrative reflection is the insight that teachers gain as a result of the self-inquiry.

### Reflective Practice in Teacher Education

The efficacy of reflective practice in helping prepare highly qualified teacher candidates has long been recognized (Bullough Jr, 1989; Ertmer, 2003; Gore & Zeichner, 1991; Shulman, 1987; Yost et al., 2000; Zeichner & Liston, 1987). The reflective approach has become a major, encompassing paradigm in teacher education (Tochon, 1999). Zeichner noted that:

It has come to the point now where the whole range of beliefs about teaching, learning, schooling, and the social order have become incorporated into the discourse about reflective practice. Everyone, no matter what his or her ideological orientation, has jumped on the bandwagon at this point and has

committed his or her energies to furthering some version of reflective teaching practice (as quoted in Tochon, 1999, p. 279).

Academic journals have dedicated special issues exploring and examining the reflective practices in education. For example, the *Journal of Teacher Education* dedicated a special issue to investigate reflective process in teacher education (Lasley, 1989), and another issue to explore portfolios and reflection in teacher education (Ducharme & Ducharme, 1996). *Pedagogy, Culture & Society* (Zay, 1999) also dedicated a special issue to reflective practices in education in general.

For the past two decades, the professionalization of teaching – “the elevation of teaching to a more respected, more responsible, more rewarding and better rewarded occupation” has been one of the recurring themes of educational reform at both national and state levels (Cochran-Smith, 2001; Shulman, 1987, p. 3; Ward & McCotter, 2004). Teachers’ ability to reflect is deemed an integral part of the professionalization agenda so that teachers can be empowered, reflective decision makers (Colton & Sparks-Langer, 1993) who can meet the increased challenges in their profession. To ensure teacher candidates’ reflective ability, NCATE (2006) has established standards that call for teacher candidates to be reflective practitioners, and demonstrate the ability to reflect. For example, in the section of professional and pedagogical knowledge and skills for teacher candidates, NCATE specifies the target standards as follows:

Teacher candidates reflect a thorough understanding of professional and pedagogical knowledge and skills delineated in professional, state, and institutional standards. They develop meaningful learning experiences to facilitate learning for all students. They reflect on their practice and make necessary

adjustments to enhance student learning. They know how students learn and how to make ideas accessible to them. They consider school, family, and community contexts in connecting concepts to students' prior experience and applying the ideas to real-world problems. (p. 15)

The goal of these efforts is to develop teachers who will engage in reflective practices as an integral and continuous component of their teaching (Reagan, 1993).

Advocates of reflective practices in education have delineated their expectations of reflective classroom teachers. For example, from the standpoint of an empowered decision maker in the classroom, Irwin (1987) and Colton and Sparks-Langer (1993) each provided a characteristic portrait of a reflective/analytical teacher. Irwin suggested that:

A reflective/analytic teacher is one who makes teaching decisions on the basis of a conscious awareness and careful consideration of (1) the assumptions on which the decisions are based and (2) the technical, educational, and ethical consequences of those decisions. These decisions are made before, during and after teaching actions. In order to make these decisions, the reflective/analytic teacher must have an extensive knowledge of the content to be taught, pedagogical and theoretical options, characteristics of individual students, and the situational constraints in the classroom, school and society in which they work. (as quoted in Reagan, 1993, p. 191)

As Reagan (1993) pointed out, Irwin's definition of reflective/analytical teachers laid out the "necessary conditions of reflective practice." (p. 191) The definition provided by Colton and Sparks-Langer (1993) focuses more on the systematic process on how reflective teachers make their classroom decisions, and what social, ethical, moral, and

democratic implications of their decisions need to be considered during their decision making process:

thoughtful persons intrinsically motivated to analyze a situation, set goals, plan and monitor actions, evaluate results, and reflect on their own professional thinking. As part of this process, the teachers consider the immediate and long-term social and ethical implications of their decisions. Technical proficiency is not enough; moral and democratic principles must also guide the reflective teacher's actions. (p. 45)

Colton and Sparks-Langer (1993) also pointed out that reflective teachers should enjoy the following four attributes: (1) efficacy, referring to teachers' belief that they can have an impact on children and schools, without such a belief, teachers will not be motivated to examine their own practice and probe deeper meanings to develop them to be more qualified teachers; (2) flexibility, necessary for responsive teaching, referring to teachers' ability to consider different perspectives in their decision making process; (3) social responsibility, referring to teachers' devotion to encouraging social responsible actions in their students, participating in various community activities, and contributing their time to social causes; and (4) consciousness, referring to teachers awareness of their own thinking and decision making.

How can we educate and prepare reflective teacher candidates then? Colton and Sparks-Langer (1993) developed a conceptual framework to guide the development of teacher reflection and decision making (see Figure 3). The framework is composed of three components: professional knowledge base, action, and constructing knowledge/meaning. First, the *Professional Knowledge Base* component lists seven



categories of knowledge in a reflective teacher: content, students, pedagogy, context, prior experiences, personal views and values, and scripts, the first four of which were adapted from Shulman's (1987) work. The first six categories are self-explanatory. Scripts here include two types: (a) ones that allow a teacher to behave automatically while focusing on more critical issues; and (b) ones that guide the thinking process.

Second, the *Action* component is characterized by three categories of decisions: teaching planning, implementation of instruction, and evaluation of teaching decisions made in the classroom, all of which require mental processing. Third, the *Constructing Knowledge/Meaning* component illustrates the conscious process of teacher reflection and decision making. "Teaching decisions are made through an interaction between the professional knowledge stored in long term memory and the information perceived in the environment." (p. 49) Four major steps are involved in teachers' interpretation of the reality in light of their professional knowledge base so that they can construct new meanings and mental representations. (1) The teachers purposefully collect certain specific information from their personal experiences. (2) The teachers analyze the information to develop mental representation that helps them interpret the situation at hand. Typically, teachers acquire new information through collaborative dialogues and professional readings. Through analysis, teachers can develop and use new and creative solutions when problems arise in the future. (3) After teachers have clearly defined the situation, they develop possible hypotheses to explain the events and guide further action. "They mentally test each hypothesis for its short-term effects and for its long-term social, moral, and intellectual consequences." (p. 49) (4) The teachers implement an action plan after considering the consequences of each action. Sparks-Langer and Colton's

conceptual framework reinforces the call that Lasley (1989) made in the editorial of the special issue on reflective process in the Journal of Teacher Education:

Both pedagogical knowledge and philosophical awareness (personal and professional) are needed for reflection to have depth. The former without the latter leads to a preoccupation with technique. Exclusive reliance on the latter, however, engenders good intentions but a repetition of poor classroom practice (¶ 3)

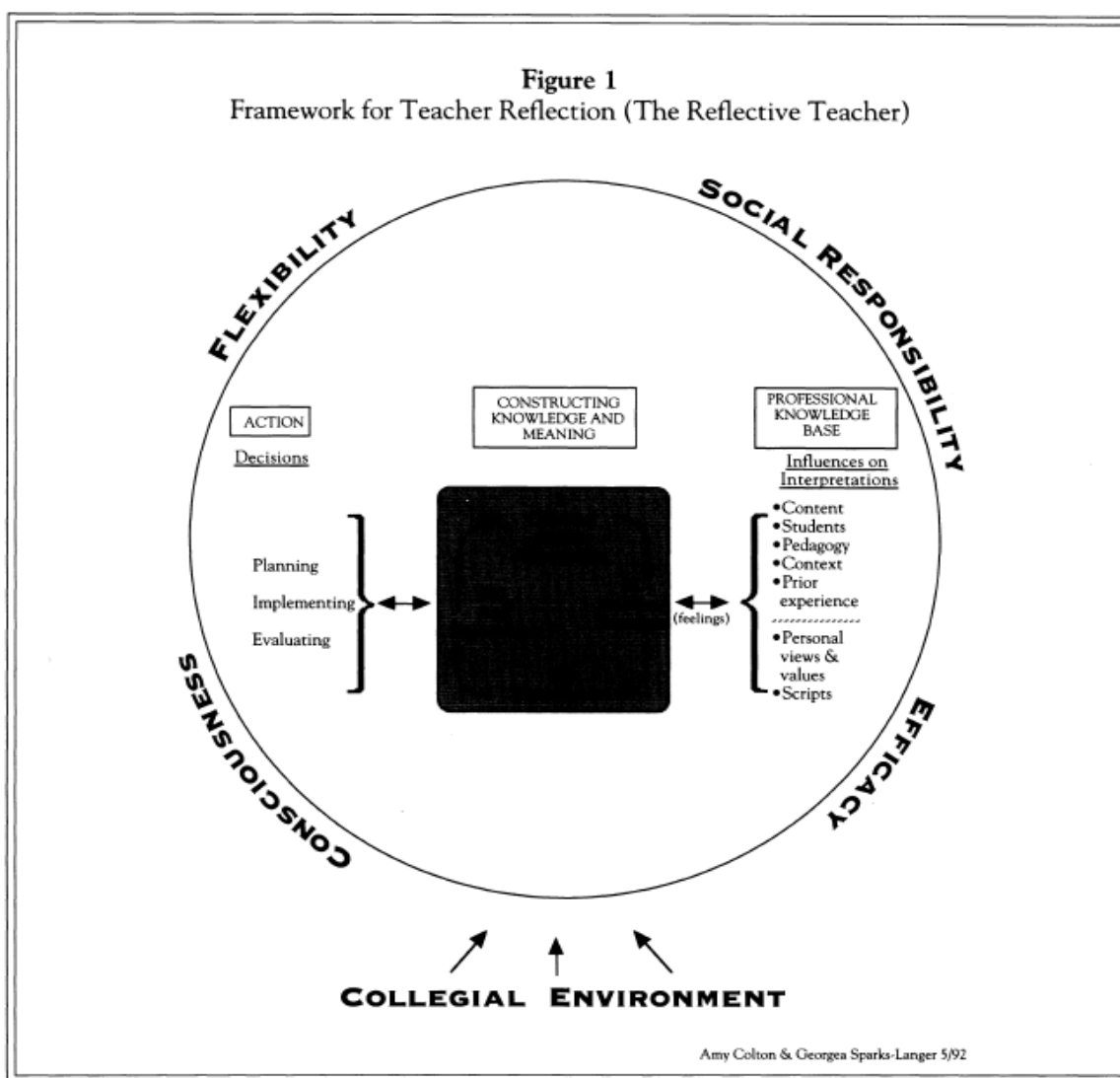


Figure 3. Conceptual framework for teacher reflection.

Various means/approaches to reflective practice have been adopted in teacher education to develop teachers' reflective ability, including reflective journal writing (Bain, Ballantyne, Packer, & Mills, 1999; Fletcher, 1997; Hoover, 1994; Kember et al., 1999; Loughran, 1996; Ross, 1989; Zeichner & Liston, 1987), portfolios (Ellsworth, 2002; Orland-Barak, 2005; Spurgeon & Bowen, 2002, June), and classroom discussions. The increased presence and influence of computer technology has changed the landscape of reflective practice in teacher education. Some common examples of electronic tools that can promote teachers' reflective practice are: E-mail (McLellan, 1998; Whipp, 2003), E-journals (Germann, Young-Soo, & Patton, 2001; F. B. King & LaRocco, 2006; MaKinster, Barab, Harwood, & Andersen, 2006), weblogs (Oravec, 2003; Williams, 2004; Xie & Sharma, 2004, October), bulletin/discussion boards (Bean & Stevens, 2002; Levin, He, & Robbins, 2006; McDuffie & Slavit, 2002; Nicholson & Bond, 2003), chatrooms (Bauer, 2002; Ohlund, Yu, Jannasch-Pennell, & DiGangi, 2000), listservs (Wepner, 1997), and digital video (Calandra, Brantley-Dias, & Dias, 2006; Spurgeon & Bowen, 2002, June). These electronic tools can serve both individual reflective practice and social, collective reflective practice.

Critical/dialectical/transformational reflection (will be called critical reflection in the following) is the distinguishing attribute of reflective practitioners (Larrivee, 2000). Dinkelman (2000) defined critical reflection as the "deliberation about wider social, historical, political, and cultural contexts of education, and/or deliberation about relationships between educational practice and the construction of a more equitable, just, and democratic society." (p. 199) Whereas according to Larrivee (2000), critical reflection "merges critical inquiry, the conscious consideration of the ethical implications and

consequences of teaching practice, with self-reflection, deep examination of personal beliefs, and assumptions about human potential and learning.” (p. 293) In teacher education programs, a particular emphasis should be placed on developing preservice teachers’ critical reflection skills, because reflection is effective only when it incorporates moral, political, social, cultural, and ethical criteria into the discourse about practical actions in education (Larrivee, 2000; Noddings, 1988; Sparks-Langer & Colton, 1991; Tom, 1987; van Manen, 1977; Yost et al., 2000; Zeichner & Liston, 1987). For example, challenged by the reality of the current classrooms where students’ cultural, ethnic, linguistic, racial, and social class backgrounds vastly differ from each other, Howard (2003) calls for critical reflection as a prelude to creating culturally relevant teaching strategies for teacher education. According to Howard, critical reflection typically deals with “issues pertaining to equity, access, and social justice,” and “Critical reflection is the type of processing that is crucial to the concept of culturally relevant pedagogy.” (p. 197) Similarly, Zeichner and Liston (1996) argue that, if teachers desire to become technically competent and reflective practitioners, they need to venture beyond the bureaucratic and technical conceptions of their role historically implicated upon them by maintaining a broad vision about their work:

Teachers cannot restrict their attention to the classroom alone, leaving the larger setting and purposes of schooling to be determined by others. They must take active responsibility for the goals to which they are committed, and for the social setting in which these goals may prosper. If they are not to be mere agents of others, of the state, of the military, of the media, of the experts and bureaucrats, they need to determine their own agency through a critical and continual

evaluation of the purposes, the consequences, and the social context of their calling. (p. 11)

Preservice teachers' demonstration of higher levels of reflection in their reflective practice is a developmental process (Hatton & Smith, 1995; Pultorak, 1996). Various contextual scaffolding mechanisms can enhance the developmental process (Koszalka, Grabowski, & McCarthy, 2003). Specifically, preservice teachers' ability for critical reflection is developmental if certain conditions are met (Yost et al., 2000):

First, preservice teachers must have supervised practical experiences that will serve as a foundation for their reflections. Second, they must acquire a personally meaningful knowledge base in pedagogy, theories of learning, as well as social, political, and historical foundation to which they can connect their experiences. (p. 47)

Using preservice teachers' journals and reflective interviews as data sources, and van Manen's (1977) levels of reflection and paralleled levels by Zeichner and Liston (1987) as theoretical frameworks, Pultorak (1996) found that preservice teachers moved from thinking about their teaching at the level of technical competency to the level of theorizing about their practice to become autonomous reflective practitioners. According to Pultorak, the development process of preservice teachers' demonstration of levels of reflection is characterized by three stages (see Table 2), and each stage can be facilitated by various contextual supports and prompts. In stage 1 of disconnected reflection, for preservice teachers who lacked experience in a specific practice but would like to experience a sense of success at doing what they were supposed to do or what they thought an expert might do, they needed simple inquiry-based questions and

contextualized supports and prompts which focus attention on practice, to guide them to reflect and respond in ways they could succeed. In stage 2 of quasi-reflection, preservice teachers paid less attention to the prompts, but still needed reflection guidelines to help them consider broader strategies, reasoning, and reframing situations. They became more flexible and showed a deeper level of understanding in their reflection. However, they were still restrained by the values and assumptions of their old practices. In stage 3 of autonomous thinking, preservice teachers exhibited greater ability to respond to new or surprising data, and to reframe situations. Supports and prompts were not needed, and thus could be faded (as reviewed in Koszalka et al., 2003).

Another school of researchers questioned whether it is realistic to develop preservice teachers' critical reflection ability (Calderhead, 1992; Rudduck, 1989, March). For example, Cochran-Smith (1991) argues that critical reflection can only be learned by beginning teachers working in a school context with seasoned teachers who themselves value and practice critical reflection. Galvez-Martin and Bowman (1998) used experimental and control groups to determine the impact of training in preservice teachers' reflection. They found that preservice teachers who received training in reflection were more reflective, but they did not achieve critical reflection level. Others posit that preservice teachers' ability of technical reflection is much more important for their classroom survival (Neijaard, Stellingwerf, & Verloop, 1997). In other words, beginning teachers' capacity for reflection is limited, and is mainly concerned with their practical experiences (Vonk, 1996). For them, critical reflection is a trait that requires a

Table 2

*Reflection Stages, Processes, and Supports*

Developmental stages of reflection	Process of knowing	Contextual supports and prompts
Disconnected reflection	All is truth	Inquiry-based questioning Open-ended recipe-based questions or statements Strategic sequencing of questions Contextualized supports and prompts which focus attention on practice
Quasi-reflection	Cannot know with certainty	Reflection guidelines used to consider broader strategies, reasoning, and reframing situations
Final stage	Deep, richly, connected schema to interpret context and develop sound reasons	Autonomous thinking – supports and prompts not needed, so can be faded and focused on new emerging environmental factors

set of skills that can be learned and developed from rules and behavior (P. M. King & Kitchener, 1994) with a few years of classroom experiences (Berliner, 1988; Calderhead & Gates, 1993; Hatton & Smith, 1995), because “...inexperience surfaces as an influential factor in supporting or impeding the development of critically reflective preservice teachers.” (Dinkelman, 2000, p. 220) Though Hatton and Smith (1995)

emphasize that preservice teachers' critical dimensions need to be fostered from the beginning, they also recognize that "The use of critical perspectives depends on development of metacognitive skills alongside a grasp and acceptance of particular ideological framework, and in most studies of preservice teachers, is not a very common occurrence." (p. 46) Moreover, standards-driven curriculum is viewed by some researchers and teacher educators as closing the door on higher levels of reflection, because "the process of dialogue and questioning that is at the heart of reflection is often perceived as conflicting with the 'coverage' mentality of a standardized environment." (Ward & McCotter, 2004, p. 244) Such mentality is particularly true for preservice teachers. "When they join the profession as first year teachers they will be immersed in the pressure of standards-driven curriculum and closely examined student outcomes. How will the habits of reflection and questioning survive under these conditions?" (Ward & McCotter, 2004, p. 244)

### Journal Writing as Reflective Practice

Journal writing is a learning technique that enjoys attributes of both an art and a science:

As an art, a journal is a product or expression of what is more than ordinary experience; it is a creative and imaginative way of describing one's thoughts, feelings, and actions. As a science, a journal helps the writer to engage in reflection intentionally and systematically (English, 2001, p. 2).

Journal writing is also a "purposeful writing" that discourages passivity, dependence, and rote thinking (Germann et al., 2001). At the heart of learning through journal writing is reflection, the process of "deliberate thinking about action with a view to its



improvement.” (Hatton & Smith, 1995, p. 40) Being the linkage between one’s past experiences and intended learning outcome, journal writing has been widely used as a tool for documentation and evaluation of learning, personal growth, and professional development (McAlpine, 1992; Moon, 1999; Rogers, 1982).

Journal writing serves various purposes. The purposes might include: recording experiences, facilitating learning from experiences, supporting understanding and the representation of the understanding, developing critical thinking or the development of a questioning attitude, encouraging metacognition, increasing active involvement in and ownership of learning, increasing ability in reflection and thinking, enhancing problem-solving skills, a means of assessment, personal development and self-empowerment, enhancing creativity, improving writing, and fostering collective communication (Moon, 1999).

There are different types of journals, including reader response journal, dialogue journal, learning log, research journal, reflective journal, and electronic journal. The current study focuses on reflective journal writing, which is often used in the courses of teacher education programs to edify teacher candidates’ reflective habits and to enhance their reflective capability (Anders & Brooks, 1994; Bain, Mills, Ballantyne, & Packer, 2002; Francis, 1995; Roland, 1995; Spalding & Wilson, 2002; Sparks-Langer & Colton, 1991; Uline, Wilson, & Cordry, 2004; Zeichner & Liston, 1987).

Ballantyne and Packer defined preservice teachers’ reflective journal writing as “a learning exercise in which students express in writing their understanding of, reflections on, response to or analysis of an event, experience or concept.” (as cited in Bain et al., 1999, p. 52) Preservice teachers’ journal writing not only allows them to confront their

confusion and articulate points of relative certainty (Emig, 1977), but also encourages them to explicitly assess values and beliefs to construct their knowledge base from their past experiences and to create new meaning (Boud, 2001).

Reflective journal writing benefits both preservice teachers and teacher educators. For preservice teachers, reflective journal writing (1) serves as a permanent tangible evidence of their mental processes on thoughts and experiences, (2) helps bridge the gap between knowledge and action, (3) provides a means of establishing and maintaining relationship with teacher educators, (4) functions as a safe outlet for personal concerns and frustration, (5) plays the role of an aid to inner dialogue that connects thoughts, feelings and actions, thus helping to illuminate automatic thinking and habits of mind, and more importantly, and (6) leads preservice teachers through a transformative process. Whereas for teacher educators, reflective journal writing (1) serves as windows into and assessment tool for preservice teachers' thinking and learning, (2) provides a means to establish and maintain relationship with students, and (3) serves as dialogical teaching tools (Calderhead, 1991; Colton & Sparks-Langer, 1993; Hubbs & Brand, 2005; Kerka, 1996; Pedro, 2005; Spalding & Wilson, 2002; Zeichner, 1983).

There are two major lines of research related to teachers' reflective journal writing. One line studies what conceptual frameworks and models can enhance teachers' levels of reflection, and the other focuses on examining the content and level of teachers' reflective thinking in the journal writing.

Conceptual frameworks and models abound in the literature that prescribe the processes of reflective thinking in journal writing. These frameworks and models include Boud, Keogh, and Walker's (1985) three-stage process of reflective writing, LaBoskey's

(1993) four dimensions of the act of reflection, Smyth's (1989) four "forms" of action, and Moon's (1999) map of reflective writing.

Boud, Keogh, and Walker (1985) developed a three-stage reflective writing process: returning to experiences, attending to feelings, and reevaluating experiences. First, lived experiences serve as the base of one's learning. The role of the journal writing is for the learner to recollect the salient features of his/her experiences in context with its full impact. Recapturing experiences this way renders it possible for the learner to revisit his/her past experiences with ease. Second, the learner attends to the positive and negative feelings and emotions associated with his/her experiences, because the existence of these feelings and emotions can inhibit or enhance the learner's possibilities for higher level of reflection and learning. Third, the learner reevaluates his/her experiences to not only make sense of the experiences, but also integrate the newly constructed knowledge into his/her conceptual framework. The role of reevaluating experiences is crucial in the learner's learning from the journal entries, as Boud (2001) later explained:

Reevaluation is about finding shape, pattern, and meaning in what has been produced. It involves revisiting journal entries, looking again at what has been recorded, and adding new ideas and extensions to those partially formed. It addressed the question: What sense can I make of this, and where does it lead me? It involves trying out new ideas and asking, "What if?" Reevaluation is the end of one cycle and the beginning of another as new situations are imagined and explored. (p. 15)

To promote critical reflection in teacher education, Smyth (1989) developed a reflective process that is characterized by four sequential stages each linked to a series of

questions: (1) describing (what do I do?), (2) informing (what does this mean?), (3) confronting (how did I come to be like this?), and (4) reconstructing (how might I do things differently?). First, Smyth suggests teachers describe the concrete teaching events happening in their own or others' teaching to build up a basis for further analysis. Second, teachers need to engage in informing theories or explanatory principles about their teaching practice. Third, on the basis of describing and theorizing, teachers should interrogate and question the legitimacy of those theories. A series of guiding question prompts can help teachers approach the confrontation of local theories of teaching. The question prompts might include: what do my practices say about my assumptions, values, and beliefs about teaching? What social practices are expressed in these ideas? What causes me to maintain my theories? What views of power do they embody? Whose interests seem to be served by my practice? What constrains my views of what is possible in teaching? And last, Smyth suggests that teachers "link consciousness about the processes that inform the day-to-day aspects of their teaching with the wider political and social realities with which it occurs." (p. 7) It is in the stage of confronting and reconstructing, teachers start their critical reflection journey by incorporating moral, political, social, and ethical criteria into the discourse about practical actions in education (Larrivee, 2000; Sparks-Langer & Colton, 1991; van Manen, 1977; Zeichner & Liston, 1987).

LaBoskey's (1993) conceptual framework incorporates four dimensions of reflection: purpose, context, procedure, and content. Dimension *purpose* refers to the driving force of reflection, which may be a perceived difficulty, an internal motivation to reflect, a need to regain control of a situation or a desire to better comprehend an issue at

hand. Dimension *context* represents the structural aids to reflection, including reflective tasks, partners or observers, timing and location. Dimension *procedure* refers to the process employed in reflection, including problem setting, means/end analysis and generalizations, and attitudes of open-mindedness, responsibility and wholeheartedness (Dewey, 1933). Dimension *content* is the focus of reflection, which may be a practical problem, a theoretical perspective, or ideally, an integration of the two. According to LaBoskey, the act of reflection should result primarily in new comprehensions rather than problem solving through a change in teaching practice. The new comprehensions include the improved ability to carry out reflection, the belief change, or altered emotional state or trait (as reviewed in Bain et al., 1999). Although the two conceptual frameworks developed by Smyth (1989) and LaBoskey (1993) aim to understand the nature of reflection in teacher education, both can be “applied to guide research and practice in the use of reflective tools such as journal writing.” (Bain et al., 1999, p. 52-53)

Moon (1999) outlined a map of the reflective journal writing process. The process includes the following steps: (1) a journal writing purpose that guides the selection of topics; (2) description of events or issues; (3) linkage to related material including further observations, relevant knowledge or experience, suggestions from others, theory, and new information; (4) reflective thinking where the learner relates, experiments, explores, reinterprets from other points of view, and theorizes; (5) other processes the learner engages in that include testing new ideas and representing material in other forms such as through graphics or dialogue; (6) product of reflection including statement of something learned or solved, or identification of new issue or question; and (7) further reflection leading to resolution or looping back to an earlier stop.

In sum, the prescriptive models by Boud, Keogh, and Walker (1985), Smyth (1989), and Moon (1999) generally follow the conceptualization of the systematic reflective thinking process that Dewey (1933) developed. The first two models offer more linear procedural guidance on how reflective writing should be carried out, whereas Moon's model is flexible rather than a linear sequence of activities. The conceptual frameworks by LaBoskey (1993) and Moon (1999) not only provide the procedural guidance for reflective journal writing, but also put reflective journal writing in a broader context and emphasize knowledge base construction and meaning making throughout the process of writing.

Another line of research focuses on the content and levels of reflective thinking in journal writing. Numerous rubrics have been conceptualized to evaluate the levels and contents of reflective thinking (e.g., Hatton & Smith, 1995; Lee, 2005; Mezirow, 1981; Sparks-Langer, Simmons, Pasch, Colton, & Starko, 1990; Valli, 1992; Ward & McCotter, 2004). For example, Hatton and Smith (1995) developed their criteria for the recognition of evidence for four different types of reflective writing: descriptive writing, descriptive reflection, dialogic reflection, and critical reflection, the last three of which are characterized as different levels of reflection. The first level, descriptive writing, is not reflective at all, but simply reports of experiences, events or literature. The second level, descriptive reflection, attempts to provide reasons to explain the experiences or events based often on one's personal judgment or reading of literature. The third level, dialogic reflection, involves discourse with one's self to explore the possible reasons. The highest level, critical reflection, involves one's reason exploration in the broader historical, social, and/or political contexts. Jay and Johnson (2002) developed a typology of

reflection profiling three dimensions of reflective thought: descriptive, comparative, and critical. The first dimension, descriptive reflection, describes the matter for reflection. The second dimension, comparative reflection, involves reframing the matter for reflection in light of alternative views, others' perspectives, research, and etc. The last dimension, critical reflection, describes the result of careful consideration of the implications of the matter to establish a renewed perspective toward the problem encountered. After synthesizing the existing reflection rubrics in the literature, Lee (2005) found out that teacher educators generally use the terms practical/technical, contextual/deliberative/conceptual, and critical/dialectical/transformational to identify the different domains of reflective thinking, much in alignment with van Manen's (1977) hierarchical classification. Based on Lee's (2005) synthesis and my literature review, Table 3 represents some of the existing rubrics that evaluate the level/content of reflective thinking.

Table 3

*Level/content of reflective thinking*

Proponent	Theme	Level/content
van Manen (1977)	Levels of reflection	Technical rationality: methodological problems & theory development to achieve objectives Deliberative rationality: pragmatic placement of theory into practice Critical rationality: value commitment toward educational process
Sparks-Langer et al. (1990)	Levels of reflective pedagogical thinking	No descriptive language Simple, layperson description Events labeled with appropriate terms Explanation with tradition or personal preference given as the rationale Explanation with principle or theory given as the rationale

Proponent	Theme	Level/content
		Explanation with principle/theory and consideration of context factors Critical explanation
Grimmett et al. (1990)	Levels of reflection	Technical: instrumental mediation of actions Deliberative: deliberation among competing views Dialectical: reconstruction of experiences
Sparks-Langer and Colton (1991)	Orientations to reflective thinking	Cognitive Critical Narrative
Mezirow	Levels of reflection	Non-reflective action Habitual action Thoughtful action Introspection Reflective action: content, process, and premise
Lasley (1992)	Pedagogical functioning	Technical Conceptual Dialectical
Hatton and Smith (1995)	Levels of reflection	Descriptive writing Descriptive reflection Dialogic reflection Critical reflection
Taggart (1996)	Reflective thinking pyramid	Technical level Contextual level Dialectical level
Bain et al. (1999)	Levels of reflection	Reporting Responding Relating Reasoning Reconstructing
Kember et al. (1999)	Coding categories for reflective thinking	Habitual action Introspection/thoughtful action Content reflection/process reflection/content and process reflection Premise reflection



Proponent	Theme	Level/content
Jay and Johnson (2002)	Typology of reflection	Descriptive Comparative Critical
Ward and McCotter (2004)	Levels of reflection	Routine Technical Dialogic Transformative
Lee (2005)	Depth of reflective thinking	Recall Rationalization Reflectivity

Despite the numerous benefits associated with the journal writing, several concerns related to preservice teachers' journal writing need to be examined. First, teacher educators may require too much of journal writing from preservice teachers, which results in their feeling "journaled to death," (Anderson, 1993, p. 306) or a feeling that that journals are "a pointless ritual wrapped in meaningless words." (Shor, 1992, p. 83) Pedro (2005) further questioned the seemingly unsound practice of overusing journal writing to enhance the development of preservice teachers' reflective thinking capability:

...there was a leaning in the education courses towards many writing activities that seemed burdensome to the preservice teachers. This raises the question about the necessity of extensive writing requirements as a means of fostering reflection. The literature points heavily towards developing portfolios, journals, and other writing tasks, however it behooves us as teacher educators to find ways that may not seem burdensome to preservice teachers that they write only because they have to. This is certainly not a positive approach to learn to become critical reflective practitioners. (p. 63)

Second, preservice teachers struggled in the process of their journal writing, and considered the journal writing process “onerous, tiresome and time-consuming” (Maloney & Campbell-Evans, 2002, p. 48). More strikingly, preservice teachers had little knowledge of reflection and reflective journal writing, and thus were at a loss as what to include in their journals (Lai & Calandra, 2007). They also had difficulty distinguishing between telling and reflection in journal writing (Bolin, 1990; Krol, 1996, February ).

Third, preservice teachers were caught between the crossfire of freely expressing their thoughts in journals and undergoing the scrutiny of teacher educator’s assessment for grading. Researchers and teacher educators have expressed their concern on the negative impact that grading has on preservice teachers’ journal writing. For example, Spalding and Wilson (2002) questioned whether grades are actually counterproductive to their goal of having students feel ownership of their journals. Students might write whatever to please the instructor for a better grade (Anderson, 1993). Or as Freese (1999) put it, “...they were telling me what they thought I wanted to hear.” (p. 906) Orem (1997) further critiqued the practice of grading of preservice teachers’ journal writing:

For a journal to be truly an instrument of transformative personal learning, the learner may need to be convinced of the safety of expressing what could be critical comments to someone who has power to award a grade to their overall performance. (p. 154)

Fourth, the value of teacher reflection is at risk of being diminished and overwhelmed by the increasing prevalence of standards, high-stakes testing, teacher accountability, and outcome assessment (Ward & McCotter, 2004):

The standards which are so widespread in basic education have been extended to teacher education programs (Cochran-Smith, 2000). A fundamental shift from an input to an output model of evaluation is taking place in the field. It is no longer enough for teacher education programs to demonstrate that their candidates have the knowledge, skills, and dispositions associated with effective teachers; teacher education programs must now demonstrate that their candidates make a positive impact on student learning (NCATE, 1999). We are all being asked to critically analyze student work in terms of how it is meeting standards. (p. 244)

And last, but not the least, the levels of reflection as evidenced in preservice teachers' journal writing have been primarily descriptive or technical rather than critical (Hatton & Smith, 1995; Surbeck, Han, & Moyer, 1991; Ward & McCotter, 2004). Davis (2006) strongly recommends that teacher educators should encourage preservice teachers to move beyond descriptive writing in their journal entries by providing carefully designed assignments and extensive scaffolding so that preservice teachers can involve analysis, "especially of interaction among different aspects of teaching." (p. 294) She noted that,

Though preservice teachers should not be expected to reflect with the same complexity of depth of reasoning as experts do, they should be supported in starting on a trajectory that will move them toward more expert reflection and 'effective reflective practice' (Loughran, 2002, p. 37) as they gain experience. (p. 294)

Because the researcher intended to examine whether the selected computer-based scaffolding tools (i.e., question prompts and writing process display) will have a

significant impact on preservice teachers higher levels of reflection as evidenced in their online journal writing, more efforts were devoted as follows to review the status quo of research on preservice teachers' levels of reflection in their journal writing, and to identify what are the possible root causes for the status quo.

Ward and McCotter (2004) employed a grounded theory approach to develop a four-level reflection rubric to evaluate preservice teachers' reflection on their student teaching. Using reflection exemplars of 13 different preservice teachers from 11 different teacher education institutions as data source, Ward and McCotter identified 94 reflective chunks (see Table 4). Among the chunks, only one reached the highest level of reflection in their rubric, transformative/critical reflection. The majority of the chunks were routine reflections and technical reflections.

Through naturalistic research, Surbeck, Han, and Moyer (1991) developed a framework to categorize preservice teachers' journal entries. At first, reaction category contained preservice teachers' initial responses to class content. Subcategories of reaction included positive feeling, negative feeling, report, personal concern, and educational issues. Second, within elaboration category, preservice teachers expanded their first reactions by explaining their feelings, verifying their thinking, giving an example, or referring to other situations. There were three forms of elaborations including concrete elaboration, comparative elaboration, and generalized elaboration. Third, contemplation category was characterized as showing the initial reaction combined with elaboration, as well as thinking about personal, professional, or social/ethical problems. The contemplation category here can be regarded as critical reflection. Surbeck et al. discovered that many preservice teachers wrote their journal entries using the reaction-

elaboration-contemplation sequence. However, only a few entries included the contemplation category, the critical reflection stage.

Table 4

*Precipitants by reflection level*

Precipitant	Routine	Technical	Dialogic	Critical	Total
Student interest (high)	2	1			3
Student interest (low)		2			2
TWS	2	2			4
Assessment/learning goals	4	5			9
Content consideration		3			3
External constraints	3	2			5
Instructional strategy	8	7	1		16
Prior-knowledge/experience	11	12			23
Relations/environment				1	1
Self-lauding	3	2			5
Struggling students/failure	1	12	4		17
Student learning/excitement	3	3			6
Total	37	51	5	1	94

Using their reflection rubric including descriptive writing, descriptive reflection, dialogic reflection, and critical reflection, Hatton and Smith (1995) evaluated 50 final year preservice teachers' written essays. The largest number of coded reflective units for any single essay was 52, and the smallest 2. The average number of coded reflective units

for the essays was 19. The largest proportion of coded units (60-70%) they found was descriptive reflection. Although preservice teachers often followed a unit of descriptive reflection with dialogic reflection, instances of critical reflection were found in only eight essays. Examples of critical reflection in preservice teachers' journals were often brief and superficial, whereas many instances of dialogic and descriptive reflection were complex, multi-dimensional, and insightful. After analyzing the content of 34 preservice teachers' reflective writing, Neijaard, Stellingwerf, and Werloopl (1997) reported the low level of reflection in these writing:

The reflections ... are mostly of a descriptive nature, that is expressions of events and actions and recognition of alternatives. ...student teachers reflected on teaching skills, personality aspects and relationships with students, the subject they taught particularly in reference to making subject matter knowledge teachable, developing an adequate attitude towards students in terms of power relations and the demonstration of interest in one another. To a lesser extent student teachers seemed to explore these events and actions, make judgments on them and explain alternatives. (p. 227)

Though based on different reflection evaluation rubrics, similar results have been found (Pultorak, 1996; Risko et al., 1999; Seng, 2001); that is, preservice teachers generally exhibited low levels of reflection in their journal writing. What are the contributing factors behind preservice teachers' low levels of reflection? First, this phenomenon might reflect the reality of preservice teachers being evaluated more for their technical and practical competencies, which, to a great extent, determines whether they are well prepared to enter a school context and survive. The existence of the survival

pressure may help explain why preservice teachers rarely reflect “beyond issues of self, task and students to questions of whether or not their practices (or the practices of their mentors) are just or ethical or lead to the improvement of society.” (Hamlin, 2004, p. 169) The results of Dinkelman’s (2000) qualitative research support “the view that the technical and practical demands of first learning to teach result in the dominance of non-critical forms of reflection.” (p. 220) Preservice teachers’ overwhelming concern with technical and practical competencies was confirmed by the results of the study Uline, Wilson, and Cordry (2004) conducted. In their study, preservice teachers addressed the same topic of “my most significant learnings” in their journal entries. After analyzing 408 journal entries by 86 preservice teachers enrolled in three different semesters of coursework that received the same instructional treatment, Uline et al. identified that the topics most frequently addressed by preservice teachers were related to technical and practical competencies of classroom teaching including classroom management (49 entries), followed by teacher flexibility (32), time management and teacher preparation (31), individualized instruction to match varying learning styles and abilities (22), amount paperwork (20), teachers as professionals, role models (19), engage students in learning activities (18), and teacher self-confidence (14). Moreover, McLaughlin and Hanifin (1994, July) discovered that it is difficult to move preservice teachers’ reflective thinking beyond their immediate concerns of classroom management and control.

Second, research has demonstrated that critical reflection is a trait that preservice teachers can develop only after they have had actual classroom teaching experiences (Berliner, 1988; Calderhead & Gates, 1993; Hatton & Smith, 1995). Cochran-Smith (1991) posits that beginning teachers will be able to critically reflect provided that they

work with seasoned teachers who themselves value and practice critical reflection. The dual lack of classroom teaching experiences and sustained teacher supervision make it even more difficult for preservice teachers to develop their capability of critical reflection. After Dinkelman (2000) discovered that the concern for technical and practical competencies led to the dominance of non-critical forms of reflection among preservice teachers, he commented that, “inexperience surfaces as an influential factor in supporting or impeding the development of critically reflective preservice teachers.” (p. 220)

Third, preservice teachers’ resistance to going beyond technical descriptions of their experiences may be due to their lack of writing skills, expressive skills, or their inability to confront comfortable assumptions (Lai & Calandra, 2007; Orem, 1997; Wellington, 1996). To be able to write reflectively, learning to be reflexive in one’s thinking is a necessary prerequisite skill (Knight, 1996). According to Knight, the practitioner’s understanding is the window through which a situation is understood and interpreted, therefore “an essential feature of ‘reflective practice’ is the need for the practitioner to be aware of her own processes in the development and construction of this interpretation.” (p. 177) Yost, Sentner, and Forlenza-Bailey (2000) suggested that teacher education programs should provide various opportunities for preservice teachers to enhance their reflectivity development:

Preservice teachers must have numerous clinical experiences linked to a variety of reflective approaches, that is, seminars, journal writing, portfolios, and action research. Teacher education programs must integrate these elements so that the developmental process of novice teachers’ reflective abilities can be actualized to the fullest extent possible. Opportunities to construct a personal knowledge of



learning theories and discuss issues relating to diversity and social, political, and economic forces that impinge upon schools will provide preservice teachers with a firm knowledge based from which they can critically reflect on the practice of teaching. Without a substantial knowledge base and mentoring by teacher educators to move novice teachers' thinking beyond a descriptive level, higher levels of reflection will be difficult to achieve for many novice teachers. (p. 47)

Fourth, preservice teachers are not well grounded in the concept of reflection and the principles of reflective practice. Pedro (2005) pointed out that the root cause of preservice teachers' reflective practice problems "remains whether the pre-service teachers were taught what the concept of reflection is, and whether they understood fully the principles of reflective practice." (p. 63) Lai and Calandra (2007) would agree with Pedro. The literature is replete with seminar works on reflective practice. Pedro (2005) believes that "...pre-service teachers, who participate in teacher education programs that maintain reflective practice as a conceptual orientation, should be exposed to such works." (p. 63) However, it is recognized that even teacher educators themselves may lack exposure to reflection. As Yost et al. (2000) noted:

A further obstacle to the development of critical reflection by preservice teachers is the limited exposure of teacher educators to the teacher education literature. Many doctoral programs that prepare teacher educators focus on curricula, instruction, and research specific to a major. Lack of exposure to important teacher education research, such as reflection, ill prepares teacher educators for understanding the vital importance of developing critical thinking in novice teachers. We believe many teacher educators hold strong beliefs that preservice

teacher are incapable of reaching higher levels of thought. The result translates to limited vision by the teacher educator and, concomitantly, no preparation of preservice teachers in this important area. (p. 46)

In summary, teaching is a learned profession (Shulman, 1987). Preservice teachers' reflective skills are developmental (Hatton & Smith, 1995; Rovegno, 1993). Unlike mental reflection, an individual's reflective journal writing is not a natural process, but one that has to be learned and practiced (Jasper, 1999). The literature review in this section indicates that journal writing is a potent means of reflective practice in teacher education programs to help internalize preservice teachers' reflective thinking ability. Researchers and teacher educators have used numerous support and scaffolding mechanisms to help support reflective journal writing, such as question prompts, modeling, guided mentoring, feedback. A more in-depth review of scaffolds in preservice teachers' journal writing will be presented in the next two sections, with a particular emphasis on the affordances of computer-based scaffolding.

### Scaffolding in Reflective Journal Writing

In general, students need to internalize the knowledge and skills of reflective journal writing until mastery occurs. A series of properly arranged scaffolding strategies for writing might enhance the internalization process. Applebee and Langer (1983) developed a model for teaching writing in which expert language users provide guidance for learners' new language activities in context. In an appropriate scaffolding process for writing, Applebee and Langer (1983) identified five features that should be in place to allow facilitation of assisting the learner in internalizing the knowledge of writing until mastery occurs. These features include: (1) *intentionality*, meaning that the task has a

clear overall purpose that drives any separate activity contributing to the whole; (2) *appropriateness*, indicating that instructional tasks pose problems that can be solved with help but which students could not successfully complete on their own; (3) *structure*, modeling and questioning activities are structured around a model of appropriate approaches to the task and lead to a natural sequence of thought and language; (4) *collaboration*, the teacher's response to student work recasts and expands upon the students' efforts without rejecting what they have accomplished on their own. The teacher's primary role is collaborative rather than evaluative; and (5) *internalization*, external scaffolding for the activity is gradually withdrawn as the students internalize the writing patterns. Applebee and Langer's model for teaching writing lays the foundation for the future research on how reflective journal writing can be scaffolded.

Research has demonstrated that even young children can learn the reflective processes in writing. For instance, Scardamalia, Bereiter, and Steinbach (1984) conducted a study to explore the teachability of reflective processes in written composition among sixth graders. For the experimental group students, the researchers adopted three instructional strategies: (a) procedural facilitation – the use of cue cards to stimulate self-questioning during planning monologues; (b) modeling thought – the frequent use of modeling with the instructor as model and with students modeling for each other, with and without cue cards, and with follow-up discussions of the thinking strategies exhibited; and (c) direct strategy instruction – the explanation of dialectical synthesis of conflicting ideas to the students. Findings from the analysis of students' topical and opinion essays indicated an overall change in the direction of reflectivity – difference scores showed a significant advantage for the experimental group on the topical essay;

difference scores also favored the experimental group on the opinion essay, but not to a degree approaching statistical significance. Meanwhile, they also found out that students' reflection at the higher levels was not evident, even though some indication of movement toward higher levels of reflection was identified from the kinds of help students sought while they were working on compositions.

The literature is replete with the scaffolding strategies intended for enhancing the learning and practice of reflective journal writing. These strategies include question prompts (Baker & Shahid, 2003, January; Bean & Stevens, 2002; Pultorak, 1996), templates (Hoban, 2000b), guided instructions (Hamlin, 2004; Hunter & Hatton, 1998; Scardamalia et al., 1984), modeling (Loughran, 1997; Scardamalia et al., 1984), feedback (Martin, 2005; Paterson, 1995) and peer collaboration (Martin, 2005), to name just a few. Researchers and teacher educators continued to call for investigating ways in which reflective journal writing can be enhanced (Bain et al., 1999; Bean & Stevens, 2002).

### *Question Prompts*

Prompts and questioning from experts and peers have been proven to be the most widely used scaffolding strategies in promoting one's higher levels of reflection. Putnam (1991) investigated the use of a type of prompt/scaffold called recipes as a reflection development tool for organization development consultants. For Putnam, a recipe refers to "a sentence fragment with a characteristic wording that can be used to designed interventions for some class of situation." (p. 147) The recipe usually consists of short open-ended phases, sentences, or questions such as "what prevents you from ..." or "what would lead you to..." The consultants followed a series of phases of recipes to contextualize and make sense of their experience and to inform their decision making. In

the first phase, the novice consultants used recipes as a one-liner due to their lack of expertise in the theory of practice from which the recipe was drawn. In the second phase, they shifted their attentions to use the recipes to implement broader strategies from the new theory of practice when exploring the reasoning is the new strategy. Coaching was needed in this stage. In the third phase, the consultants became able to respond to surprising data by reframing the situation or even questioning their own use of the recipes. “The three phases thus show a progression from using recipes as one-liners, to using them as part of a new strategy but still within old frames, to using them more consistently with the new theory of practice.” (Putnam, 1991, p. 161) Though Putnam’s use of the recipes was geared toward organization development consultants’ reflective learning, its efficacy in enhancing preservice teachers’ reflective journal writing is evident.

Baker and Shahid (2003, January) reported how they used a systematic set of nine question prompts to guide preservice teachers’ reflection about their field experience of classroom teaching:

Prompt A – Describe your initial impressions of the classroom. What challenges and opportunities do you see for yourself as a teacher? How do you expect to meet these?

Prompt B – How have you become familiar with what your students already know and are able to do? How have you become familiar with your students’ individual interests and cultural backgrounds?

Prompt C – How do you plan to assess how well the students have achieved the learning objectives? How will you accommodate different instructional levels and learning styles of students in your class?

Prompt D – How have you encouraged students to take responsibility for their own learning? What resources are available for students needing assistance?

Prompt E – Analyze a lesson you have taught. In terms of instructional strategies, were the strategies effective for all students? Why or why not? What would you do differently to improve the lesson?

Prompt F – Analyze another lesson you have taught in terms of student activities, materials, resources and technology. Were these aspects of instructional delivery effective for all students? Why or why not? What would you do differently to improve the lesson?

Prompt G – What strategies have been particularly successful? Why do you think this is so? How can you build on this success?

Prompt H – What have you learned about effective teaching practices? How do you know if you have been effective? What can you do to become more effective?

Prompt I – As a teacher with this group of students, what has been your greatest success? What were the decisions you made that attributed to that success? Think back over the course of the teaching experience and identify your greatest challenge with this group of students. How have you addressed this challenge? (p. 15)

As the authors pointed out, these learner-centered prompts helped preservice teachers reflect on the roles of teacher and students, think deeply about their effective teaching

practices, and take responsibility for their students' learning process. In other words, if framed in Shulman's (1987) categories of a teacher's knowledge base, these question prompts focus more on preservice teachers' content knowledge, general pedagogical knowledge, curriculum knowledge, pedagogical content knowledge, and knowledge of learners and their characteristics, but there was no emphasis on their knowledge of educational contexts and/or knowledge of educational ends. Furthermore, students' higher levels of reflection such as dialogic, transformative, or critical reflection did not seem to be required or encouraged. The design of the prompts seemed to embody the challenge that preservice teacher education encounters. That is, preservice teachers are evaluated more for their technical and practical competencies.

Bean and Stevens's (2002) qualitative study explored how online bulletin board discussion prompts by teacher educators such as those shown below shaped pre- and in-service teachers' reflective responses.

Week One: Hello, Fantastic Forum Folks! The author of our text goes through many different sorts of assessment: 1. What sounded familiar from class this week? What have you seen in your practicum [field-experience] classroom?

Considering all of this, what is the difference between an assessment and a test and when should we use each? (p. 210)

Results from the analysis of the teachers' discussions and personal journal entries showed that the prompts helped students focus on their reflections, and provided explicit support in modeling the role of reflection. The results also showed that the prompts helped the students formulate and articulate their personal belief systems, but did not substantively

help them challenge larger discourses of teaching, learning, and students, the highlights of critical reflection.

Whipp's (2003) qualitative study focused on exploring what scaffolds were effective to promote preservice teachers' critical reflection on their field experiences in online discussions. The findings suggested that questioning strategies such as tailored questioning and general questioning from the professor and peers about sociopolitical and moral issues were particularly effective scaffolds. One example of tailored questioning was "Can white teachers effectively teach African American students?" An example of general questioning was "What would you do in your class to counter gender bias?" Whipp suggested that such scaffolds encouraged a higher level of discussion that, in turn, supported higher levels of reflection. He also suggested using more sophisticated technological tools other than emails to better scaffold preservice teachers' higher levels of problem solving and joint knowledge building.

### *Templates*

Templates have been used to support a reflective framework for preservice teachers to reflect on their learning in university classes (Hoban, 2000c). Three phases in Hoban's reflective framework including analysis, synthesis, and theorizing was incorporated into Web-based templates. During the analysis phase, preservice teachers were required to log into Website each week to write reflections on their classroom experiences to identify personal, social (teaching and peer) and situational factors that influenced their learning. Preservice teachers followed four templates to reflect: (1) the template of personal factors guides preservice teachers to reflect on their prior knowledge, feelings, self esteem, motivation and personal learning strategies; (2) the



template of teaching factors concerns class organization, teaching strategies, class organization goals, and rapport related to instructor/tutor; (3) the template of peer factors suggests preservice teachers to reflect on how they encourage each other, share ideas and cooperate in tasks; and (4) the template of situational factors leads preservice teachers to take into consideration of the task, setting and environment. During the synthesis phase, the system enabled preservice teachers to collate their weekly reflections to compare, combine and synthesize factors to identify several key factors for each of the four categories. Then preservice teachers developed their learning profile to identify the factors that would establish an optimal learning environment for them in a university class. During the theorizing phase, preservice teachers theorized about the various relationships among the key enhancing factors identified in synthesis phase to devise a metaphor, such as “learning to snow ski.” The purpose was to use the metaphor to represent an optimal learning environment for a university class. The process of theorizing was assisted by having the reflective data presented systematically and collectively in the templates. Hoban (2000c) discovered that the use of the templates helped preservice teachers gain an understanding of the complexity of classroom learning which links personal, social and situational influences.

### *Structured Writing Guidance*

Structured writing guidance, such as critical incident technique (Flannagan, 1954), can be used to promote preservice teachers’ higher levels of reflection. From critical incident analysis, preservice teachers can interpret the significance of an event following four steps developed by Tripp: (a) describe and explain an incident; (b) find a general meaning and classification for the incident; (c) take a position regarding the

general meaning; and (d) describe actions to be taken (as cited in Griffin, 2003).

Preservice teachers in Hamlin's (2004) qualitative study used critical incident analysis to assist their field observations and development of their professional judgment. To facilitate the development, Hamlin required her students to report critical incident analysis following the guides that Posner (2000) prescribed in the fieldwork log chapter of his book, *Field Experience: A Guide To Reflective Teaching*. Hamlin discovered that, using structured writing guides, preservice teachers participating in early field experiences were capable of reflection at multiple levels including critical reflection. Griffin (2003) also conducted a study to determine the effects of critical incidents technique and associated instructional activities including explicit instruction and coaching on preservice teachers' levels of reflection. The study evaluated 135 critical incidents, written by preservice teachers during a six-week field experience. Examination of frequency and category data showed that writing critical incidents increased the degree of preservice teachers' orientation toward growth and inquiry, and from a concrete thinker to an alert thinker. Although dialectical/critical reflections were scarce, contextual reflections doubled as preservice teachers cycled through writing, feedback, dialogue, experience, and writing.

### *Modeling*

Modeling is another effective scaffolding strategy adopted to develop preservice teachers' levels of reflection. Advocates of reflective practice agree that reflection should be modeled throughout preservice teachers' education years while at teacher education programs (Hoban, 2000a; Loughran, 1996; Reagan, 1993). Modeling is strongly related to cognitive apprenticeship pedagogy (Collins, Brown, & Holum, 1991; Collins, Brown,

& Newman, 1989) and is usually applied together with coaching and fading. For example, teacher educators, who use cognitive apprenticeship models, make their reflectivity knowledge and reflective thinking processes explicit to preservice teachers by explaining exactly what they are doing and thinking and how they do it as they model the reflective practice. Then they provide necessary coaching while preservice teachers attempt to imitate their reflective practice. After additional modeling, corrective feedback, and reminders from the teacher educators, if preservice teachers can achieve the reflectivity performance close to that of the teacher educators, fading of the assistance from the teacher educators occurs.

Loughran (1995; 1996; 1997) has significantly contributed to our understanding and knowledge of how teacher educators' modeling of reflective practice can influence preservice teachers' reflective practice. Loughran modeled reflective practice to his preservice teachers by talking aloud his reflective thinking process in classroom and by writing his journals for them to review. First, he verbalized his reflective thinking about his pedagogy and his pedagogical reasoning in class, the explicit act of modeling reflection-in-action. Second, he wrote journals before, during, or after the class sessions about what he was doing, the decisions he was making and why he made the decisions, and gave his students an access to his journals to understand his reflective thinking process. Through these two scaffolding strategies, he was open to public scrutiny of any of the suggestions, problems, hypotheses, reasoning or resultant testing that he had been considering. To explore the impact his modeling of reflective practice on his students, Loughran (1995) conducted a qualitative study employing students' journal writing and interview transcripts as data sources. He discovered that modeling of reflection can be

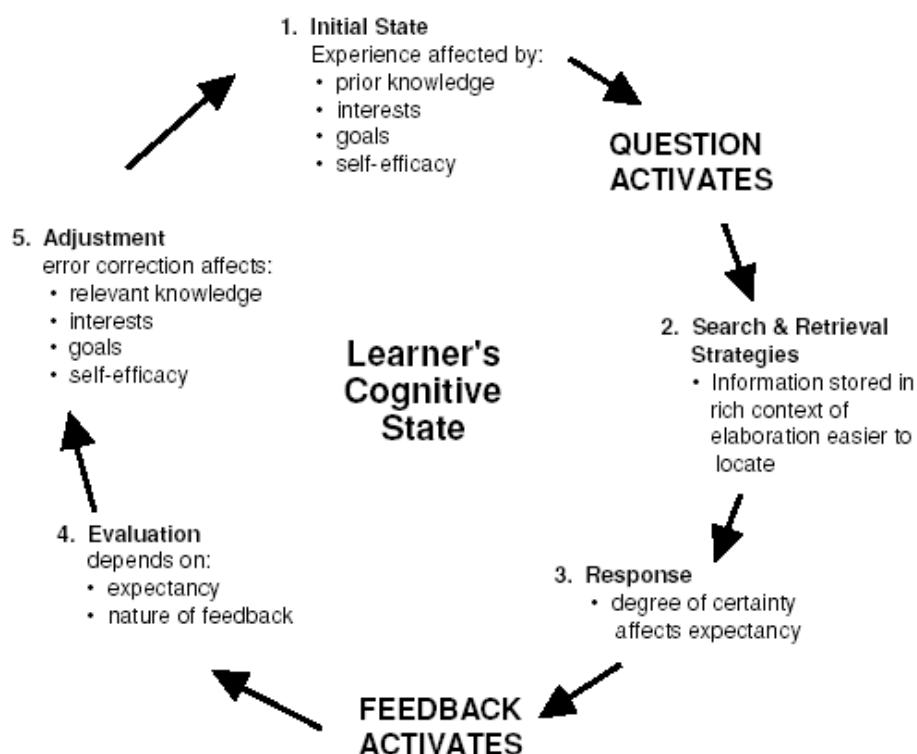
successfully incorporated into preservice teachers' learning about teaching. Moreover, preservice teachers valued the teacher educator's reflection modeling in and outside of the classroom.

### *Feedback*

The significance of feedback to promote learning is well documented. Dempsey, Driscoll, and Seindell (1993) described text-based feedback as "a reflective process in which the learner explores situational cues and underlying meanings relevant to the task involved." (p. 38) According to them, feedback significantly contributes to the learner's behavioral and cognitive operations that occur in learning, provided that the learner receives the feedback mindfully. They further developed a five-stage model to describe how learner's cognitive states change upon text-based feedback (see Figure 4). The five stages are (1) the learner's initial state, (2) what search and retrieval strategies are activated, (3) the learner's response, (4) the learner's evaluation of the response, and (5) adjustments the learner makes.

Feedback has been applied as a scaffold to facilitate preservice teachers' developments of levels of reflection. For example, Ryken (2004) gave written feedback to her students' reading journal entries, and valued it as a collaborative process to enhance both her reflective teaching and her students' reflective learning. She categorized her written comments into four types: (1) validating student insights and struggles, e.g., "You share very important insights about your desire to know your students as people and learners." (p. 114) (2) Asking students to further explain or elaborate their stand, e.g., "What types of assessment norms do you hope to set up in your classroom? How can your *assessment strategies support student inquiry*?" (p. 115) (3) Suggesting other

connections, e.g., “Think about how your interest in science shapes your notions of inquiry.” (p. 115) And (4) calling for continued reflection about an issue, e.g., “As you continue to reflect, think about how you might make education relevant to student life – both now and in the future.” (p. 115) Students regarded the interactive journaling instigated by teacher educator’s comments as cues to extend and challenge their reflective thinking.



*Figure 4.* The state of the learner receiving text-based feedback.

In Spalding and Wilson’s (2002) study, both traditional (comments on hard-copy journals) and technology-enhanced (response via email) ways of feedback were utilized. One instructor asked her preservice teachers to turn in hard-copy journals on which she provided her marginal feedback; whereas the other instructor received journals via email

and offered her feedback holistically by email as well. They reported using several varieties of feedback:

(1) positive comments (e.g., ‘You’ve done a good job of description!’); (2) questions to stimulate elaboration or further reflection? (e.g., ‘WHY is there a give and take to classroom management? If it is so important for students and teachers to understand one another’s backgrounds, why don’t we spend more time on this in schools?’); and (3) making personal connections to the content of the journal entry (e.g., ‘I myself have many doubts and questions about special education policy and practice.’) (p. 1399)

Preservice teachers in the study all agreed that the instructors’ feedback helped them become more reflective. Such unanimous agreement triggered Spalding and Wilson to claim that medium (email/hard copy) of journaling or mode (email holistic/hard copy marginal) of response makes no difference in enhancing preservice teachers’ development of reflective thinking – “what mattered most to the students was the response itself.” (p. 1414) They also discovered that teacher educator’s personalized feedback on preservice teachers’ journals and the relationship between teacher educator and preservice teachers are most important in help preservice teachers grow their levels of reflection.

### *Peer Collaboration*

Peer collaboration is another scaffold conducive to preservice teachers’ development of critical thinking capability. Levin (1999) conducted a study to examine different types of online discourse, including (1) student to peer journals, (2) student to keypal journals, (3) student to instructor e-mail journals, and (4) student to group of peers

threaded discussion. Levin discovered that electronic communications in peer-to-group settings fostered reflection the best because participants had a larger audience to share their thoughts. Nicholson and Bond (2003) also found out that preservice teachers' reflective thinking developed over time after they used the electronic discussion board to share experiences and ideas with peers. Initially, preservice teachers were preoccupied with typical technical concerns of discipline and the larger school setting from rather egocentric perspectives. As preservice teachers continued to interact on the discussion board throughout the semester, they greatly increased their orientation toward critical inquiry.

### Computer-based Scaffolding

Scaffolding is a learner-centered strategy specifically engineered to assist learners to achieve the learning goals or performance which would be beyond their unassisted efforts (Laffey, Tupper, Wedman, & Musser, 1998; Soloway, Guzdial, & Hay, 1994; Wood et al., 1976). Scaffolding may support a range of instructional targets. These instructional targets include:

- (a) learning domain knowledge (e.g., concepts, procedures, etc), (b) learning about one's own learning (e.g., metacognition, self-regulated learning), (c) learning about using the computer-based learning environment (e.g., procedures, embedded tools, functionality, etc), and (d) learning how to adapt to a particular instructional context (e.g., engaging in adaptive help-seeking behavior, modifying contextual features to facilitate learning, etc). (Azevedo & Hadwin, 2005, p. 370)

Within each of these targets, scaffolding supports people's development of declarative, procedural, conceptual, or metacognitive knowledge (Azevedo & Hadwin, 2005).

Vygotsky (1978), the former Soviet psychologist, initiated the concept of scaffolding in child psychology as he explained children's zone of proximal development (ZPD), even though he never used the exact terminology of scaffolding. Vygotsky claimed that children's learning should be matched in some manner with their developmental level. Prior to the matching, at least two developmental levels related to children should be determined, namely, their actual development level and their potential development level. Vygotsky defined the ZPD as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers." (p. 86) The ZPD thus is the area between what a child can do by himself or herself and that which can be attained with the help of a more knowledgeable adult or peer. One's ZPD is always changing as s/he expands and gains knowledge, so the scaffolding provided to help him/her achieve the learning goal must constantly be individualized to address his/her changing ZPD.

Though Vygotsky initiated the concept of scaffolding, he did not identify the nature of the scaffolding, nor did he provide any scaffolding processes appropriate in the learning environment. Decades later, Wood, Bruner, and Ross (1976), for the first time, introduced the scaffolding metaphor in the context of tutorial interactions between an adult and an individual child. They also identified the nature of the scaffolding process during which the adult serves several key tutoring functions. To gain knowledge about the scaffolding process in children's problem solving, Wood et al. (1976) conducted a study to explore how 30 individual small children worked on a task that required a degree of skill initially beyond their unassisted efforts. The children were equally divided into



three-, four-, and five-year-old groups with each age-group being equally divided between genders. The laboratory task required children to build a three-dimensional pyramid out of 21 specially designed blocks, each of which had pegs, holes, and depressions that constrained their assembly. During the laboratory task session, although the children were readily engaged in playing with the blocks, they found the pyramid assembly difficult and needed significant assistance from the tutor to complete the task. After allowing the child five minutes of free play session, the tutor began by tutoring the child how pairs of pieces could be put together and by drawing the child's attention to some important features of the blocks. The tutor geared her guidance to the needs of each individual child, allowing him/her to do as much as possible. Although the tutor always tried to verbally help first, she applied direct intervention when she found that the child failed to follow her verbal instruction. Furthermore, the child's success or failure at any point determined the tutor's next level of instruction. From the study, Wood et al. discovered that, during problem solving or skill acquisition, the interaction between a tutor and a learner generally involves a " 'scaffolding' process that enables a child or novice to solve a problem, carry out a task or achieve a goal which would be beyond his unassisted efforts." (p. 90) The scaffolding process is characterized as "the adult's 'controlling' those elements of the task that are initially beyond the learner's capacity, thus permitting him to concentrate upon and complete on those elements that are within his range of competence." (p. 90) In analyzing the tutor's interactions with the children, Wood et al. identified the nature of the scaffolding process during which the adult could serve several key tutoring functions. During the scaffolding process, they suggest that the adult should be able to (1) recruit the child's attention in the task, (2) reduce degrees of

freedom in the task to manageable limits, (3) establish and maintain an orientation toward problem solving, (4) highlight critical features that the child might otherwise overlook, (5) control child's frustration during problem solving, and (6) demonstrate solutions when the child can recognize them.

Wood, Bruner, and Ross (1976) identified the nature of the scaffolding process between an adult tutor and an individual child. According to Stone (1998), it was Cazden (1979) who first made explicit the implicit link between Vygotsky's ZPD (1978) and the scaffolding metaphor introduced by Wood et al. (1976). Cazden extended the scaffolding metaphor from its original use in the context of dyadic adult-child interactions to an analysis of teacher-student ones in classroom settings. Just as parents use language games and turn-taking as temporary scaffolds for their children's early language use and problem-solving activities, she argued that classroom teachers use repeating question-answer sequences as scaffolds for their students' mastery of the implicit participation structures of classroom discourse. Cazden argued, adults scaffold children's learning in a broad array of situations, and Vygotsky's notion of the adult-child interactions in the ZPD would provide an analytic link in understanding these dynamics (as cited in Stone, 1998). The parallels between scaffolding and Vygotsky's ZPD were further drawn by the researchers (Rogoff & Wertsch, 1984; Tharp & Gallimore, 1990). For example, Tharp and Gallimore (1990) pointed out that inservice teachers need assistance to realize their ZPD. They identified six means of performance assistance for inservice teachers, including modeling, contingency management, feedback, instructing, questioning, and cognitive structuring. Feedback was identified as the single most effective means of performance assistance (as cited in Samaras & Gismondi, 1998).

The success of scaffolding is dependent on calibrated support for diagnosed learning targets and on its adaptability to the learner's needs (Azevedo & Hadwin, 2005; McLoughlin, 2002). Four attributes are usually associated with scaffolding, including diagnosis, calibrated support, fading, and individualization (Azevedo & Hadwin, 2005). Scaffolding provided goes beyond simple physical support such as tools in a learning environment by addressing learning of concepts, procedures, strategies, and metacognitive skills (Hannafin, Land, & Oliver, 1999). According to Laffey, Tupper, Wedman, and Musser (1998), scaffolding has two forms: (a) explicit forms delivered through face-to-face interaction with a tutor or an expert, and (b) implicit forms, e.g., procedure and task facilitation, realized through physical and structural support. Whereas according to Azevedo and Hadwin (2005), scaffolding can be in the forms of pre-stocked static questions, dynamic support tailored to student needs and context, or computer tools guiding students in their tasks. One salient feature of scaffolding is the temporariness of the support and guidance it provides. The support and guidance will not be necessary after the learner has incorporated given strategies into his/her repertoire, a process usually called fading. Guzdial (1994) provided an elaborated definition of fading:

A critical component of scaffolding is fading. If the scaffolding is successful, students will learn to achieve the action or goal without scaffolding. For students to practice the action or goal without the scaffolding, the scaffolding must fade. However, scaffolding should not be all-or-nothing. Instead, scaffolding should be adapted to individual student needs, typically through gradual reduction in scaffolding. (p. 4)

Supporting novice learners by limiting the complexities of the learning context or allowing them to participate at an ever-increasing level of competence only explains one side of the efficacy scaffolding plays, gradually removing those limits or withdrawing as the learners gain the knowledge, skills, and confidence to cope with the full complexity of the context plays a more salient role (Rosenshine & Meister, 1992; van Merriënboer, Kester, & Kirschner, 2003; Young, 2001).

Traditionally, scaffolding occurs through personal interactions between students and instructors. The famous Socratic dialogues are a prime example. The scaffolding metaphor has recently been used by researchers to describe features and functionality of computer-based educational software that help users to complete certain tasks (Kao, Lehman, & Cennamo, 1996, October; Lin et al., 1999; Sherin et al., 2004; Winograd, 2002). For example, to support students' learning of applied statistics, Kao, Lehman, & Cennamo (1996, October) used a contingent scaffolding model (see Figure 5) to develop a 3-Dimensional hypermedia system to "systematically vary the instructor's support in response to the learner's performance in a learning task consisting of a sequence of steps/sub-tasks." (p. 304) The following rules determined the process of scaffolding in the hypermedia system:

1. Each practice involves a full performance of sub-tasks from the first to the last.
2. The first practice starts with the highest level of support. After that, each practice starts with the level of support which is one level lower than the latest one used in the previous practice.

3. At the current level of support, the learner has the chance to work on the following sub-tasks unless he/she encounters any difficulty.
4. In each sub-task of the practice, if the learner encounters difficulty, the support level is increased by one until reaching the highest level. (p. 305)

Elements of Scaffolding and "Hypothesis Testing-- the Z-Test" CAI Design Features	
Elements of Scaffolding	CAI Design Features
1. Hierarchical component skills	Four serial steps to carry out the Z-test
2. Decreasing support levels	Four levels of support
3. Repetitive authentic practice	Up to 20 authentic problem scenarios
4. Ongoing assessment	Performance is judged at the end of each step

*Figure 5.* The four elements of the scaffolding model.

Three types of support were provided in the system: visual support, verbal support, and symbolic support. Visual support refers to the graphic illustration of the problem situation. Verbal support includes the text instruction and leading questions or hints shown on the computer screen. Symbolic support includes a specific Greek/English letter with a pre-defined meaning or a mathematical symbol for operations. Based on the three types of support, four levels of support were classified and ranked by the types of support provided at the time. (a) In level one of full support, the instruction demonstrates the steps needed to solve the problem in detail with visual, verbal, and symbolic support (see Figure 6). (b) In level two of visual, verbal, and symbolic support, the instruction only provides the visual and verbal hints to the current problem step and requests the learner to answer after the symbolic prompts (see Figure 7). (c) In level three of verbal and symbolic support, the information in the figure area disappears. Only the verbal hint is provided, informing the learner of some specific information and asking him/her to provide answers after the symbolic prompts (see Figure 8). And (d) in level four of

symbolic support, only the symbolic prompts are provided, requiring the learner to provide the answers (see Figure 9).

Hypothesis Testing

Now

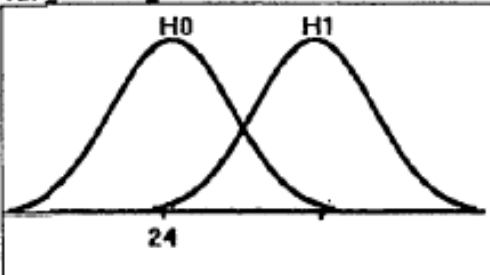
Next

End

1. Rats that are raised in a laboratory environment have a mean life span of around 24 months. A sample of 36 rats reared to adulthood in a germ-free environment had life spans with a mean of 27. Assuming a population standard deviation of 6 months, does this type of rearing increase the life span of the laboratory rats to a point that is enough to reject the null hypothesis at 0.05 level of significance? (McGhee, 1985, p331, Example 9.13)

From the problem statements, we expect the mean  $\mu$  of the population from which the sample was drawn will be greater than 24. Therefore, the null hypothesis  $H_0$  and the alternative hypothesis  $H_1$ .

STEP 1 LEVEL 1



written in symbols, are

$H_0: \mu = 24$

$H_1: \mu > 24.$

A one-tailed test to the right is required.

Figure 6. Level 1: full support.

**Hypothesis Testing**

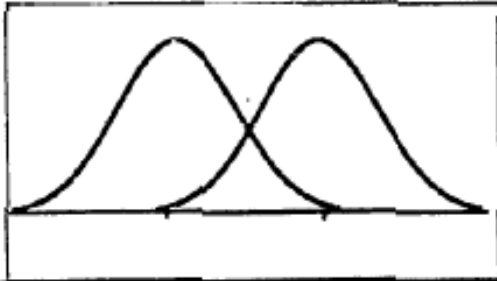
**Now**

2. In several studies it has been reported that the natural age at menopause of non smoking women is around 50 years. In a study entitled Cigarette Smoking and Natural Health, a sample of 43 heavy smokers had a mean age at menopause of 48 years. Assuming a population standard deviation of 5.6 years, test the hypothesis that cigarette smoking is associated with early onset of menopause with 0.05 level of significance. (McGhee, 1985, p332, Example 9.14)

**Next**

The first step of the hypothesis testing is to state the Null and Alternative Hypotheses. What hypotheses can you state for this problem? Click one of the buttons to decide the direction of the alternative hypothesis.

STEP\_1 LEVEL\_2



$H_0: \mu = 50$

$H_1: \mu \square 50$

**End**

Figure 7. Level 2: visual, verbal, and symbolic support.

**Hypothesis Testing**

**Now**

3. A survey of faculty workloads at a large university in 1979 showed an average of 44.3 hours per week of instructional and academic-related work. Recently the university switched to the quarter system. Assuming a population standard deviation of 6 hours, test the hypothesis that the workload is unchanged and did not increase as predicted if a random sample of 36 faculty members showed workloads with a mean of 45.7 hours per week. Use 0.05 as the level of significance. (McGhee, 1985, p333, Exercise Set 9.3, Part A, #5)

**Next**

The first step of the hypothesis testing is to state the Null and Alternative Hypotheses. What hypotheses can you state for this problem? Click one of the buttons to decide the direction of the alternative hypothesis.

STEP\_1 LEVEL\_3

$H_0: \mu = 44.3$

$H_1: \mu \square 44.3$

**End**

Figure 8. Level 3: verbal and symbolic support.

**Hypothesis Testing**

**New**

4. Suppose the I.Q.s of graduating high school seniors at a metropolitan area have a standard deviation of 24. The metropolitan area selects 84 students at random and will use them to demonstrate (hopefully) that students from this area have I.Q.s exceeding the national average of 105. The sample of students showed I.Q.s with a mean of 111. What is the conclusion if the level of significance is 0.01. (McGhee, 1985, p333, Exercise Set 9.3, PartA, #6)

**Next**

Click one of the buttons to decide the direction of the alternative hypothesis.

STEP\_1 LEVEL\_4

$H_0: \mu = 105$

$H_1: \mu \square 105$

Figure 9. Level 4: symbolic support.

Kao et al. then conducted a quantitative pretest, posttest study to evaluate the effects of scaffolded instruction on Z-test in terms of comprehension, knowledge maintenance, and knowledge transfer between the full support instruction and the least-support instruction. Seventy-two undergraduates participated in the study. They were assigned to three support conditions including full support, scaffolded, and least support. For knowledge maintenance posttest, the results of the regression analysis indicate that the availability of full support hampered the learner's independence, and the scaffolded instruction was successful in enhancing the learner's knowledge maintenance. For knowledge transfer posttest, though the group difference did not reach statistically significant level, the scaffolded group got a higher average score and a smaller standard deviation than the other two groups. In summary, the results indicated that the computer-



based contingent scaffolding model successfully promoted student learning of applied statistics.

Hannafin, Land, and Oliver (1999) categorized four types of scaffolding strategies in computer-based learning environments: (1) conceptual scaffolding guides learners in what content to consider, and helps them reason through complex or fuzzy problems and concepts where misconceptions or misunderstandings are prevalent. Conceptual scaffolding can be made available through a variety of mechanisms, ranging from the graphical depiction of structure maps and content trees, to explicit hints and prompts provided by experts; (2) Metacognitive scaffolding provides guidance on how to think about the problem under study. They can be either domain-specific, such as where enabling contexts are externally induced, or more generic where the enabling context is not known in advance. (3) Procedural scaffolding provides guidance on how to utilize available resources and tools. They orient learners/performers to system features and functions, or aid them while navigating the system. The scaffolding can be achieved by providing tutoring on system functions and features, or by providing a “balloon” or “pop-up” help to define and explain system properties. And (4) strategic scaffolding guides a learner to analyze and tackle a given learning task or problem. It not only focuses on approaches for identifying and selecting needed information, evaluating available resources, and relating new to existing knowledge and experience, but also involves alerting the user to available tools and resources that might prove helpful under given circumstance, and providing guidance in their use. Strategic scaffolding can be achieved by enabling intelligent responses to system use, suggesting alternative methods or

procedures, providing start-up questions to be considered, and providing advice from the experts.

Ping and Swe (2004) categorized four types of existing scaffolding strategies in computer-mediated learning environments. The scaffolding strategies include (1) orienting strategies that direct student attention to key variables, concepts and visual cues; (2) peer interactions that facilitate cognitive thinking and metacognition skills; (3) prompts (including question generation, elaboration, and reflection prompts) that promote knowledge generation; and (4) modeling that guide students to generate questions and elaborate thinking.

The presence of various support/scaffolding mechanisms have become an inalienable component of computer-based learning environments (Jonassen, 1999). Consequently, researchers have begun to emphasize the importance of embedding conceptual, metacognitive, procedural, and strategic scaffolds in computer-based learning environments to facilitate learning and performance. Such emphasis was validated by two special journal issues on scaffolding, one in the *Journal of the Learning Sciences* (Davis & Miyake, 2004), and the other in *Instructional Sciences* (Azevedo & Hadwin, 2005). As Lajoie (2005) summarized it, researchers continued to investigate the core questions related to scaffolding including

what to scaffold, when to scaffold, how to scaffold and when to fade scaffolding, since these questions are determined by the domain in question, the tasks involved, what you want learners to accomplish and the individual differences that need to be addressed in such contexts. (p. 542)

Recently, research has demonstrated that computer-based scaffolds embedded in the computer-based learning environments can enhance preservice teachers' reflective practice. For example, in their literature review, Lin, Hmelo, Kinzer, and Secules (1999) identified four types of scaffolding strategies that can support preservice teachers' reflection in technology-enhanced environments: (1) process prompts, "the designs in which the technology poses appropriate questions and guides students in tracking and understanding their own process." (p. 49) Students may be asked of various forms of domain-specific questions so that they can engage in explaining aspects of their learning processes. The question prompts are usually developed on the basis of studies of questions generated by experts in similar problem situations. (2) Process displays, "technology that makes normally tacit learning processes explicit and overt." (p. 47) Traditionally, reflection on process is normally facilitated through the use of support structures such as study guides and advance organizers, which do not always occur at appropriate times. Instead, appropriately designed technological process display can capture or record a learner's actions as they occur and play them back. (3) Process modeling, strongly related to cognitive apprenticeship pedagogy, "focuses on the process that an expert would use in order to think about or solve specific problems." (p. 50) For example, technology renders it possible to track, replay, and analyze expert teacher's thinking and problem solving processes. Preservice teachers who are learning about the same domain can compare and contrast those processes with their own to acquire deeper understanding of their own thought and problem-solving processes. Reflection scaffolded by process prompts, process displays and process modeling entails an individual activity. And last, (4) reflective social discourse, the technology- and community-based discourse

in the context of complex problem solving, is characterized by multiple perspectives contributed by the peers and instructors.

### Summary

People learn from their experiences. Reflection about one's experiences leads to learning. In recent years, the reflective approach has become a major, encompassing paradigm in teacher education. NCATE even specifies target reflective thinking standards for teacher candidates so that they will engage in reflective practice as an integral and continuous component of their teaching.

There are three types of reflection: reflection-on-action, reflection-in-action, and reflection-for-action, all of which make reflection encompassing past, present, and future simultaneously. In general, teacher educators use the terms practical/technical, contextual/deliberative/conceptual, and critical/dialectical/transformational to identify the hierarchical domains of reflective thinking. Researchers have increasingly stressed the importance of developing preservice teachers' ability to reflect at higher levels (i.e., critical, dialectic, or transformational reflection). Critical reflection is a distinguishing attribute of reflective practitioners. Researchers suggest that a particular emphasis be placed on developing preservice teachers' critical reflection skills, because reflection is effective only when it incorporates moral, political, social, and ethical criteria into the discourse about practical actions in education.

Journal writing is the most widely adopted means of reflective practice in teacher education programs to develop preservice teachers' reflective thinking capability, coupled with the development of a variety of conceptual frameworks and models related

to reflective practice. Preservice teachers' inability to achieve critical reflection is one of the most pressing issues related to their journal writing.

Teaching is a learned profession. Preservice teachers' reflective skills are developmental. Unlike mental reflection, an individual's reflective journal writing is not a natural process, but one that has to be learned, practiced, and scaffolded. Teacher educators have used numerous support and scaffolding mechanisms to support preservice teachers' reflective journal writing, including question prompts, templates, modeling, structured writing guidance, feedback, and peer collaboration. The scaffolding metaphor, traditionally occurring through personal interactions between students and instructors, has been used by researchers to describe features and functionality of a computer interface that help users to complete certain tasks. Recently, research has demonstrated that computer-based scaffolds can be embedded in the computer-based learning environments to enhance preservice teachers' reflective practice. For example, after synthesizing the literature, Lin, Hmelo, Kinzer, and Secules (1999) identified four types of computer-based scaffolding strategies that can support preservice teachers' reflection in technology-enhanced environments: process prompts, process displays, process modeling, and reflective social discourse.

## CHAPTER 3

### PRELIMINARY STUDY

This chapter reports the findings of a preliminary study conducted in the summer of 2006. The preliminary study was conducted to inform the current study. The preliminary study emerged from the researcher's conversations with the teacher educators who worked with PASS-PORT in a teacher education program at a major southern university in the United States. According to these teacher educators, despite the growing success of PASS-PORT, preservice teachers' reflections as captured in the system were often descriptive, shallow, unfocused, and lacking in detail. The researcher decided to explore the problems and issues with preservice teachers' journal writing, and to identify whether and how computer-based scaffolding tools can be leveraged to enhance preservice teachers' reflective practice in PASS-PORT.

#### Context: PASS-PORT

In response to the teacher education standards set by the National Council for the Accreditation of Teacher Education (NCATE), the state of Louisiana's Board of Regents for Innovative Teaching and Learning funded the development of PASS-PORT. PASS-PORT (2002) is a Web-based system that provides college of education candidates, university faculty and administrative staff in the state of Louisiana a tool to gather, demonstrate and evaluate the performance data on preservice teachers and professional teachers during the first three years of service after graduation.

- PASS-PORT provides candidates a tool for the creation of standards-based portfolios, a mechanism for sending and receiving feedback on portfolios, and portability of portfolios to other universities and to state professional development systems.
- PASS-PORT provides university faculty with a system to collect data, manage and evaluate candidate performance based on coursework, field experiences and clinical practice. University faculty uses these data to improve their teaching, scholarship, and service.
- PASS-PORT provides institutions with a mechanism to directly address the National Council for the Accreditation of Teacher Education (NCATE) Standards 2000 that require institutions to have a viable method of collecting and analyzing data on program qualifications, initial candidate and advanced graduate performance, and unit operations to evaluate and improve the unit and its programs. (§ 1)

PASS-PORT has been adopted by 21 colleges and universities in the state of Louisiana. Preservice teachers use PASS-PORT mainly for the purpose of portfolio building. In PASS-PORT, preservice teachers create standards-based portfolios to document their professional and academic development. Reflective journal writing about their professional and academic experiences is an integral component of their portfolios. The following screen captures (Figure 10 and Figure 11) represent the exemplar computer interfaces where preservice teachers wrote their reflective journals. As can be seen from Figure 11, the current PASS-PORT did not provide any embedded scaffolding mechanisms to support preservice teachers' journal writing.

### *Purpose of the Study*

Via interviews with both teacher educators and preservice teachers, the preliminary qualitative study described herein was conducted to not only explore difficulties preservice teachers had during their reflective journal writing in PASS-PORT, but also explore participants' perceptions of a selected set of prototypical computer-based scaffolding tools. By prototypical, the researcher means that they were not yet functional within PASS-PORT. These tools will be described in detail below. Using the participants' perceptions, the researcher intended to identify the computer-based scaffolding tools that had the potential to enhance preservice teachers' journal writing, and ultimately develop the tools for use within PASS-PORT.



Figure 10. Computer interface for reflective journal writing in PASS-PORT.



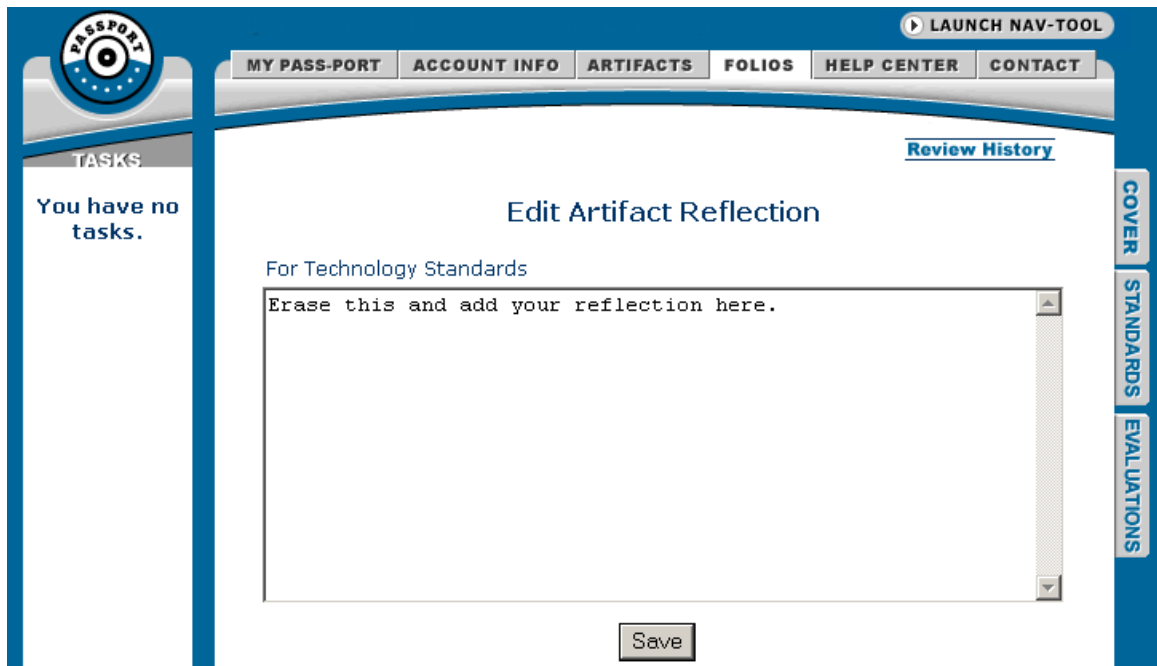


Figure 11. Computer interface for reflective journal writing in PASS-PORT.

#### *Research Questions*

1. With what aspects of reflective journal writing do preservice teachers need support?
2. What strategies or scaffolds have teacher educators successfully used in the past to improve preservice teachers' reflective journal writing?
3. What computer-based strategies or scaffolds do teacher educators and preservice teachers suggest to support preservice teachers' reflective journal writing? And
4. What are teacher educators' and preservice teachers' perceptions of a set of prototypical computer-based scaffolding tools?

## *Methods*

Given the exploratory nature of the research questions, the preliminary study adopted a qualitative case study approach to gather and analyze data. The four research questions all focused on exploring perceptions or suggestions from teacher educators and preservice teachers. Qualitative case study can yield an in-depth and comprehensive analysis of a limited number of participants in their natural setting (Stake, 1995).

Therefore, via one-on-one interviews, the researcher intended to examine the participants' perceptions of the difficulties preservice teachers encountered while writing their journals and the strategies teacher educators adopted to support preservice teachers' journal writing. Moreover, from analyzing the participants' perceptions of the prototypes, the researcher intended to identify computer-based scaffolds that had the potential to enhance preservice teachers' reflectivity development as evidenced in their journal writings in PASS-PORT.

## *Participants*

The participants were drawn from teacher educators and preservice teachers in College of Education at a major southern university in the United States. The researcher followed a purposeful sampling strategy (Creswell, 2005) to select five teacher educators (see Table 5) and six preservice teachers (see Table 6) to participate in the study. To ensure a well-represented sample, the researcher considered a few factors including teaching experience, grade levels, field of study, familiarity with computer-based learning systems, and ethnicity. Unexpectedly, all participants were females and whites. For the purpose of assuring anonymity, pseudonyms were used to report the results.

Table 5

*Teacher Educator Participants*

Participant	Years of Faulty	Content Area	PASS-PORT Experience (yrs)	Frequency of PASS-PORT Usage	Frequency of Journal Writing Requirement
Ms. Lake	3.5	Instructional Technology	3.5	Very Often	Very Often
Dr. Muzzie	2	Early Childhood Ed.	2	Very Often	Sometimes
Dr. Barbara	8	Social Studies	3.5	Sometimes	Very Often
Dr. Jimmy	6	Science	3.5	Very Often	Very Often
Dr. Kathy	3	Gifted Ed.	2.5	Occasionally	Sometimes

*Prototypical Scaffolds*

Through literature review, the researcher identified five computer-based scaffolding tools that can be used to facilitate and enhance preservice teachers' reflective writing: question prompts (Bean & Stevens, 2002; Lin & Lehman, 1999), templates (Hoban, 2000a), process display (Bell, 1997; Lin & Lehman, 1999), modeling (Gorrell & Capron, 1990; Pedersen & Liu, 2002), and resources (Hill & Hannafin, 2001). The researcher used the software tools *Dreamweaver*, *Visio*, and *Microsoft Word* to develop prototypes of the five computer-based scaffolding tools (see Figure 12 - 15). For the last strategy, resources as a journal writing scaffold, the researcher provided the conceptual framework developed by Colton and Sparks-Langer (1993) (see Figure 3), first with a

brief introduction of its three overarching components, followed by the figure of framework for teacher reflection (p. 48).

Table 6

*Preservice Teacher Participants*

Participant	Status	Content Area	PASS- PORT Experience (yrs)	Frequency of PASS- PORT Requirement	Frequency of Journal Writing Requirement
Molly	Junior	Early Childhood Ed.	2	Very Often	Very Often
Kerri	Junior	Early Childhood Ed.	3	Very Often	Sometimes
Sarah	Senior	Math & Business	3	Very Often	Occasionally
Megan	Master	Math	2	Occasionally	Sometimes
Nicole	Senior	Language and Arts	3	Sometimes	Sometimes
Rose	Senior	Early Childhood Ed.	1	Very Often	Very Often

**Strategy 1: Question prompts.**

Ask students to think about a list of questions as they write their reflection

- What experience have you had that is similar to or different from this experience?
- What do you like or dislike about this experience?
- What learning and instructional theories may help make sense of the experience?
- If you were the teacher, what would you do?

*Figure 12.* Question prompt as a journal writing scaffold

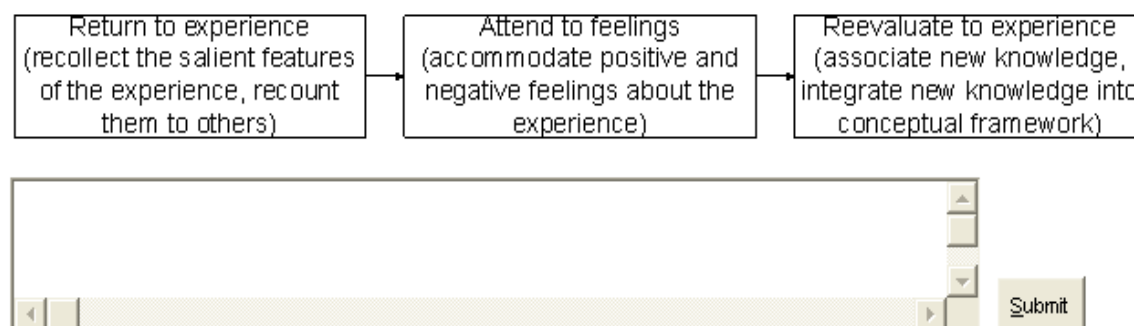
**Strategy 2: Reflection Writing Template**

Provide a template for students to use while writing reflection.

*Figure 13.* Template as a journal writing scaffold

**Strategy 3: Process Display**

Provide a visual aid illustrating the reflection writing process



*Figure 14.* Process display as a journal writing scaffold

#### Strategy 4: Modeling

Provide examples or models to guide journal writing.

Please click the following links to read the sample reflections before writing your own:

- <http://msit.gsu.edu/PDF/reflection/sample1.pdf>
- <http://www.pt3.org/samples/reflectionwriting2.html>
- <http://cilat.louisiana.edu/writingsample.html>



Figure 15. Modeling as a journal writing scaffold

#### *Procedure*

Following an interview protocol (see Appendix A) to guide the interview process and using a digital recorder, the researcher conducted one-time interviews with the participants during two consecutive semesters (spring and summer of 2006). The length of interviews ranged from 20 to 50 minutes.

First, the researcher asked the participants to share their experiences with preservice teachers' reflection writing, using problems they usually encountered as the context. Then, the researcher asked them to recollect the strategies and scaffolds that they had used in the past, as well as to recommend what strategies and scaffolds they should have used or would use to help with preservice teachers' reflection writing. And last, the researcher handed the participants the paper-based prototype of the scaffolding tools, and asked them to imagine that these tools were provided in PASS-PORT to support preservice teachers' reflection writing. The researcher explained to the participants the features of the scaffolding tools and the reflection writing task scenarios, and asked them to address issues such as: "Things you like about the tool," "Things you don't like about the tool," and "What is missing in the tool?"

### *Data Analysis Procedures*

The researcher transcribed the interviews and used qualitative research software NVivo 7 (OSR International Pty Ltd, 2007) to code and organize the interview transcripts. Miles and Huberman's (1994) three-step technique guided the data analysis. In the data reduction step, the researcher condensed the data through selecting, focusing, simplifying, abstracting, and transforming the transcripts; and then coded all the transcripts. In the data display step, the researcher organized and assembled information into graphs and charts. During the last analysis step, the researcher reviewed and synthesized the findings, and drew conclusions.

### *Results*

#### *Perceived Issues with Reflective Journal Writing*

*Teacher educators' perspectives.* Two themes emerged as they related to preservice teachers' reflective journal writing issues. First, the teacher educators felt that the levels of preservice teachers' reflective journal writing were often limited to descriptive/technical reflection, and the reflections were shallow, unfocused, and lacking in detail. Preservice teachers usually reiterated their reading assignments or retold their field experiences, thus failing to reflect on their learning. According to Kathy, an Assistant Professor of Gifted Education, preservice teachers simply recalled their field experiences as opposed to analyzing, synthesizing, and evaluating what they experienced to help them become better teachers. Similarly, Muzzie, an Assistant Professor of Educational Leadership, characterized preservice teachers' reflection writing as surface writing. Her students usually did not provide examples in their writings to explain how

their reading and field experiences actually affected them, impacted them, or changed their thinking. Second, preservice teachers, especially in their freshman and sophomore years, struggled with their reflection writing because they easily lost their thought process during writing due in part to their poor writing skills. For Kathy, reflective writing seemed to prove more difficult for preservice teachers because it is a more advanced skill and entails more effort than “just telling a story.”

Teacher educator participants attributed preservice teachers’ poor reflection writing to the following reasons: First, preservice teachers had limited understanding of the concept of reflection and the conceptual frameworks related to reflection writing. They also had little reflection writing experience while in high school. Ms. Lake, an Instructor of Instructional Technology, and Professor Jimmy, an Associate Professor of Science Education, both thought reflection was a novel concept for preservice teachers especially in their freshman and sophomore years, because they had never done anything reflective before, and had also not been taught how to answer reflective questions. Another reported factor contributing to the preservice teachers’ poor reflection was the disconnection between theories and concrete classroom teaching experiences. Both Barbara, an Associate Professor in Social Studies and Language and Arts, and Muzzie, thought reflection writing for undergraduate students was very challenging because their education focused more on a theoretical level and they lacked exposure to classroom teaching. Jimmy further associated preservice teachers’ maturity level with their student teaching:

There is the maturity level that’s involved here. Also when they get out in the real world, and they’re actually teaching real students. Those students tend to whip



them and shake them and get them to realize what's real out there, because we have 180 hours of field experiences that they have to complete. But usually they go in, they observe, they look at it more from a perspective of "this is the work I have to do for this class. This is not real to me yet." When you get to student teaching, it's suddenly very real. And then they know they are going to graduate, they know they are going to have their own class, it's suddenly a reality that [they have to deal with].

A third factor had to do with the guidance teacher educators provided. Barbara thought that reflection writing at the undergraduate level was most successful when teacher educators provided students with focused questions.

*Preservice teachers' perspectives.* Two themes emerged from the preservice teachers' perspectives on their reflection writing problems. First, preservice teachers felt they struggled with their understanding of the meaning of reflection, and were at a loss as what to include in their reflections. This was in agreement with teacher educators' perspectives. Nicole's response was representative:

They never really sat down and discussed with us what reflection writing is or what you should accomplish. They just kind of assume that you knew what it was, and that you knew what you were doing.

As Megan put it, "We don't have an idea about what a reflection is in the first place."

Second, preservice teacher participants found reflective writing assignments to be technical and repetitive, or in most cases, not reflective writing at all. Nicole's experience with reflection writing was typical. She felt that she consistently received similar reflection writing requirements for her field experiences, and found those requirements

burdensome. For example, for each of her field experiences, she was required to write about classroom management issues. Therefore, she had to write how the desks were set up, how the class was demographically composed, and how the teacher enforced rules in the classroom, rather than investigating whether or not she thought the classroom management could be effective.

In preservice teachers' perceptions, three factors contributed to their poor reflection writing. First, they had little knowledge of reflection and reflection writing. Second, they lacked specific requirements and guidance from teacher educators. The requirements and guidance they received were directly tied to their motivation in reflection writing. For example, Rose, a senior in Early Childhood Education, always felt stressed if her professors did not give her specific questions for the reflection writings. Moreover, if her professors did not provide specific requirements on how deep she needed to explore in her reflection, she simply did the minimum. The third and last reported factor was the disconnection between theories and field experiences. That is, teacher educators failed to ask students to apply the theories to reflect on their classroom experiences. Nicole's comment below was exemplary:

Because by reflecting, you are taking what you have learned in your textbook and your lecture courses with the teacher, and you are actually applying it to what you have learned in the classroom, so it kind of makes you thinking in your head and helping you better understand it.

#### *Adopted Strategies or Scaffolds*

*Teacher educators' perspectives.* The strategies or scaffolds that teacher educator participants reported using to facilitate reflection included a) question prompts, b)

modeling, c) guidance, d) feedback, and e) a qualitative method. First, teacher educators reported widely using verbal and written *question prompts* to lead preservice teachers' reflection writing. Barbara utilized topical question prompts to guide her students' field experience reflection writings. The topics usually included resources to teach the content, integration of technology, and interactions in the classroom. Teacher educators also used reflection *examples* to model their students' reflection writing. Muzzie, who partially attributed her students' reflection writing problems to their not being given freedom to think, usually gave them a reflection example in class and critiqued the example with them. Teacher educators also gave their students specific and sufficient *guidance* on how to write their reflections. For example, for each session of her students' field experience, Kathy specified different elements that her students must examine, including what they must look for, how they should take notes, how they should write it up, and how long the writing needs to be:

I have very specific things they need when they go into field experiences. Each session is designed for them to target and examine different elements...let's say, session 6 is about lesson planning, a cycle on how a lesson functions. And the teacher is doing something, not quite following a cycle of a lesson, I ask them to write their reflection based on what they saw. If they were to teach the lesson, how might they include the pieces they were looking for? So it's not just about reflecting about what they saw, but it is utilizing what they saw, to help them think about becoming a better teacher.

Teacher educators also treated the *feedback* as quasi-dialogue journals with their students. In the feedback, Muzzie specified what her students did right, and what they needed to

improve. Because of the feedback she provided, she witnessed more positive changes in her students' writing. Kathy introduced a *qualitative method* to help her students with their reflection on their field experience. She taught and required them to separate observations from reflections using a two-column process. In the left-hand observations column, students documented what actually occurred; while in the right-hand reflections column, students analyzed, synthesized, and reflected on their observations.

*Preservice teachers' perspectives.* The preservice teacher participants were asked to describe the strategies or scaffolds their professors provided. These included a) question prompts, b) guidance, c) feedback, and d) the use of a qualitative method. With the exclusion of modeling, the strategies preservice teachers recollected matched those practiced by teacher educator participants. First, student participants affirmed that teacher educators mostly used *question prompts* to support their reflection writing. For example, typical classroom management related prompts were "Do you like what the teacher did for the classroom management? And explain why." "How would you deal with classroom management situation differently?" Second, preservice teachers perceived that the *guidance* on what needed to be covered in the reflection, as well as reflection writing layout and format were beneficial in guiding their writing. Third, teacher educator's *feedback* such as "I want you to think more about this, or look into that" prompted them to think more reflectively so as to eventually develop their reflectivity. And last, Megan explained how the *qualitative method* for reflection writing worked:

[The professor] categorized field experience as observation and then reflection.

So the observation was to include only the facts that we observed, for example, the teacher entered such and such time in the classroom, the students were

sitting...none of our opinions about any of the things that were going on in the classroom should be recorded in the observation section. Then there was a reflection section, in which we were supposed to analyze whatever was going on in the classroom, and what we felt about it --- whether it was good or bad, or how the teacher handled the classroom management, and how students behaved and reacted, and what were the consequences of the teacher's behavior and the students' behavior, and everything like that.

Megan, for example, experienced benefits of the method because it helped her to be objective while observing, and not to judge based on what she saw immediately, but to get a more holistic picture and then reflect upon it later.

#### *Suggested Computer-Based Strategies or Scaffolds*

*Teacher educators' suggestions.* Teacher educator participants suggested the use of writing prompts and reflection writing tutorials, followed by reflection writing examples. First, Muzzie suggested the use of popup windows or rollovers where a list of question prompts would appear during the reflection writing process. She also suggested using messages embedded within popup windows right before students submit their writing. An example message might read, "Did you remember to do ...?" "Did you incorporate ... in your reflection?" Second, tutorials provided in the system on how to write reflectively were deemed to be potentially helpful. Third, teacher educators suggested the use of online examples of both successful and unsuccessful reflective writing embedded with critiques to model preservice teachers' writing.

*Preservice teachers' suggestions.* Preservice teacher participants' suggestions fell into four categories. First, consistent with teacher educators' suggestions, preservice

teachers would like to have Web-based question prompts, online tutorials on the concepts and conceptual frameworks of reflection and reflection writing, as well as a few successful and unsuccessful reflective writing samples. If possible, they preferred the samples to be explained and discussed in-class to point them in the right direction. For Molly, a junior in Early Childhood Education, online reflection-related tutorials would be wonderful resources where she could find in-time, on-demand references or help on reflection writing. Second, the preservice teachers expressed the need for more detailed and meaningful reflection requirements and guidelines (this scaffold was not suggested by any teacher educator participants). Molly specified the need for detailed information on teacher educators' expectations to help guide her reflection writing. Whereas Nicole preferred to have reflective writing assignments that were parallel with her ability and maturity level:

Possibly in upper-level classes, instead of asking you to write the same things that you wrote at your freshman year, give you some type of like "OK, find something that you saw in the classroom that you thought was a good idea that the teacher had or a bad idea, and explain why you thought it was a good or bad idea; or explain why and how you think the teacher could improve it." I guess by that, it kind of goes back to make you apply what you learned in the class, instead of saying the teacher had a purple desk.

#### *Perceptions of the Prototypical Computer-Based Scaffolding Tools*

*Question prompts.* Teacher educator participants alleged that Web-based question prompts had the potential to help students start thinking reflectively, focus, and guide

their writing process. Kathy commented on how the question prompts could help the students start thinking reflectively:

If they are struggling with writing, then they are struggling with the next level of reflective writing. If they have no structure or nothing to scaffold them in reflective process, I find that I don't get anything that is worth anything. So if I get them at least a start that they can begin to start thinking reflectively by guiding them with some questions, it seems to be, I am finding I am getting a better quality of reflection.

Whereas Barbara thought that the question prompts might help the students to focus on their writing:

It helps students to focus. Students have limited experience with this kind of activity. I think it helps them focus, and I think it launches them into this quickly. Otherwise, they have to sit and think about this. They might know the answer readily to any of these questions. But if they have to generate, it will be more difficult.

To make the question prompts more effective, Muzzie suggested that question prompts be placed both before and after the reflection writing to remind students to incorporate what teacher educator required.

Preservice teacher participants all thought that question prompts could function as a guide for their writing process. To make question prompts more effective, they suggested that the prompts need to be customized to meet students' different content area requirements, and entail the connection between experiences and learning and instructional theories. Nicole explained how the prompts should be tailored:

I guess you have to go beyond just the idea of putting questions on there. It will have to be the type of questions connecting to something that you have done before, or actually making you think deeper about it, or what learning and instructional theories may help you make sense of the experience, kind of goes back to connect what you have learned in the class to what's in the classroom.

*Writing templates.* Teacher educator participants, even though they thought the templates might be an effective tool for entry-level undergraduate students to cultivate their reflective thinking habit, did not recommend the use of writing templates because they assumed that templates go against a central tenet of reflection. That is, reflection needs to be personal and creative. They felt that the use of templates might limit, and even stifle, preservice teachers' creativity because the students would be "so conscientious about what they think I want," as Lake put it. Therefore, teacher educator participants suggested that templates be used as an instructional tool to train students on how to write reflections in the classroom as opposed to using it to scaffold the actual writing of their reflections on the field experiences. They thought templates might be helpful for earlier level students to get started in reflection writing, but might risk stifling students' creativity and even disrupting their thinking and writing process.

*Process display.* Teacher educator participants perceived procedural and visual flowcharts as potentially conducive to preservice teachers' thinking process because they could help keep their students' writing focused. Preservice teacher participants held similar perceptions. Moreover, one student, Megan, thought that reflection writing process displays could be a helpful addition to question prompts, and suggested the two strategies be combined.



*Modeling.* Teacher educator participants felt that the availability of both successful and unsuccessful reflection writing samples could help preservice teachers become good judges of reflective writing. Meanwhile, they suggested the writing samples be critiqued by questions including “What’s right? Why was it right?” “What’s wrong? Why was it wrong?” And “How can it be improved?” They were concerned with the potential of plagiarism, and they were also suspicious of a potentially stifling effect. As Lake put it, preservice teachers might “hold too close to the sample. They may use the sample almost as a template.” Preservice teacher participants noted a few benefits of modeling as a writing support. First, modeling was congruent to professors’ classroom explanation of a writing sample, as Molly put it, “we are taught in the classroom to always model before you do an activity. So I will definitely use this to go over and look up some sample reflections. That way I can make mine fit within that realm.” Second, it was observed that examining others’ writings could help preservice teachers improve their brainstorming process. Third, preservice teachers appreciated the idea of making unsuccessful reflection writing samples available. That way, they would have a yardstick to evaluate their own writing, as Kerri commented, “If you just give bad examples to people, they will say, oh, I need to do more than just that or something like that.” Similar to teacher educator participants, one preservice teacher participant expressed her concern about the plagiarism. Moreover, another preservice teacher participant discouraged the use of modeling as a strategy because she worried the availability of samples might take away the reflective process from the students.

*Resources.* Teacher educator participants thought that the reflection-related resources such as conceptual frameworks and reflection writing tutorials would be

beneficial. First, the availability of the resources could prove to be an excellent addition to their traditional classroom reflection instruction. Muzzie shared her rationale:

I think something like that is helpful for teachers and instructors as well as students, because as an instructor, I don't have time to go back to where they should have got it long time ago. So I think the resource piece will be very helpful for instructors, because I can say "go and look up your resource piece on how to write reflection."

Second, teacher educator participants perceived that resources might be nice materials for juniors or seniors, as well as for motivated learners looking for self-tutorials on reflection. Meanwhile, teacher educators admitted that resources might not be appreciated by the majority of preservice teachers, especially for entry or lower level ones. In Barbara's words, "students will be drown in this [the conceptual framework example the researcher provided in the contextual interview]. And if it is optional, few will go to it for that."

Preservice teacher participants shared their understanding of the benefits online resources could bring about. First, the availability of the resources could satisfy their growing needs for in-depth understanding of reflection due in part to the increasingly higher expectation on their reflectivity development. Second, they echoed teacher educator participants' perceptions that resources might be nice materials for more advanced students to better enhance their reflective thinking process, and prove helpful to standardize the use of terminology in their reflection writing. However, because of their lack of classroom teaching experiences, three preservice teacher participants complained that resources, especially the conceptual framework example the researcher provided in

the contextual interview, proved too complicated for education majors. In the end, they provided their suggestions on what could be incorporated into the online resources. These suggestions included: A collection of high-order, high-level type of reflection-related thinking questions; examples of reflection writing on field experiences; exemplar writings following the reflective conceptual frameworks to make the abstraction of the conceptual frameworks tangible to students; a list of Internet-based resources about reflection, and a list of the names of clearly written texts on the subject.

Eventually, participants offered their top three choices for computer-based scaffolds. Question prompts and process display remained the top two favorites, followed by modeling, online resources and writing template.

### *Summary and Conclusion*

The results of the preliminary qualitative study using PASS-PORT as a context revealed that preservice teachers ran into a few issues when writing their reflective journals. First, the levels of preservice teachers' reflective journal writing were often limited to shallow and/or descriptive/technical reflection. Second, preservice teachers struggled in the process of their reflection writing. And third, preservice teachers found reflective writing assignments to be technical and repetitive, or in most cases, not reflective writing at all. Preservice teachers' poor reflection writing in the preliminary study was attributed to the following factors, including (1) limited understanding of the concept of reflection, (2) lack of reflection writing experience prior to college, (3) disconnection between theories and concrete classroom teaching experiences, and (4) lack of sufficient guidance from teacher educators. The study also showed that the participants (teacher educators and preservice teachers) perceived that computer-based

scaffolds hold the potential to enhance preservice teachers' reflectivity development as evidenced in their online journal writing. Out of the five prototypical computer-based scaffolds explored earlier, they ranked question prompts, process display, and modeling as their top three choices, followed by online resources and writing templates.

Despite apparent enthusiasm about using the computer-based scaffolding tools to support preservice teachers' reflective practice, there is a lack of empirical research, especially quantitative research, which examines how the tools may impact preservice teachers' reflective journal writing. For example, Spector (2001) claims that, for the many dramatic educational technology applications currently available, little empirical research is being conducted with regard to their effects on learning.

As a consequence, we have little evidence on which to base a judgment with regard to the advantages of using specific kinds of technology in various educational settings. We continue to invest in technology and proceed on the basis of our implicit faith in technology-enhanced learning and instruction. (p. 34)

Before incorporating the selected computer-based scaffolding tools (i.e., question prompts and process display) in PASS-PORT, the researcher intended to use an explanatory mixed methods design (Creswell, 2005) to examine the potential effects of their implementation on preservice teachers' reflective journal writing. The following chapters describe the methodology, results, and discussion related to this study.

## CHAPTER 4

### METHODOLOGY

#### Introduction

This chapter starts with a discussion of the rationale for selecting explanatory mixed methods as the research methodology for the current study. It then presents the setting of the research and introduces the Saturday Technology Programs. Finally, the chapter presents quantitative methods followed up by qualitative methods. Topics within the quantitative methods section include participants, instrument, treatments, data collection procedures, and data analysis. Topics within the qualitative methods section include participants, data collection procedures, data analysis, and rigor or trustworthiness of qualitative research.

#### Rationale for Explanatory Mixed Methods

Mixed methods serve as the methodology for this study. Creswell, Plano Clark, Gutmann, and Hanson (2003) defined mixed methods research as a study that “involves the collection or analysis of both quantitative and/or qualitative data in a single study in which the data are collected concurrently or sequentially, are given a priority, and involve the integration of the data at one or more stages in the process of research.” (p. 212)

Mixed-methods research is a natural complement to traditional qualitative and quantitative research (Johnson & Onwuegbuzie, 2004; Onwuegbuzie & Leech, 2004), because it bridges the schism between quantitative and qualitative research, and is now

deemed as the third paradigm in educational research. Moreover, the goal of mixed methods research is not to replace either quantitative or qualitative research but rather to draw from the strengths and minimize the weaknesses of both in single research studies and across studies.

This study employed an explanatory mixed methods design. It first used a control and treatment group design with random assignment to quantitatively examine the effects that a set of computer-based scaffolding tools (i.e., question prompts and visual writing process display) had on preservice teachers' highest levels of reflection in their online journal writing and the length of their reflection writings. Outcomes for the treatment groups using question prompts and writing process display were compared to those of a control group using no writing scaffold, followed by a correlation analysis between the highest level of reflection reached and the length of the reflection writings. Then qualitative data sources including interviews and participants' reflective writings were used to explore how and why the set of computer-based scaffolding tools enhanced or failed to enhance preservice teachers' reflective writing.

An explanatory mixed methods design was appropriate for the study, which aimed to not only examine whether the integrated computer-based scaffolding tools can enhance preservice teachers' reflective journal writing, but also explore how and why the computer-based scaffolding tools enhanced or failed to enhance preservice teachers' journal writing. Quantitative data were first gathered to answer the quantitative research questions; qualitative data were then collected and analyzed to supplement and explain the quantitative findings.

### The Setting

This study was conducted at the College of Education of a major southern university in the United States. There are three departments within the College, including Curriculum and Instruction, Educational Foundations and Leadership, and Kinesiology. The College currently offers 28 undergraduate degree programs, five master's degree programs, and one Doctor of Education degree program.

The College adopts the *Responsive Professional* as its conceptual framework for the education of preservice teachers. The framework is composed of four driving elements: *Knowledge and Expertise in Practice*, *Diversity*, *Reflection*, and *Professionalism*.

- Knowledge and Expertise in Practice – The *Responsive Professional* demonstrates knowledge of content disciplines and engages in effective pedagogical practice.
- Reflection – The *Responsive Professional* actively, persistently, and carefully considers practices, experiences, and available alternatives to guide decision-making.
- Diversity – The Responsive Professional articulates an understanding that beliefs, traditions, and values across and within cultures affect both learning and relationships with learners, their families and the community.
- Professionalism – The Response Professional actively seeks opportunities to grow professionally, collaborate to meet complex needs of learners, advocates educational principles, and models leadership skills. (College of Education, 2007, p. 10)

### Saturday Technology Programs

The pedagogical laboratory is a concept advocated in a National Academy of Sciences report that synthesizes new findings on learning and presents a research agenda to improve teaching and learning (Brandsford, Pellegrino, & Donovan, 1999). One of the research and development areas for teacher education is to develop model pedagogical laboratories, in which preservice teachers experiment with the latest findings in learning and instructional theories by trying them out with students recruited from local schools. The laboratory provides preservice teachers an opportunity to work like scientists who try out new strategies, observe student learning, and reflect on the strategies used. The laboratory has a repository of model lessons and units as well as protocols for teaching the lessons. Expert teachers staff the laboratory to offer guidance and feedback to preservice teachers to encourage reflection and improvement. Teacher educators at the College in question applied the concept of the pedagogical laboratory in one of the technology integration courses they offered to its preservice teachers. More details related to the course will be provided as follows.

IREN 320, Technology in the Classroom, is an undergraduate course at the College. The goal of IREN 320 is for preservice teacher to become knowledgeable about strategies, materials, evaluation, organization, and management of the integration of technology into instruction. It requires preservice teachers to acquire 10-hours of field experience. The objective of the field experience is to provide preservice teachers with the opportunity to observe or teach with technology. Prior to this study, after each practice teaching session, preservice teachers followed general guidelines to reflect on their field experiences including: (1) description of the lesson; (2) description of the



students' technology proficiency level at the beginning of the lesson and their technology growth; (3) how preservice teachers adapt the lesson to meet the students' needs; and (4) how technology impacts student learning. In the past, to fulfill the field experience requirements, preservice teachers primarily went to public and private schools to observe how classroom teachers use technology. However, many classroom teachers lacked effective use of technology (Bauer & Kenton, 2005; Cuban, Kirkpatrick, & Peck, 2001; Ertmer, 2005; U. S. Department of Education, 2003). Field experience observations had limited impact on preservice teachers' learning of technology integration because they did not observe exemplary use of technology.

To address this problem, faculty members at the College developed a technology-enhanced model pedagogical laboratory to provide an environment for preservice teachers to observe and practice technology-enhanced instructional approaches that are based on theory and research (Ma, Williams, Prejean, Lai, & Ford, 2008). In the laboratory, the faculty and preservice teachers of IRED 320 offered Saturday Technology Programs on November 3 and 10, 2007. Five technology programs were provided free of charge, including robotics for children in grades 1-5, digital storytelling for children in grades 1-5 and in 6-10 respectively, the *Making History* World War II game for students in grades 8-10, and scientific research on the topic of bird flu for students in grades 10-12. These programs provided an opportunity for local K-12 students to experience student-centered activities. It also provided teaching experience to the preservice teachers enrolled in IRED 320. Each pair of children worked with two or more preservice teachers with a major either in Early Childhood, Elementary, or Secondary Education.

## Quantitative Methods

### *Participants*

The population for the study was the preservice teachers enrolled in seven sections of IRED 320 in fall 2007. Among the seven sections of IRED 320, two were dedicated for the preservice teachers with a major in Elementary Education, two for the preservice teachers in Early Childhood Education, and the other three sections for the preservice teachers in Secondary Education. All preservice teachers in Elementary and Early Childhood Education were in their junior year of college, and most of the preservice teachers in Secondary Education were juniors. The preservice teachers from five of these sections of IRED 320 (one from Elementary Education, two from Early Childhood Education and two from Secondary Education) participated in the current study. These five sections were taught by three teacher educators. The professor teaching the other two sections of IRED 320 still required his students to fulfill the field experience requirement by conducting classroom observations. Therefore, the preservice teachers in those two sections did not participate in the current study. Seventy-four preservice teachers enrolled in these five sections. However, the sample for the quantitative phase of the study included only sixty-five preservice teachers. In one Secondary Education section, practical teaching was not required for field experience, so four out of ten preservice teachers did not participate in the Saturday Technology Programs and thus were not required to finish the online field experience reflection writing. In addition, five more preservice teachers declined to sign on the consent form, and their participation in the study was dropped. Demographic data for the participants are presented in Tables 7 – 11.

Table 7

*Frequency by Major and Gender*

Major	Gender	Frequency n=65
Elementary Education	Male	0
	Female	18
Early Childhood Education	Male	0
	Female	24
Secondary Education	Male	5
	Female	18

Table 8

*Frequency by Race*

Race	Frequency n=65
African American	6
White (Non-Hispanic)	58
Asian American	0
Hispanic	0
Other (Native Indian)	1

Table 9

*Frequency of Preservice Teachers' Section Enrolment and Participation*

Race	Enrolment n=74	Participation n=65
Section 1 – Elementary Education	20	18
Section 3 – Early Childhood Education	11	11
Section 4 – Early Childhood Education	15	13
Section 5 – Secondary Education	18	17
Section 7 – Secondary Education	10	6

Table 10

*Frequency by Random Treatment Conditions*

Treatment Condition	Frequency n=65
Control	20
Question Prompts	23
Process Display	22

Table 11

*Frequency by Participating Field Experience Activity*

Treatment Condition	Frequency n=65
iMovie	36
Educational Game	6
Robotics	21
Science – Bird Flue	2

### *Instrument*

The goal of this study was to examine whether question prompts and writing process display scaffolds are related to higher levels of reflection in preservice teachers' online journal writing. In order to evaluate the highest level of reflection achieved in their journal writing, the researcher adopted the reflection rubric developed by Ward and McCotter (2004). More description related to the rubric was provided as follows.

The data sources for Ward and McCotter's (2004) study came from 13 exemplar reflective samples on preservice teachers' learning from two publicly available online databases. Using grounded theory characterized by a "controlled and systematic approach," (p. 249) Ward and McCotter developed the rubric that lists four levels of reflective writing: routine reflection, technical reflection, dialogic reflection, and transformative reflection (see Table 12). Each level of reflection can be described by the following three dimensions: focus (What is the focus of concerns about practice?), inquiry (What is the process of inquiry?) and change (How does inquiry change practice and perspective?). The following paragraphs describe these four levels illustrated by writing examples drawn from Ward and McCotter (2004) and Dinkelman (2000).

In routine reflection, preservice teachers focus on definitive statements related to their experiences or phenomena. They are not concerned with problems and are self-disengaged from change. The routine reflection tends to be fairly short as illustrated by the following example where the preservice teacher expressed his/her concern of classroom management, but did not doubt or question the source of problems:

The other barrier I found was the ability of many of my students. As an entire class, they did not have much experience working hands-on. I would have liked to

teach many more concepts hands-on, but due to the lack of experience in the class it was feasible. Classroom management was a problem the first few times we tried a hands-on activity. If this had been my classroom, students would have been familiar with my mode of teaching and classroom management would not have been an issue. When I taught my fall week I did not run into any classroom management problems because they knew my expectations. (Ward & McCotter, 2004, p. 252)

In technical reflection, preservice teachers attempt to solve specific problems related to teaching tasks, but fail to question the nature of the problems. In the following example, the preservice teacher focused on a specific teaching task, which was to make lectures more engaging. S/he did not question the practice, nor did s/he examine the perspectives of students or peers.

I could use more professional development in...getting students more involved in “lecture” material and making a connection from class notes and lecture material to the overall understanding of the lesson. Sometimes there is not the opportunity to do a hands-on activity related to a particular topic. The material can be very dry, but definitely necessary to the understanding of the topic. I try to play review games, and get the students involved in the lectures by asking questions that make them more active participants. But, I feel I need to find some more strategies on how to make lecture material more interesting and engaging for the students. (Ward & McCotter, 2004, p. 252)

Table 12

*Reflection rubric*

	Level			
	Routine Self-disengaged from change	Technical Instrumental response to specific situations without changing perspectives	Dialogic Inquiry part of a process involving cycles of situated questions and action, consideration for others' perspectives, new insights	Transformative Fundamental questions and change
Focus (What is the focus of concerns about practice?)	Focus is on self-centered concerns (how does this affect me?) or on issues that do not involve a personal stake. Primary concerns may include control of students, time and workload, gaining recognition for personal success (including grades), avoiding blame for failure.	Focus is on specific teaching tasks such as planning and management, but does not consider connections between teaching issues. Uses assessment and observations to mark success or failure without evaluating specific qualities of student learning for formative purposes.	Focus is on students. Uses assessment and interactions with students to interpret how or in what ways students are learning in order to help them. Especially concerned with struggling students.	Focus is on personal involvement with fundamental pedagogical, ethical, moral, cultural, or historical concerns and how these impact students and others.
Inquiry (What is the process of inquiry?)	Questions about needed personal change are not asked or implied; often not acknowledging problems or blaming problems on others or limited time and resources. Critical questions and analysis are limited to critique of others. Analysis tends to be definitive and generalized.	Questions are asked by oneself about specific situations or are implied by frustration, unexpected results, exciting results, or analysis that indicates the issue is complex. Stops asking questions after initial problem is addressed.	Situated questions lead to new questions. Questions are asked with others, with open consideration of new ideas. Seeks the perspectives of students, peers, and others.	Long-term ongoing inquiry including engagement with model mentors, critical friends, critical texts, students, careful examination of critical incidents, and student learning. Asks hard questions that challenge personally held assumptions.
Change (How does inquiry change practice and perspective?)	Analysis of practice without personal response – as if analysis is done for its own sake or as if there is a distance between self and the situation.	Personally responds to a situation, but does not use the situation to change perspective.	Synthesizes situated inquiry to develop new insights about teaching or learners or about personal teaching strengths and weaknesses leading to improvement of practice.	A transformative reframing of perspective leading to fundamental change of practice.

In dialogic reflection, preservice teachers are involved in an ongoing process of probing the situated questions, taking action, considering others' perspectives and gaining new insights into the problem, as seen in this exemplar:

Student one, who is an English as a second language student, did very poorly on the preassessment. My first reaction was to have his ESL teacher give him the assessment. When I found out that this was not feasible, I decided to try it myself. My first step was to borrow one of the student's English-Spanish dictionaries. I was surprised to find out that a lot of words I needed were not in the dictionary. After finding as many words as I could, I made notes on a blank assessment and set a time to meet with student one. I went through the assessment again with this student, only to find that my efforts did not help. My analysis of this exercise, however, allowed me to understand a little better why he did poorly on the preassessment. I found that it was not just his English deficiency that hindered him on the assessment. Student one did not have the prior knowledge needed to answer the question on the assessment.

I also discovered other helpful information from this exercise. Student one is able to answer question that require on-word answers, but could not answer questions that required him to write sentences. If I had not discovered this, I would have just assumed he didn't know the material. Because of this discovery, I was able to make modifications on the rest of his assessments. (Ward & McCotter, 2004, p. 252-253)

In transformative reflection, preservice teachers question fundamental assumptions and purposes more deeply. For example, this preservice teacher linked her



students' obedience to authority to her growing sense of critique about standard school practice:

Think of all the times that students obey in their lives and how much obeying they've had to do to get to an AP Psychology class. That's why when my cooperating teacher and I were going through this, I'm like, "I really want to teach this because I think it is something we need to talk about."...I think this is really important, especially for kids that have been through school and have been trained to obey what the teacher says and do what people do (notes, 4-26-96)

(Dinkelman, 2000, p. 202)

Whereas this preservice teacher critiqued the teaching which was not conducive to students' learning:

As I sit in Nuevo High School's Global History class, and observe students "pretending" to watch a video on Mesopotamia, I wonder what they are learning...maybe to sit quietly and pretend. If you seem interested you'll please the teacher and do well in the course. Isn't that what they want (their parents, teachers, principals) students to do well – sit quietly, tell teachers what is right, what they want to hear? (assignment, 1-17-97) (Dinkelman, 2000, p. 204)

A panel of three experts was involved in critiquing the validity issue of the instrument. All three experts had deep knowledge of reflection and actively required reflective journal writing in their classrooms. Expert A was specialized in Science Education. Expert B and C had deep knowledge of computer-based scaffolding, and were involved in design and development of a series of education-related projects. The researcher emailed the panel the description of Ward and McCotter's (2004) reflection

rubric, as well as the exemplar writings that symbolize the different levels of reflection drawn from the study of Ward and McCotter (2004) and Dinkelman (2000). The panel unanimously agreed that the reflection rubric is appropriate for evaluating the levels of reflection achieved in participants' reflective journal writings.

### *Treatments*

#### *Rationale for the Treatments*

The treatments were informed by the results of the preliminary qualitative study described in the previous chapter and careful review of the literature. First, the results of the preliminary study revealed that both teacher educators and preservice teachers perceived that question prompts and writing process display held the potential to enhance preservice teachers' levels of reflection. Second, the researcher incorporated multiple theoretical concepts into the design of the treatments, including reflective thinking (Dewey, 1933), reflective practitioner (Schön, 1983), critical incident analysis (D. Tripp, 1993), multimedia learning (Mayer, 2001), scaffolding (Vygotsky, 1978; Wood et al., 1976), and scaffolding strategies in computer-based learning environments (Hannafin et al., 1999; Lin et al., 1999).

#### *Design and Development of the Web-based Treatments*

The researcher used rapid prototyping (Gustafson & Branch, 1997; S. D. Tripp & Bichelmeyer, 1990) to design and develop the treatments. Rapid prototyping is a design and development methodology that can meet the design challenge of a system when no established design guidelines exist and when there are no perfectly matching prescribed procedures to follow. As an instructional design model, rapid prototyping involves the

early development and evaluation of prototypes to ensure that stakeholders' needs are met. Tripp and Bichelmeyer (1990) provided a definition of rapid prototyping: "...after a succinct statement of needs and objectives, research and development are conducted as parallel processes that create prototypes, which are then tested and which may or may not evolve into a final product." (p. 35)

The researcher did not use the actual PASS-PORT as the platform to evaluate the effects of the embedded computer-based scaffolding tools because a common practice in computer system modification and update calls for the use of a development server, rather than a production server. Moreover, PASS-PORT had been licensed to a third-party vendor and the researcher had not access to the production server where PASS-PORT was housed. Because of these two reasons, the researcher used Microsoft Office Visio, Microsoft Office Word, Macromedia Fireworks, and Macromedia DreamWeaver to create the Web-based treatments. First, the researcher saved an exemplar journal writing Web page in PASS-PORT, and used Macromedia DreamWeaver software to edit the Web page to remove the university identity and the unneeded content, and to disable all the links in the menu bar and the right-side navigation bar. The edited page thus served as the template for all the web pages needed for the study. The purpose was to simulate the Web-based reflective journal writing as if preservice teacher participants were writing in an authentic PASS-PORT setting. Second, the researcher used Microsoft Office Visio to create the flowcharts for the writing process display treatment, and copied and pasted the flowcharts in Microsoft Office Word. Third, the researcher copied the flowcharts in Microsoft Office Word, and pasted them and processed them in Macromedia Fireworks to create graphic images available for Web use. Fourth, the

researcher used Macromedia DreamWeaver to develop all the needed Web pages for the study.

### *Evaluation of the Treatments Design*

The same panel of experts evaluated design and development of the Web-based treatments. After designing and developing each iteration of the prototype, the researcher distributed the printouts of the Web pages to the panel to solicit their feedback on the conceptualization and the Web presentation of the treatments. After six iterations of the prototype evaluation, the panel confirmed the design and development of the treatment prototype. Their suggestions for improvement included: more concise introduction of the study in plain words; simple and easy-to-understand definition and explanation of the critical incident (Calandra, Brantley-Dias, & Fox, 2007); explicit requirements that guide participants' reflection writing; navigation of the Web pages; clarity of the question prompts; juxtaposition of the writing process flowcharts and text box for writing; and easy-to-read content presentation on the Web pages. The most critical suggestions from the panel were as follows: the panel perceived that the participants would be overwhelmed by the immediate and comprehensive presentation of the question prompts and the writing process flowchart. They suggested that, for the question prompts treatment, the participants should be first provided a Web interface where they can write their reflection after each question prompt, and then be provided with the comprehensive set of question prompts while previewing their reflective writing. For the writing process display treatment, the panel suggested that the researcher first present the high-level overview of the writing process flowchart to the participants, then the elaborated writing process of the three overarching writing steps to reduce the participants' cognitive load.

Moreover, illuminated by the temporal contiguity principle of Mayer's multimedia learning - "students learn better when corresponding words and pictures are presented simultaneously rather than successively," (2001, p. 184) the panel suggested the researcher horizontally juxtapose the writing process flowchart and the text box for writing to facilitate the participants' effortless reference to the flowchart for scaffolding. Finally, the complete writing process flowchart was provided to the participants on top of the preview text to reinforce their understanding of the complete writing process. After the panel approved the content and the Web presentation of the treatments, a Web programmer helped with the database design and management and computer programming to make the Web pages ready for this study.

#### *Introduction of the Treatments*

The introductory Web page for both control group and treatment groups was the same, providing a brief introduction of the study and instructions on how to use the system to finish the reflective journal entry (see Figure 16). After participants put their unique student identification (ID) number in the specified text field, the system would look up in the database their student IDs<sup>1</sup>, and evenly and randomly redirect them to one of three different URLs that represented different treatment conditions.

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<sup>1</sup> Before the experiment, the IDs of the participating participants were saved in the database.

The screenshot shows a web application titled 'PASSPORT' with a circular logo in the top left. A top navigation bar contains links: MY PASS-PORT, ACCOUNT INFO, ARTIFACTS, FOLIOS, HELP CENTER, and CONTACT. A 'LAUNCH NAV-TOOL' button is in the top right. On the left, a 'TASKS' sidebar states 'You have no tasks.' The main content area is titled 'Introduction' and contains the following text:

Thank you for taking your time to participate in this study!

You will use this tool to write a reflection about your field experience (all the tabs on the top and right side of the screen are disabled). This study will help the researcher examine whether this tool can help you write better reflections.

You can take the remaining class time to work on your writing. Please enter your student ID (CLID) and click Submit.

Below the text is a form with the label 'Enter your student ID' followed by a text input field and a 'Submit' button. On the right side, a vertical sidebar contains tabs: COVER, 1, 2, 3, 4, 5, 6, STANDARDS, and EVALUATIONS.

Figure 16. Introductory reflective journal writing webpage.

The second Web page for the control group presents the computer interface where the participants completed their reflective journal writing in the specified text area following the requirements as provided (see Figure 17). After the participants submitted their reflective journal writing, they were greeted with a Web page informing them of their completion of the writing (see Figure 18). The same greeting was applied to the participants with treatment conditions.

The screenshot displays a web-based interface for a control group. At the top, there is a blue header bar with a 'PASSPORT' logo on the left and a 'LAUNCH NAV-TOOL' button on the right. Below the header, a navigation menu contains links: 'MY PASS-PORT', 'ACCOUNT INFO', 'ARTIFACTS', 'FOLIOS', 'HELP CENTER', and 'CONTACT'. On the left side of the main content area, a sidebar states 'You have no tasks.' The main content area is titled 'Field Experience Reflection' and contains the following text: 'During your practice teaching, you were constantly interacting with your students. Please recollect a critical incident that happened during your practice teaching. The critical incident was usually an "aha..." or "oops" moment that you experienced during a teaching episode. The incident may be something that amused or annoyed you, or something that helped you achieve a sense of difficulty or success. Generally, the incident raises a few questions for you to think over and challenge your previous beliefs about teaching and learning. In the following journal entry, you are going to reflect on the incident that happened in your practice teaching.' Below this text is a large text input box with the placeholder text 'Erase this and add your reflection here.' and a 'Submit' button at the bottom center. On the right side of the interface, there is a vertical sidebar with a 'COVER' button at the top, followed by numbered buttons '1' through '6', and then 'STANDARDS' and 'EVALUATIONS' buttons at the bottom.

**PASSPORT** **LAUNCH NAV-TOOL**

**MY PASS-PORT** **ACCOUNT INFO** **ARTIFACTS** **FOLIOS** **HELP CENTER** **CONTACT**

**You have no tasks.**

### Field Experience Reflection

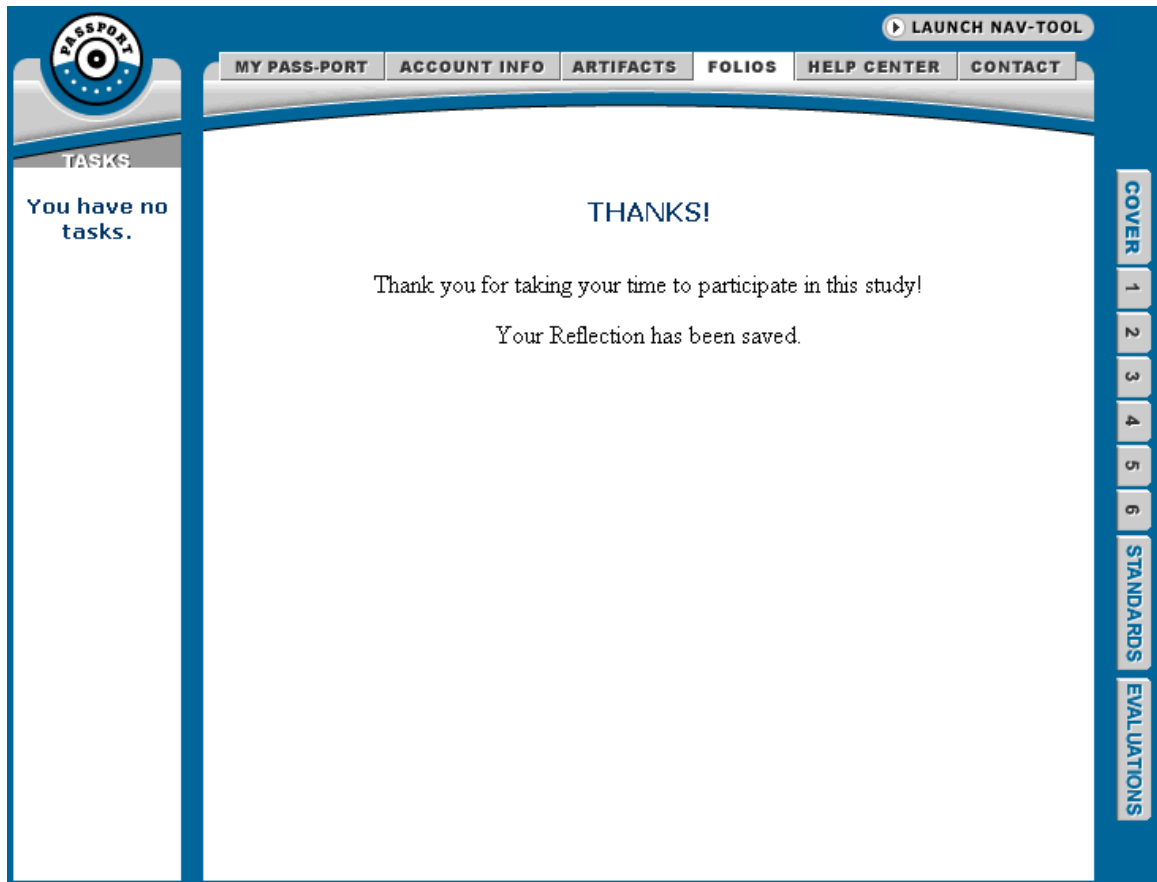
During your practice teaching, you were constantly interacting with your students. Please recollect a critical incident that happened during your practice teaching. The critical incident was usually an "aha..." or "oops" moment that you experienced during a teaching episode. The incident may be something that amused or annoyed you, or something that helped you achieve a sense of difficulty or success. Generally, the incident raises a few questions for you to think over and challenge your previous beliefs about teaching and learning. In the following journal entry, you are going to reflect on the incident that happened in your practice teaching.

Erase this and add your reflection here.

**Submit**

**COVER** **1** **2** **3** **4** **5** **6** **STANDARDS** **EVALUATIONS**

Figure 17. Computer interface for control group.



*Figure 18.* Screen capture for acknowledging the completing of the writing.

The second Web page for the question prompts treatment (see Figure 19) presents the computer screen where preservice teachers completed the reflective journal writing in the specified text areas following the requirements and the question prompts. Figure 20 presents the preview page for the question prompts treatment.



**PASSPORT**

LAUNCH NAV-TOOL

MY PASS-PORT ACCOUNT INFO ARTIFACTS FOLIOS HELP CENTER CONTACT

You have no tasks.

## Field Experience Reflection

During your practice teaching, you were constantly interacting with your students. Please recollect a critical incident that happened during your practice teaching. The critical incident was usually an "aha..." or "oops" moment that you experienced during a teaching episode. The incident may be something that amused or annoyed you, or something that helped you achieve a sense of difficulty or success. Generally, the incident raises a few questions for you to think over and challenge your previous beliefs about teaching and learning.

In the following journal entry, you are going to reflect on the incident that happened in your practice teaching. Please follow the question prompts to write your reflection.

- What happened in the incident? Describe the incident itself, the activities that led up to the incident, the people involved in the incident, the consequence(s) of the incident, and the significance of the incident for you.  
Erase this and add your reflection here.
- What were you thinking when the incident happened? What feelings guided your responses toward the incident?  
Erase this and add your reflection here.

COVER 1 2 3 4 5 6 STANDARDS EVALUATIONS

Figure 19. Question prompts as a scaffold strategy – step by step.

**PASSPORT**

LAUNCH NAV-TOOL

MY PASS-PORT ACCOUNT INFO ARTIFACTS FOLIOS HELP CENTER CONTACT

You have no tasks.

## Preview Field Experience Reflection

Please preview your reflection on the incident you identified. Before previewing, please refer to the following prompts that have guided your writing.

- What happened in the incident? Describe the incident itself, the activities that led up to the incident, the people involved in the incident, the consequence(s) of the incident, and the significance of the incident for you.
- What were you thinking when the incident happened? What feelings guided your responses toward the incident?
- What was your decision-making or problem solving in the incident? What influenced your decision making or problem solving?
- What were you thinking after the incident? What will you do if you are in a similar situation in the future?
- What have you learned from the incident? Did the incident change your assumptions, values, and beliefs about standardized tests, teacher accountability, and technology integration in classroom teaching? For example, if you find that girls do not like using computers, consider explaining why; if some students are far behind in their knowledge and skills of computer technology, you may find that their low social economic status is a factor; teacher's attitude toward the computer use has great impact on students' computer learning and use...Please go beyond the surface to investigate the factors (e.g., social, political, moral, ethic, economic) behind the phenomenon.

When finishing editing, click "Submit" button below to submit your writing.

COVER 1 2 3 4 5 6 STANDARDS EVALUATIONS

Figure 20. Question prompts as a scaffold strategy – preview.

The following six figures (see Figure 21 – 26) represent the complete process that the participants followed to complete their reflective journal writing. The flowcharts were juxtaposed to the text area to facilitate the participants' writing.

The screenshot displays the PASSPORT web application interface. At the top, there is a navigation bar with a 'PASSPORT' logo on the left and a 'LAUNCH NAV-TOOL' button on the right. Below the logo, a sidebar contains the text 'You have no tasks.' The main navigation bar includes links for 'MY PASS-PORT', 'ACCOUNT INFO', 'ARTIFACTS', 'FOLIOS', 'HELP CENTER', and 'CONTACT'. On the right side, a vertical navigation menu lists 'COVER', '1', '2', '3', '4', '5', '6', 'STANDARDS', and 'EVALUATIONS'. The central content area is titled 'Field Experience Reflection' and contains two paragraphs of text. The first paragraph describes the task: 'During your practice teaching, you were constantly interacting with your students. Please recollect a critical incident that happened during your practice teaching. The critical incident was usually an "aha..." or "oops" moment that you experienced during a teaching episode. The incident may be something that amused or annoyed you, or something that helped you achieve a sense of difficulty or success. Generally, the incident raises a few questions for you to think over and challenge your previous beliefs about teaching and learning.' The second paragraph provides instructions: 'You are going to reflect on the incident that happened in your practice teaching. The flowchart below describes the overarching steps that you can follow to write your reflection. Please click "Continue ==>" link to start your writing. Remember, after you finish, you will be able to preview your writing and make the necessary modifications.' Below the text is a flowchart with three steps: '1. Describe incident', '2. Rationalize decision making', and '3. Reconstruct', connected by arrows. At the bottom of the flowchart is a purple link labeled 'Continue ==>'.

**Field Experience Reflection**

During your practice teaching, you were constantly interacting with your students. Please recollect a critical incident that happened during your practice teaching. The critical incident was usually an "aha..." or "oops" moment that you experienced during a teaching episode. The incident may be something that amused or annoyed you, or something that helped you achieve a sense of difficulty or success. Generally, the incident raises a few questions for you to think over and challenge your previous beliefs about teaching and learning.

You are going to reflect on the incident that happened in your practice teaching. The flowchart below describes the overarching steps that you can follow to write your reflection. Please click "Continue ==>" link to start your writing. Remember, after you finish, you will be able to preview your writing and make the necessary modifications.

```

graph LR
    A[1. Describe incident] --> B[2. Rationalize decision making]
    B --> C[3. Reconstruct]
  
```

[Continue ==>](#)

Figure 21. Visual writing process display as a scaffolding strategy – overall.

**PASSPORT**

LAUNCH NAV-TOOL

MY PASS-PORT ACCOUNT INFO ARTIFACTS FOLIOS HELP CENTER CONTACT

You have no tasks.

## Field Experience Reflection - Describe

The first step of your writing focuses on describing the incident. The flowchart below describes the steps you can follow to describe the incident. Type your writing in the specified text box. When finished, click "Continue ==>" link to go to the next step of your writing.

```

graph TD
    A[1. Describe incident] --> B[1.1 The incident itself]
    B --> C[1.2 The activities that led to the incident]
    C --> D[1.3 The people involved in the incident]
    D --> E[1.4 The consequences of the incident]
    E --> F[1.5 The significance of the incident to your learning and teaching]
  
```

Erase this and add your reflection here.

[<= Back](#) [Continue ==>](#)

COVER 1 2 3 4 5 6 STANDARDS EVALUATIONS

Figure 22. Visual writing process display as a scaffolding strategy – step one.

**Field Experience Reflection - Rationalize**

You just finished the "Describe" step of your writing. The next step is concerned with how you rationalize your decision making in the incident.

2. Rationalize decision making

2.1 Your thinking during the incident

2.2 Your feelings that guided your responses towards the incident

2.3 Your decision making in the incident

2.4 Factors that influenced your decision making in the incident

2.5 Your thinking and feelings after the incident

Erase this and add your reflection here.

[<= Back](#)      [Continue ==>](#)

Figure 23. Visual writing process display as a scaffolding strategy – step two.

**You have no tasks.**

## Field Experience Reflection - Reconstruct

You just finished the "Rationalize" step of your writing. The next step is how you reconstruct your beliefs in learning and teaching. The flowchart below describes the steps that you can follow to reconstruct your beliefs. Type your reflections in the specified text box. When finished, click "Continue for Preview=>" link to the final step of your writing.

3. Reconstruct

↓

3.1 Your action if in a similar situation in the future, and why

↓

3.2 Your learning from the incident

↓

3.3 Your belief change about the standardized tests, teacher accountability, and technology integration in classroom teaching

↓

3.4 Identify and explain why certain phenomena happened in the classroom .  
E.g., boys vs. girls in computer use; the relationship between students' computer skills and family social economic status; teacher's attitude toward the computer use ...Consider going beyond the surface to look into the factors (e.g., social, political, moral, ethic, economic) behind the phenomenon.

Erase this and add your reflection here.

COVER

1

2

3

4

5

6

STANDARDS

EVALUATIONS

[<= Back](#)
[Continue for preview =>](#)

Figure 24. Visual writing process display as a scaffolding strategy – step three.

**You have no tasks.**

### Preview Field Experience Reflection

Please preview your writing before submission. You may find it helpful to refer to the flowchart to edit your writing recaptured below in the text box. When finishing editing, click "Submit" button to submit your writing.

COVER

1

2

3

4

5

6

STANDARDS

EVALUATIONS

```

graph TD
    1[1. Describe incident] --> 2[2. Rationalize decision making]
    2 --> 3[3. Reconstruct]
    1 --> 1.1[1.1 The incident itself]
    1.1 --> 1.2[1.2 The activities that led to the incident]
    1.2 --> 1.3[1.3 The people involved in the incident]
    1.3 --> 1.4[1.4 The consequences of the incident]
    1.4 --> 1.5[1.5 The significance of the incident to your learning and teaching]
    2 --> 2.1[2.1 Your thinking during the incident]
    2.1 --> 2.2[2.2 Your feelings that guided your responses towards the incident]
    2.2 --> 2.3[2.3 Your decision making in the incident]
    2.3 --> 2.4[2.4 Factors that influenced your decision making in the incident]
    2.4 --> 2.5[2.5 Your thinking and feelings after the incident]
    3 --> 3.1[3.1 Your action if in a similar situation in the future, and why]
    3.1 --> 3.2[3.2 Your learning from the incident]
    3.2 --> 3.3[3.3 Your belief change about the standardized tests, teacher accountability, and technology integration in classroom teaching]
    3.3 --> 3.4[3.4 Identify and explain why certain phenomena happened in the classroom. E.g., boys vs. girls in computer use; the relationship between students' computer skills and family social economic status; teacher's attitude toward the computer use...Consider going beyond the surface to look into the factors (e.g., social, political, moral, ethic, economic) behind the phenomenon.]
          
```

Figure 25. Visual writing process display as a scaffolding strategy - preview.

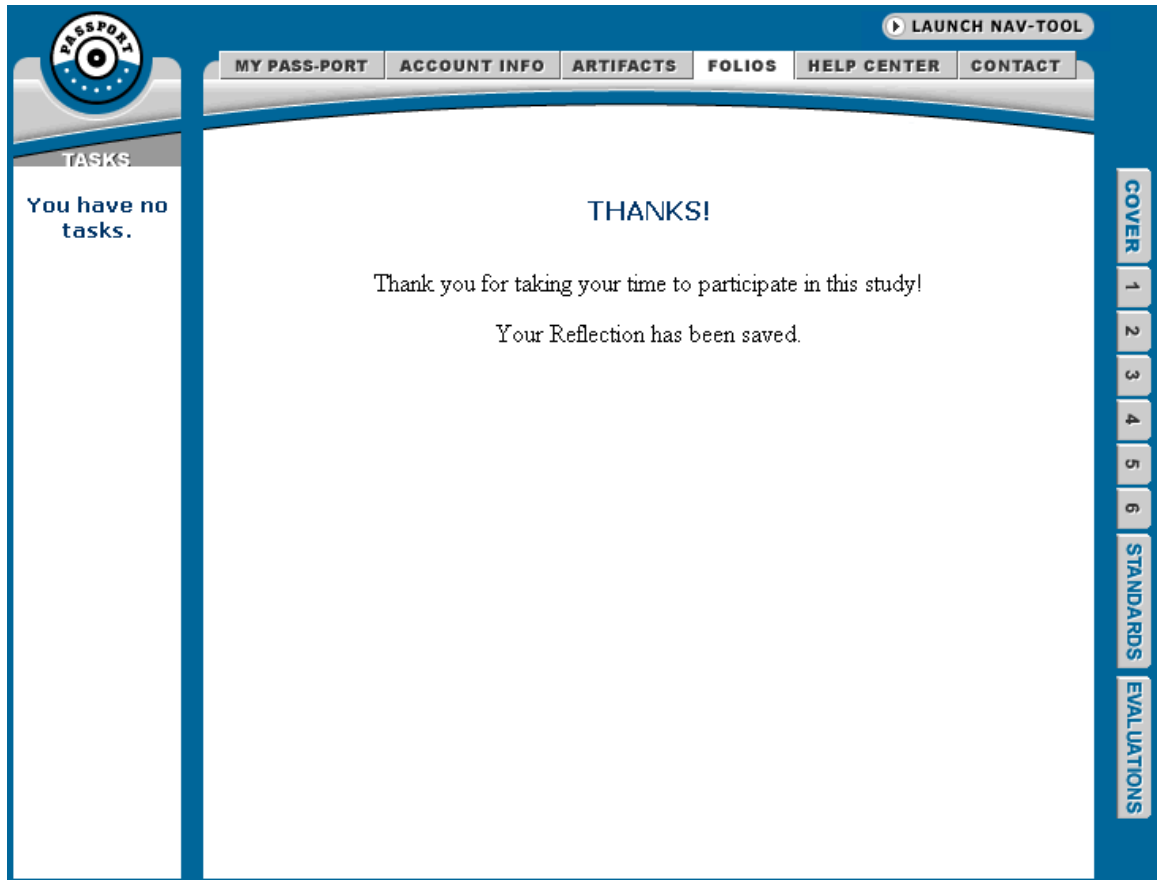


Figure 26. Screen capture for acknowledging the completion of the writing.

#### *Data Collection Procedures*

The first Saturday Technology Programs took place on November 3, 2007. Online journal writing took place the week after the preservice teachers finished their first field experience of practical teaching in the programs (November 5-9). For four sections of IRED 320 (1 in Elementary Education, 2 in Early Childhood Education, and 1 in Secondary Education), writing took place in a university classroom setting where each preservice teacher had access to a laptop with a wireless internet connection. After a brief introduction from each participating teacher educator, all participants were asked to sign the informed consent form (see Appendix E) that the researcher prepared in advance. Then they were provided a URL to log in using their student ID. The system randomly



and evenly assigned them to three different Web pages associated with their different treatment conditions. Within an hour and a half, they reflected on a critical incident that happened during their practical teaching. Their one-time in-class reflection writings were automatically captured in the database upon submission. For the fifth section of IRED 320, due to an unexpected classroom event, the professor did not have enough classroom time for the six preservice teachers to finish their reflection writing. Instead, after signing on the informed consent forms and being given the instructions, the preservice teachers finished the reflection writing in their spare time.

### *Data Analysis*

Reflection writings were evaluated by two raters who were blind to the participants' treatment conditions and names. The raters coded the highest level of reflection achieved in each participant's reflection writing using the reflection rubric developed by Ward and McCotter (2004). The defining characteristics and exemplars for each level of reflection are provided in the "Instrument" section in this chapter. An ordinal scale ranging from 1-4 was coded for the writing. If the highest level of reflection reached in the writing was routine reflection, a score of number 1 was coded; if the highest level of reflection reached was technical reflection, a score of number 2 was coded; if the highest level of reflection reached was dialogic reflection, a score of number 3 was coded; and if the highest level of reflection reached was transformative/critical reflection, a score of number 4 was coded. Exemplar writings representing each level of reflection are provided in Appendix F.

Several different approaches were used to analyze the data. There was an analysis of the data for mean values and standard deviations for the coded writings in different

treatment conditions. Frequencies were obtained within each treatment group and across the three treatment conditions.

In order to answer the quantitative research questions, group differences in the highest level of reflection reached in the journal writing and the length of reflection were statistically assessed using an analysis of variance (ANOVA). If the group differences were significant, then *Post hoc* multiple comparisons tests using Gabriel's procedure (Field, 2005) were conducted to determine if there was a statistically significant difference between control group and question prompts group, between control group and process display group, and between question prompts group and writing process display group. Moreover, a correlation analysis was conducted to investigate the relationship between the highest level of reflection achieved and the length of reflection writing. The alpha level for all analyses was set at  $\alpha = .05$ . Data were compiled and analyzed using the Statistical Package for the Social Sciences 12.0 (SPSS). The results of the quantitative phase of the study are presented and discussed in Chapter 5.

To address threats to reliability, the researcher adopted the following strategies in the study. There were two raters in the study, the researcher and an assistant professor in Instructional Technology from the College of Education where the study took place. As one of the top researchers in the college (based on annual merits evaluation, the professor was ranked in top 10% for year 2006 and 2007), the professor had been requiring preservice teachers in her technology integration classes to write reflections about their field experience in the Saturday technology programs. First, the researcher standardized measurement methods by providing the reflection rubric to the professor and by discussing with her the exemplar reflection examples excerpted from the journal articles

(Dinkelman, 2000; Ward & McCotter, 2004). Second, both raters were blind to the participants' treatment conditions. Each rater did the initial evaluation independently of all the reflection writings. Ratings from each rater were then compared. The initial agreement between the two raters was 88%. Difference in any single evaluation was reconciled through discussion resulting in full agreement.

## Qualitative Methods

### *Participants*

After their field experience in the Saturday Technology Programs on November 3, 2007, preservice teachers from all five sections of IRED 320 participated in the data collection during the week of November 5 – 9, 2007 to complete their online reflection journals. After that, preservice teachers from four sections of IRED all used writing process display to support their journal writing on their second field experience on November 10, 2007. The journal writings on preservice teachers' second field experience did not serve as a part of the quantitative data. The participants representing the two treatment groups were drawn from the preservice teachers who participated in the journal writing after their first field experience practical teaching. However, the participants representing the control group were drawn from those who participated in both journal writings so that they could compare their journal writing experiences.

The researcher followed a purposeful sampling technique (Creswell, 2005) to select sixteen preservice teachers to participate in the qualitative phase of the study. To ensure a well-represented sample, the researcher selected one preservice teacher to present each level of reflection achieved in their writing for the control group; the researcher then selected one preservice teacher to present routine and technical level of

reflection. Because higher level of reflection was expected to be achieved in the writings of the participants assigned to the two treatment conditions, the researcher selected two preservice teachers to present dialogic and transformative level of reflection for question prompts and writing process display treatment groups (Table 13).

Table 13

*Participants Selected from Control and Treatment Groups*

Treatment Condition	Levels of Reflection	No. of Participants n=16
Control	Routine	1
	Technical	1
	Dialogic	1
	Transformative	1
Question Prompts	Routine	1
	Technical	1
	Dialogic	2
	Transformative	2
Process Display	Routine	1
	Technical	1
	Dialogic	2
	Transformative	2

Table 14 shows the general demographic information of the preservice teachers who participated in the qualitative phase of the study. All participants were in their junior year of college. They fell into three age groups, with one participant in the 30-39 age

group, one in the 40-49 age group, and the remaining in the 20-29 age group. Three of the participants majored in Elementary Education, five in Early Childhood Education, and eight in Secondary Education. All participants were white. Their names were changed to maintain anonymity.

Table 14

*Participant Demographic Data*

Name	Status	Age	Gender	Content Area
Clint	Junior	30-39	M	Secondary
Holly	Junior	20-29	F	Early Childhood
Jeremy	Junior	20-29	M	Secondary
Jessica Deen	Junior	20-29	F	Secondary
Arianna	Junior	20-29	F	Elementary
Elizabeth	Junior	20-29	F	Early Childhood
Kimberly	Junior	40-49	F	Secondary
Rachel	Junior	20-29	F	Secondary
Randi	Junior	20-29	F	Elementary
Summer	Junior	20-29	F	Elementary
Stephanie	Junior	20-29	F	Secondary
Kalyn	Junior	20-29	F	Early Childhood
Elizabeth	Junior	20-29	F	Secondary
Jenna	Junior	20-29	F	Early Childhood
Jessica	Junior	20-29	F	Early Childhood
Mark	Junior	20-29	M	Secondary

### *Data Collection*

The data sources for the qualitative analyses included the interview transcripts and all participants' reflective journal writing captured in the database. The participants were interviewed once in late November and early December of 2007. Each participant volunteered to be interviewed as a follow-up to his/her field experience reflection writing using the Web-based system the researcher designed. The researcher developed and followed the interview protocol provided in Appendix C to conduct the one-on-one interviews. The interview was structured by open-ended questions. The length of interviews varied from 7 minutes to 29 minutes. The goal of the interview was to explore the participants' perceptions of the question prompts and process display as computer-based scaffolds for their reflective journal writing, and how and why computer-based scaffolds might have enhanced or have failed to enhance their journal writing quality. Finally, the participants were asked for their suggestions on future design and development of the computer-based scaffolds.

### *Data Analysis Procedures*

The researcher transcribed the interviews, and used qualitative research software NVivo 7 (OSR International Pty Ltd, 2007) to code and organize the interview transcripts. Miles and Huberman's (1994) three-step data analysis procedures guided data analysis. First, in the data reduction step, the researcher coded the interview transcripts into conceptual chunks and then grouped the chunks into categories. In the data display step, the researcher ran queries to make sense of the relationship among the categories. During the last analysis step, the researcher wrote conclusions that will help explain the

quantitative result. Journal writings were not coded, although some direct quotes were used to triangulate the findings from the interviews.

### *Rigor or Trustworthiness*

Lincoln and Guba's (1985) means for establishing trustworthiness were employed. The means include credibility, dependability, confirmability, and transferability.

*Credibility.* Credibility is concerned with the truth value of a qualitative study. The researcher used two methods to ensure the credibility of the qualitative phase of the study: data triangulation and peer debriefing. Triangulation is a technique used to cross check or confirm findings using multiple data sources. In this study, other than the quantitative coding as a data source, the researcher used both preservice teachers' journal writings and interviews as data sources. Collection of data from the participants with different education majors and who achieved different levels of reflection also helped satisfy the need for triangulation. The peer debriefer for the study has extensive and established qualitative research experience. The researcher constantly discussed with her on issues including researcher bias, data collection, data analysis procedures, and research limitations.

*Dependability and confirmability.* Dependability examines the stability of the data and confirmability is concerned about the replicability of the study by other researchers. A good documentation of the research process and the product of a study can establish dependability and confirmability. The researcher kept a detailed description of the steps involved in the study, copies of the data gathering protocol, various versions of the paper-based and computer-based conceptual models and prototypes, raw data in the format of

digitalized audio files, transcriptions, and the data coding, query and management in Nvivo software.

*Transferability.* Transferability examines the ability to apply the findings from one study to another setting, or the generalizability of the study. The researcher adopted the following strategies to enhance transferability: providing an in-depth, thick, and rich description of the research context, participants and results, and citing relevant research results that support current findings.

#### *The Researcher and Researcher Biases*

In qualitative studies, the researcher is the instrument. The researcher's hands-on experience with PASS-PORT (the researcher had incorporated PASS-PORT into the two educational courses he taught at the College where the study was conducted), education related to computer systems development, and literature review in reflection, reflection writing, and computer-based scaffolding provided him with the knowledge and skills needed to carry out the study. Meanwhile, they brought up with the potential research biases. First, the researcher had a strong belief that computer-based scaffolding tools (e.g., question prompts and writing process display), if seamlessly embedded in PASS-PORT, can significantly enhance preservice teachers' higher level of reflection writing. This belief might have drawn the researcher to find the compatible qualitative data to validate his belief. Second, the researcher infused the theoretical framework of reflection hierarchy into designing the question prompts and writing processes in the tools. These question prompts and writing processes might bias the participants when they were writing their reflections and when they were sharing their perceptions of the tools during the interviews.



### Summary

This chapter presented the methodology for this study. An explanatory mixed methods research design was adopted as the research methodology because of the nature of the current study. Quantitative methods were introduced first, followed by the introduction of the qualitative methods. The next chapter presents the quantitative results of the study.

## CHAPTER 5

### QUANTITATIVE RESULTS

#### Introduction

The data for the quantitative phase of the study were drawn from the ordinal scales of the highest level of reflection achieved in participants' reflection writings and the length of reflection writing. Five quantitative research questions were answered: (1) Will preservice teachers, who are exposed to computer-based question prompts while writing their online reflective journals, demonstrate a higher level of reflection in their writing than those in the control group? (2) Will preservice teachers, who are exposed to computer-based writing visual process display while writing their online reflective journals, demonstrate a higher level of reflection in their writing than those in the control group? (3) Will preservice teachers, who are exposed to computer-based question prompts while writing their online reflective journals, write longer reflections than those in the control group? (4) Will preservice teachers, who are exposed to computer-based writing process display while writing their online reflective journals, write longer reflections than those in the control group? And (5) are there any correlations between the highest level of reflection achieved and the length of reflection writing?

## Report of the Data

### *Highest Level Achieved in Journal Writing*

While completing their online journal writing, the participants were randomly and evenly assigned to the control group, the question prompts group and the writing process display group. Due to participation attrition explained in the methodology chapter, the number of writings available for analyses was not evenly distributed among the treatment conditions. In a total of 65 reflection writings, 20 were from the control group, 23 were from the question prompts treatment group, and 22 were from the writing process display treatment group (Table 15).

Means of the highest level of reflection achieved for the treatment groups were higher than that of the control group (Table 15). As indicated in Table 16, overall, the highest level of reflection achieved was dialogic reflection, followed by technical reflection, transformative reflection, and routine reflection. Within each group, distribution of reflection levels was skewed. As indicated in Table 17, for the control group, 80% of all writings fell into lower levels of reflection including routine and technical reflection; whereas for the two scaffold treatment groups, most writings reached higher levels of reflection, with dialogic and transformative reflection together representing 78.2% and 81.8% of all writings respectively.

Table 15

*Descriptive Statistics for Highest Level of Reflection Achieved*

Treatment Condition	N	Min	Max	Mean	Std. Deviation
Control	20	1	4	1.9	.8522
Question Prompts	23	1	4	3.0435	.8245
Process Display	22	1	4	3.0909	.8112

Table 16

*Overall Frequency and Percentage of Levels of Reflection*

Level of Reflection	Frequency n=65	Percentage %
Routine	9	13.8
Technical	16	24.6
Dialogic	25	38.5
Transformative	15	23.1

Table 17

*Frequency of Levels of Reflection within Each Treatment Group*

Treatment Condition	Level of Reflection	Frequency n=65	Percentage %
Control	Routine	7	35
	Technical	9	45
	Dialogic	3	15
	Transformative	1	5
Question Prompts	Routine	1	4.3
	Technical	4	17.4
	Dialogic	11	47.8
	Transformative	7	30.4
Process Display	Routine	1	4.5
	Technical	3	13.6
	Dialogic	11	50
	Transformative	7	31.8

*Length of Reflection Writing*

The length of the preservice teachers' reflection writing greatly varied among the three groups. Overall, the minimal length of writing in the number of words was 109, and the maximal length was 1003. The descriptive statistics for the length of reflection writing is presented in Table 18.

Table 18

*Descriptive Statistics for Length of Field Experience Reflection Writing*

Treatment Condition	N	Min	Max	Mean	Std. Deviation
Control	20	109	544	285	32
Question Prompts	23	200	793	455	31
Process Display	22	283	1003	551	39

## Results Related to the Highest Level of Reflection Achieved

Analysis of variance (ANOVA) was performed on the highest level of reflection achieved in preservice teachers' online journal writing. The independent variable, the grouping variable, had three levels: the control group, the question prompts group, and the writing process display group. The dependent variable was the highest level of reflection achieved (from 1 to 4). The level of significance was set at .05. Levene's test of homogeneity of variances was conducted to test the null hypothesis that the variances of the three groups are the same. The test indicated that the variances of the three groups were similar,  $p = .947$  (Table 19), thus satisfying the homogeneity assumption of the ANOVA. As Table 20 illustrates, the overall effect of reflection writing scaffold was significant,  $F(2, 62) = 13.741$ ,  $p < .05$ , with effect size  $\omega = .53$ . The formula for omega squared ( $\omega^2$ ) is  $(SS_M - (df_M)(MS_R)) / (SS_T + MS_R)$  where  $SS_M$  refers to model sum of squares,  $df_M$  refers to degree of freedom,  $SS_T$  refers to total sum of squares, and  $MS_R$  refers to the within groups' mean squares (Field, 2005, p. 358).

Table 19

*Levene's Test of Homogeneity of Variances*

Levene Statistics	df1	df2	Sig.
0.54	2	62	.947

Table 20

*ANOVA Summary Table*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	18.871	2	9.436	13.741	.000
Within Groups	42.575	62	.687		
Total	61.446	64			

Because sample sizes in the three groups were slightly different, *Post hoc* multiple comparisons tests using Gabriel's procedure (Field, 2005) were conducted to compare all different combinations among the three groups. As indicated in Table 21, a statistically significant difference was found between the control group and the question prompts group ( $p < .0001$ ), between the control group and the writing process display group ( $p < .0001$ ); and no statistically significant difference was found between the question prompts group and the writing process display group ( $p = .980$ ).

Table 21

*Post hoc Multiple Comparisons on Levels of Reflection Achieved*

(I) TreatmentType	(J) TreatmentType	Mean Difference (I-J)	Std. Error	Sig.
CG	QP Treatment	-1.143	.253	.000
	PD Treatment	-1.191	.256	.000
QP Treatment	CG	1.143	.253	.000
	PD Treatment	-.047	.247	.996
PD Treatment	CG	1.191	.256	.000
	QP Treatment	.047	.247	.996

*Note:* CG = Control Group; QP = Question Prompts; PD = Process Display

## Results Related to the Length of Journal Writing

As the descriptive statistics for the length of the journal writing revealed (Table 18), there existed differences in the length of the journal writing among the three groups. To further investigate the effects of the treatments on the length of preservice teachers' journal writing, another ANOVA was performed. The independent variable treatment group had three levels: the control group, the question prompts group, and the writing process display group. The dependent variable was the length of preservice teachers' journal writing in the number of words. The level of significance was set at .05. Levene's test of homogeneity of variances was conducted to test the null hypothesis that the variances of the three groups were the same. The test indicated that the variances of the three groups were similar,  $p = .737$  (Table 22), thus satisfying the homogeneity



assumption of the ANOVA. As Table 23 illustrates, the overall effect of reflection writing scaffold was significant,  $F(2, 62) = 14.895$ ,  $p < .05$ , with effect size  $\omega = .55$ .

Table 22

*Levene's Test of Homogeneity of Variances*

Levene Statistics	df1	df2	Sig.
.307	2	62	.737

Table 23

*ANOVA Summary Table*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	754596.3	2	377298.174	14.895	.000
Within Groups	1570471	62	25330.172		
Total	2325067	64			

Because the sample sizes in the three groups were slightly different, *Post hoc* multiple comparisons tests using Gabriel's procedure were conducted to compare all different combinations among the three groups. As indicated in Table 24, a statistically significant difference was found between the control group and the question prompts group ( $p = .002$ ), between the control group and the writing process display group ( $p < .0001$ ); and no statistically significant difference was found between the question prompts group and the writing process display group ( $p = .117$ ).

Table 24

*Post hoc Multiple Comparisons on Length of Journal Writing*

(I) TreatmentType	(J) TreatmentType	Mean Difference (I-J)	Std. Error	Sig.
CG	QP Treatment	-170.117	48.660	.003
	PD Treatment	-265.855	49.172	.000
QP Treatment	CG	170.117	48.660	.003
	PD Treatment	-95.737	47.462	.136
PD Treatment	CG	265.855	49.172	.000
	QP Treatment	95.737	47.462	.136

*Note:* CG = Control Group; QP = Question Prompts; PD = Process Display

## A Correlation Analysis

The treatment conditions were found to have a statistically significant effect on the highest level of reflection achieved in preservice teachers' online reflective journal writing and the length of reflection writing. A correlation analysis revealed that there was a positive relationship between the level of reflection and the length of journal writing,  $r = .344$ ,  $p < .05$  (Table 25). The formula for Pearson correlation coefficient  $r$  is  $\text{Cov}_{xy}/S_x S_y$ , where  $\text{Cov}_{xy}$  refers to the covariance between the level of reflection and the length of writing,  $S_x$  refers to the standard deviation of the treatment conditions and  $S_y$  refers to the standard deviation of the length of writing (Field, 2005, p. 111).

Table 25

*Correlation Between Reflection Level and Length of Reflection Writing*

Control Variables			Level	Length
TreatmentType	Level	Correlation	1.000	.344
		Sig. (1- tailed)	.	.003
		df	0	62
	Length	Correlation	.344	1.000
		Sig. (1- tailed)	.003	.
		df	62	0

## Summary

The quantitative phase of the study sought to answer the five quantitative questions. Analyses of the data indicated that the computer-based journal writing scaffolds, including question prompts and writing process display, statistically significantly influenced the highest level of reflection achieved in preservice teachers' online journal writing and in the length of their journal writing. Further correlation analysis revealed that there was a positive relationship between the level of reflection and the length of journal writing. In the next chapter, the researcher will present qualitative data to answer why and how the computer-based scaffolding tools, question prompts and writing process display, had a positive effect on preservice teachers' higher level of reflection in their online journal writing.

## CHAPTER 6

### QUALITATIVE RESULTS

#### Introduction

This chapter presents the research findings that address the qualitative research question – how and why did the selected computer-based scaffolding tools (i.e., question prompts and writing process display) affect preservice teachers’ reflective journal writing? This chapter describes the factors that might have contributed to the two treatment groups’ higher levels of reflection, including (a) specific requirements conveyed in the treatment scaffolds, (b) the structure of the scaffold, and (c) the use of critical incidents to anchor reflective journal writing. The presentation of some of the findings will be separated by their respective treatment conditions. However, given the fact that the four participants selected from the control group later used the writing process display scaffold to support their second journal writing, their perceptions will be presented together with those in the writing process display treatment group.

#### Factor 1: Specific Requirements Conveyed in the Treatment Scaffolds

The two treatment groups attributed the higher levels of reflection in their reflection journals to the specific requirements conveyed in the treatment scaffolds. This was in contrast to the vague requirements provided in typical reflection writing assignments. Data were provided as follows to support the conclusion.

*Limitations in Typical Reflection Requirements*

According to these preservice teacher participants, their professors typically provided them with short and vague requirements on what they should write in their reflections and how they should write their reflections. They reported having difficulties writing meaningful and in-depth reflections. The following paragraphs present several problems related to the reflection writing requirements that these preservice teachers experienced in other classes.

First, the typical reflection requirements were limited to the description of observed classrooms and teaching strategies, resulting in descriptive/technical reflections. Anna, an Elementary Education major in her early 20s, recalled that in another class in which she was required to write reflections on her classroom observations, her professor simply instructed her to “write what you will see physically, and then describe the makeup of the classroom.” She thought that she was not challenged to reflect in more depth on what she observed in the classroom. Jackie, an Early Childhood Education major in her early 20s, shared a similar experience. For her classroom observation reflections, her professor simply asked her to write journals about what she observed in the classroom including such details as classroom setup, classroom management, and teacher’s attire. She wished that her professor had given her more meaningful reflection requirements:

Instead of just telling me how the room was arranged, she should have asked [us] to investigate why do you think the room was arranged like that? And how did that arrangement affect student learning? You should be required to really

examine what you are looking at instead of just reporting, and to think about what you are saying.

The seeming lack of specific reflection writing requirements caused preservice teachers to lose focus in their writing, and eventually led to brief and general reflections. Michael, a Secondary Education major in his early 20s, expressed the confusion that he experienced while writing reflections with minimum requirements.

In other classes, they really don't give us anything to go with. A lot of times, you aren't even sure of the instructions. They will just say, write whatever your reflections are. It's a little bit too open-ended. It just tells us to write anything. It is confusing. You can't really focus on anything in particular to write on whatever that open-ended for a lot of the other classes.

When asked to compare his reflection journal using the control treatment in the study with the reflections for the other classes, Michael commented:

I think my reflections for the other classes were more like the reflection I wrote after my first field experience. Because this one does seem briefer and more general, that would be what I usually write for other classes. They ended up being very brief and general.

Another problem related to reflection requirements was that preservice teachers were confused about the objectives of the reflection because they were so simple and vague. Josephine was a Secondary Education major in her 40s who asked for structure and specific rules in reflection requirements. While she was writing her reflections for other courses, she constantly asked herself "Am I touching base on everything they wanted us to touch on? Am I making a comment about everything that I was supposed to

be observing in the class?” Even though she thought she understood why her professors provided so little instruction to guide her reflections– not to influence her thinking on what she observed, she acknowledged her inclination toward specific reflection writing requirements. She joked that she could not survive the “too freeway, too open” reflection writing requirements she received from her professors. Helen, an Early Childhood Education major in her early 20s, had similar perceptions. While writing reflections on her classroom observations for other courses, she was not only unclear of what to write about, but also struggled with how much detail she should include. Kathy, an Early Childhood Education major in her early 20s, shared the same reflection writing experience. She felt lost when her professors just asked her to write a reflection about her opinions on classroom observations.

Third, preservice teachers were not motivated to write in-depth reflections due in large part to the lack of specific requirements from professors. Matthew, an eloquent Secondary Music Education major in his early 20s, provided a glimpse of his personal take on how he approached his previous reflection writing:

For the reflection writing, to me actually, most of the times, it depends on how much time I have. For most of the times, I will write a paragraph. I will write what you ask me for. If I know that the expectations are not that high, I won't go as much depth as I need to.

Rebecca, a Secondary Education major in her early 20s, had the same attitude. If no detailed guidance or requirements were provided, she would only do the minimum in her reflection writings. The low motivation of reflection writing manifested by Matthew and Rebecca revealed the “I will only do what you require” mentality among the preservice

teachers. Clark, a Secondary Mathematics Education student in his late 30s, shared his opinions on such frame of mind. He recalled that, whenever his professors assigned essays or reflections to the class, the most general questions he heard from his peers were “What do you want from us?” and “Will this be on the test?” They did not seem to appreciate the value of reflection to their current learning and future teaching. Clark himself used to dislike reflection writing, but one professor successfully changed his mindset by helping him realize that he could grow as a teacher through writing critical reflections.

You know, it’s weird. I hate writing. I used to hate writing. I would love to do a lot of research. But now, when I do the reflections, I actually enjoyed writing the reflections, because it does help you to become a better teacher, especially when you start to take it seriously and you are able to look back as to what you have been doing. I think somebody really drilled that into me, I think it was Dr. Nathan Roberts in the EDFL 106. He is one that really drilled me into the reflection, because all of the tests were all written. He just kind of gave us an idea that through what you have been doing, you can grow as a teacher.

#### *Values of the Specific Requirements Conveyed in the Scaffolds*

Preservice teacher participants treated the question prompts and the step-by-step writing process conveyed in the scaffolds as specific reflection writing requirements that they needed to follow. When asked to compare the reflective writing requirements in the study with the requirements in other courses, preservice teacher participants shared their perceptions of the values of the writing scaffolds in the following.



First, the specific requirements guided preservice teacher participants to reflect on the situations they were in or the problems they encountered in a greater depth. They put more effort into their thinking while writing the reflection journal. Blenda, a Secondary English Education major in her early 20s recalled that, “I was forced to put more depth into it, rather than where it would just say, reflect on your field experience on computer camp. So I think that was better as far as the depth and everything.” Jackie perceived that the question prompts scaffold she used guided her to recall situations she might not think of if she was just given the general instruction of describing what happened. Rebecca pointed out that the specific questions in the question prompts scaffold “made you think about what you write as opposed to, normally, you just write whatever comes to your mind.” Iris, an Early Childhood Education major in her early 20s, perceived that her reflection writing experience using the writing process display scaffold was quite different from all her previous writings. The series of steps made her think beyond her comfort zone. Julia, an eloquent speaker with a major in Social Studies, had a special appreciation of a main step in the writing process display scaffold. That step required her to reconstruct her learning from the critical incident she experienced in her practical teaching. She elaborated on the relationships among experience, reflection and learning:

This [the reconstruction step in the writing process display scaffold] is very important. In another class, we talked about what you would do differently and why. This is more detailed when it says you’re learning from the critical incident, like what you learned. This is good because as a teacher, for every lesson, you need to go back to see, was this effective? What can I change from it? And things like that. It made you look back. Was this a proper lesson? Did the kids get a lot

out of it? Every class, every year, there are going to be different kids, and they understand differently. This is too long, these kids talk too much, and groups and things like that.

Right after acknowledging his low motivation in writing long, meaningful, and in-depth reflections for his previous classes, Matthew claimed that the wording of the questions in the question prompts scaffold helped him think more thoroughly.

The first week, for example, when I thought about a teaching idea, I was like, OK, let's try this. That's something that I have never done before. I haven't been in that situation. So when you asked me to come upon with a critical incident, I knew definitely what to write about. I knew the ultimate depth of it. So I wrote on it. I wrote it in depth because, one, the questions asked me on all these different directions about it, you know, I had to think about it in different ways. But if you had told me to write about it myself, I probably would only touch upon most of those. I won't go over all of them. So the questions did help.

Both the question prompts scaffold and the writing process display scaffold asked preservice teachers to think about the transformational effect the critical incident might have on them. To guide their critical reflection, the researcher provided some examples in the scaffolds (see Figure 20 and Figure 25). Preservice teacher participants believed that these examples supported their in-depth thinking so that they could easily associate the examples with what happened in their practical teaching. For example, Jackie and her partner taught two first grade girls on how to use iMovie for digital storytelling. At the end of her reflection journal, she began to make sense of the girls' computer skills and explained why. She reflected:

The girls enjoyed working with the computer but did not appear to have a whole lot of exposure to it. One really liked to type, but needed help with spelling. The other student was shy about typing and using the mouse, but these factors were most likely due to their new environment.

In the interview, when asked if she had not been given the examples to think about in her reflection, she commented that she probably would not think in a similar fashion:

I think the examples definitely helped me think that way, like the girls, when they are not used to the computer, that made it clearer to what the question was asking.

I probably would not have thought about that, if the example hadn't been there.

Whereas Jennifer, an Early Childhood Education major in her early 20s, pointed out that the examples provided in the question functioned as writing requirements that she needed to consider in her reflection writing. She perceived that the examples helped her think beyond her comfort zone by showing her the directions of potential in-depth reflective thinking:

I think the examples were great, because they were kind of prompting questions where we could actually look up and go "oh, I need to look up that, that was a factor or whatever." I like how you just didn't put the question and then leave it that, it just kind of helped, and see what we want to talk about by giving us examples...I think because your questions, like you gave us examples, we knew we need to take from that and draw from it and continue with it, I think that helped.

Second, the two scaffolds used in the study made preservice teacher participants' writing process easier by instructing them on exactly what to write. Kathy, an Early

Childhood Education major in her early 20s, shared her perceptions of the question prompts scaffold she used: “It tells you this is what you have to respond, you can’t put what you really want. But then it’s easier, you don’t have to think about what you put, you just answer the questions.” Though feeling restricted as to what she had to respond, she enjoyed the ease of the writing process. Rebecca echoed the same. Helen’s writing experience in the study was enriched by that fact that she used the control treatment for her first writing and the writing process display scaffold for her second writing. During the interview, she manifested her preference to the writing process display scaffold and explained why.

I will use this one next time. It gave you a list of everything. Like I said, it’s more detailed on what you want. You don’t really know you talked about the aha or oops moments in the first one [Note: the control treatment she used], because you did not know how much information you should put or how detailed. You really don’t know what to write about. This just guides you and helps you a whole lot more.

Helen realized that she easily wrote a longer piece of reflection writing for her second field experience, and she attributed that to the detailed writing steps embedded in the scaffold. At the end of the interview, she summarized her perceptions of the writing process display scaffold she used, which she considered beneficial – “It allows you to see what happened, what led up to that point, how you dealt with it, what were the consequences, what you did after it, and what you should do next time.” According to Jackie, the question prompts scaffold gave her a clear focus on what she was answering and successfully prevented her from wandering around. Jennifer enjoyed the specific

questions in the question prompts scaffold. Because of the questions, she no longer read over her notes to figure out what she needed to put and how she needed to put them.

Blenda had a different experience with her second writing using the process display scaffold. Initially she felt compelled to write more for each suggested writing step. Later, she found out that the scaffold helped her guide her thoughts throughout her writing process. Eventually, she perceived that the potential of the writing guidance outweighed her being restricted as what she had to write.

Third, the scaffolds helped preservice teacher participants reflect on the critical incident considering various factors and in different ways. Jennifer and Rebecca both agreed that, if without the specific questions in the question prompts scaffold, they would have left out some aspects associated with the incident because they might not be able to think of those. When asked specifically what question(s) she might skip and the significance of those question(s) to her writing, Jennifer responded:

I liked about how it talked about the feelings I guess it says in the second question, what feelings guided your responses toward the incident? Like a lot of times, the teachers had to stress - don't forget to say what happened, how you feel about it and everything. But they would never say that, you know, in that kind of wording to say about the feelings, and how it affects us, how therefore we can affect the children. You know they pick on our feelings and everything. I like that one. Also like the last one when it talked about what will you do if you are in a similar situation in the future, what will you do, and will you do differently. I think that was good, because it really made me reflect for the future instead of just say what I saw, what happened.

Christine, a Secondary Education major in her early 20s, added that, without the question prompts scaffold, she would only think about some positive and negative aspects of her practical teaching, and would not reflect in details. She attributed her inability to think in different ways to her lack of authentic classroom teaching experience. She believed that the scaffold enriched both her knowledge of the critical incident and her skills in reflection writing.

The preservice teacher participants having used the writing process display scaffold shared similar perceptions. Helen perceived that the scaffold allowed her to consider every aspect of the critical incident, because “It allows you to see what happened, what led up to that point, how you dealt with it, what were the consequences, what you did after it, what you should do next time.” Blenda, although confident and competent in her reflection writing, admitted that, without the scaffold, she would not (a) consider the significance of the incident while describing it; (b) reflect on her thinking when the incident occurred and after the incident phased out; (c) reflect on the various factors that might have influenced her decision making; and (d) reflect on her beliefs change. Hillary echoed that, if without the scaffold, she would focus on reflecting on what happened. She would not mention the activities that led to the incident, nor would she mention her feelings that guided her responses towards the incident. Just as Blenda, she would not reflect on her beliefs change on all the suggested aspects; even if she did reflect on certain aspects, she would not develop them in depth. Michael was in control treatment condition for his first reflection writing, and used the writing process display scaffold to support his second reflection writing. When asked to compare his two writings,

he admitted that, if without the scaffold, he would easily skip some of the aspects related to the incident:

I think I definitely would just focus more on what happened, not necessarily “oh, what would occur afterwards...” point 1 to point 5, the significance of the incident to your learning and teaching. I don’t think I necessarily would have thought of that. I would write my own like the first one, thus would have left something like that, and write this and this happened, that’s it... This is much like the first part, because it does rationalize my decision making and everything, but again, the conclusion part, your thinking and feelings after the incident, I think that’s the part where I would have skipped. I would just say what’s the decision that was made, how I made the decision, not really going into what happened afterwards.

## Factor 2: Structure of the Scaffolds

This second factor deals with how the structure of the scaffolds impacted participants’ journal writing. The findings related to this factor will be presented in two subsections: question prompts scaffold and writing process display scaffold.

### *Question Prompts Scaffold*

Preservice teacher participants acknowledged that the structure of the question prompts scaffold was conducive to their journal writing. As evidenced in the interviews, preservice teacher participants lacked authentic classroom teaching experiences. Before their participation in the first Saturday technology program, their previous field experiences were restricted to going into public or private schools to observe how

expert/seasoned teachers teach. Christine commented on the benefits of the structure of the scaffold. Without the question prompts, she found that she would probably just think about any positive and some negative incidents that occurred during her practical teaching. Moreover, she would not reflect on the incidents in detail and in depth. Because of her lack of practical teaching experience, she desired a well-designed structure to guide her reflection writing. Having realized that the question prompts scaffold was an excellent tool to facilitate her reflective thinking, Christine emphasized the long-term positive effect the structure of the scaffold would offer to preservice teachers who are on their way to learn to teach: “when they actually go into the classroom to teach themselves, they can relate to what they have already experienced, they kind of know...”

Matthew specifically emphasized how the structure of the scaffold enhanced his reflection in a comprehensive way as opposed to his previous reflections on classroom observations. While writing his reflection, on one hand, Matthew would like to know where he is going and thus desire an overall picture of his writing to make sure that he gets all the aspects of the questions; on the other hand, he would like the question prompts to motivate his thinking. Matthew perceived that, compared with his previous reflection on his classroom observations when his professors usually only gave him limited and general instructions on what and how he needed to write his reflections, the question prompts scaffold had an integral and constructive format/structure that made his in-depth reflective thinking possible and enjoyable.

I like the fact that it did not focus on the observation itself. Some of the observations were just, ok what happened, or what do you feel about what happened, overall. This was particularly about something. I mean, we were



teaching. One, methodology really came into play; secondly, it was something like you were addressing a potential problem, or surprise factors, which I think they're a really important part of that, so you addressed what happened, why it happened, what were your feelings, that way, you can really think what happened and why it happened, so you know how to better tackle it for your next time. I think it is really good in this format.

In addition, the transition embedded in the scaffold enriched the preservice teacher participants' reflection writing experience. Jennifer's experience with the scaffold was unique. Her years of writing practice made her accustomed to starting her writing with an introduction on what happened, followed by elaboration and rationalization of the occurrence, and a conclusion. After her initial fleeting confusion as how to start and end her reflection writing using the scaffold, she eventually came to enjoy the structure of the scaffold:

I think it's easier, because sometimes you had to read over your notes and figure out, OK, what do I put and how do I put, the sequence and everything. While I was all done, I was reading, well, this transitioned so well, not just for me to answer my questions.

### *Writing Process Display Scaffold*

Preservice teacher participants showed their appreciation of having the writing process broken down into three major steps: (a) describing the incident, (b) rationalizing their decision making in the incident, and (c) reconstructing their beliefs in teaching and learning. They found it helpful to organize their reflective thinking within such a framework, as Anna commented, "I definitely liked how it gave you directions as far as

what you need to input. I liked how it is broken down, after you finish this part and then you go to the next.” Michael and Clark had similar views. Michael attributed his organized reflection writing in the study to the specific writing guidelines in the scaffold. Scarlet echoed the similar, but explained in an elaborative fashion:

I liked how it breaks down into three parts and gave you specifically what you need to write about. For each part, instead of saying tell us about your field experience, something happened and how you resolved it, it breaks down to exactly what you want to know. So it gives me an idea of what to write about...I think that helped with thought process, to help you get along, because sometimes, you just write and don't have anything to go by and what you are going to write next.

In addition, preservice teacher participants perceived that the parallel juxtaposition of writing process flow chart with their text field was conducive to their reflective writing. Both Scarlette and Hillary perceived that the juxtaposition effectively prevented her from flipping back and forth between Web pages. That way, they could concentrate on their writing by following the prescribed writing steps. Julia shared the similar view. She further explained that, by providing the flow chart and the writing text box in comfortable length, the scaffold made her reflection writing both focused and enjoyable:

It's good because you don't need to flip back and forth, but you are answering this specific question on this box. It breaks down. Sometimes, if people see things that are long and detailed, you get overwhelmed. With this, I found the shorter the box, the flow chart in the side helps you structure the specific section that you can

focus just on this section, rather than thinking what I am going to write for the next section.

### Factor 3: Use of Critical Incident

No matter what their scaffold treatment condition was, the preservice teacher participants were provided with the same opening statement that introduced them to the concept of a critical incident, and were asked to reflect on the critical incident that occurred in their practical teaching. The opening statement on the critical incident went as the following:

During your practice teaching, you were constantly interacting with your students. Please recollect a critical incident that happened during your practice teaching. The critical incident was usually an “aha...” or “oops” moment that you experienced during a teaching episode. The incident may be something that amused or annoyed you, or something that helped you achieve a sense of difficulty or success. Generally, the incident raised a few questions for you to think over and challenge your previous beliefs about teaching and learning. In the following journal entry, please reflect on the incident that happened in your practice teaching.

Analysis revealed that the use of critical incident to anchor the preservice teacher participants' reflection writing was quite a novel experience for them. They claimed that their journal writing was quite different from all the other reflections they had ever done before because it was based upon the aha or oops critical moment that occurred in their practical teaching. If not specifically instructed, most of them commented that they would never write their reflections on the basis of critical incident; and they perceived that the

use of critical incident improved their in-depth reflective thinking. Presented below are the benefits brought forth by preservice teacher participants' use of critical incident to anchor their reflection writing.

First of all, they perceived that the use of critical incident to anchor their reflection writing worked best when they had the opportunity to practice authentic teaching. According to Anna, when she went into classrooms to observe teachers' teaching, even though she carefully observed and saw what was happening in the classrooms, she felt detached and thought that there was nothing critical that happened that she could write about. However, her hands-on teaching practice in the Saturday technology program reshaped her perceptions of the critical incident that occurred in her practical teaching, and her journal writing greatly benefited from it.

Second, they perceived that the use of critical incident sparked their memory of what occurred in their practical teaching. Their better recall of what happened laid a solid foundation for them to develop in-depth reflection. Josephine provided an example explaining how the use of critical incident helped her remember her students' excitement seeing the robotics, and their initial assumptions of the capabilities of the robotics used in their Saturday technology program.

When you talked about the activities that led to the incident, well, you know, is there different interaction? Or what they did that sparks. For instance, when the children saw the robotic, they got all excited. One of the things I guess could be oops was that these children thought it's gonna fly and dance like in science fiction. They were just like moving their arms and legs, just wanting to move around. I was like, no, it's not that just of dance. So that's kind of an incident. But

it helped you remember by saying that. But that was kind of funny. They were expecting, I am telling you. I remembered telling them that, “No, they are legos. You know what legos are. It’s not gonna do too much, because they will fall apart.” They were like, OK. Because they thought the circus is going into town.

A few more preservice teacher participants echoed the same. Take Hillary as an example, she even realized the ripple effect of the use of critical incident in helping her recall all the details and aspects associated with the incident.

I think that works really well because it made you think of a more important situation and then kind of branch off, kind of help you to remember other smaller things. I thought it was good. Because first, I am like, what I am gonna write about. You know, and then when it said the incident, I recalled right away. Like when I thought about the one thing that happened, it makes you think about the other little things that led to that. I thought that was good.

Third, the preservice teacher participants perceived that critical incident served as an excellent start to their reflection writing and it functioned as guidance to their overall writing process. Rebecca used to struggle with what to write for her reflection assignments, but found that the use of critical incident sparked her idea of what to write about. In the following quote, Jennifer first described the approach she used for her previous reflections on her classroom observations, and then attributed her ease of reflection writing in the study to the use of critical incident to anchor her writing.

Basically, [for my previous reflection assignments,] I will follow my notes I have taken when I was there, looking at the classroom, the teacher-student interactions or whatever, I will focus on that and write a paper. Whereas this, it was so much

easier, and it took me less time to write it, because I didn't have to sit there for so much time thinking how to formulate it, and transition it...I liked it because instead of having me to sit there and think the drawbacks from what happened and everything, it just threw me into it, I just started and it went.

Julia further elaborated how the use of critical incident got her into reflective thinking mode from the start of her writing.

I like how you put aha and oops, because a lot of times when you are teaching or doing presentation in the class, you suddenly realized oh my gosh, I should have got that, which I think that's quite a good introduction to think, you are so used to writing what you see what happened, this was more like reflecting back what I should have done, and what I should improve. If I would have this before the workshop, I can remember better all those little things. After doing something, a lot of times, you kind of like oh, I should have done this; I should have done that, which I thought that's a good introduction, because immediately, you are trying to write a mini paragraph trying to make you think back what I could have done differently. If you admit what you have done wrong as a teacher, that makes a better teacher the next time, because you know you made mistakes, and you need to correct them.

Fourth, the use of critical incident influenced the preservice teacher participants' approach to what to write about. Eventually, they focused on those oops or aha moments constructive to their learning to teach, and achieved meaningful, in-depth reflection writing. Josephine, in a brief statement, made sense of the uniqueness of the use of critical incident to anchor her reflection writing.

It is what you want to know vs. is it just anything. You want something that really stood out and talked about it. It wasn't just, we read through this story, the child would grab the paper and read it himself aloud. I would be like, a wow moment stuff.

Matthew and Blenda echoed Josephine's comments. Blenda explained why the use of critical incident allowed her to focus on her reflection writing:

The incident helped me to think about the situations that I was going to write about before hand rather than just writing the whole that everything happened during the computer camp. I was able to focus on one thing, that either kind of aha moment or a moment where I wish I hadn't done that or something...Because otherwise, I tend to just write about everything that I observed and put in everything I saw or whatever, and then reflect on it. But that kind of helped me centered on one particular incident.

Hillary also accredited her in-depth reflective thinking to the use of critical incident. Compared with her previous reflection writings which she identified as "general", the writing in the study allowed her to reflect on "a major incident that really struck me, either good or bad, that I will write about...That's why I said it actually made you think more into what happened."

And last, though the delineation of critical incident was clearly presented to preservice teachers when they were introduced to the study, the use of critical incident to anchor their reflection writing brought up some unexpected consequences. Though the preservice teacher participants acknowledged that the determination of a critical incident in the field experience was an individual judgment call, some participants subconsciously

associated a critical incident with something bad or negative. For example, Helen, Jackie and Josephine all perceived that the wording of incident carried a tone of negativity. Because of that, they focused their reflection writing on what went wrong and what can be done to correct the situation. Josephine's comments illustrate that misinterpretation of a critical incident can negatively impact preservice teachers' reflective thinking in their journal writing.

I think honestly, with the incident, you might have got a poor reflection, a negative type of reflection, vs. one reflexive with the whole thing, because the type of wording that was used. I perceive it as a negative word. I had thought they want some what's the challenge vs. what's the opportunity type of reflection, which I wouldn't talk about anything positive.

Helen's experience, from a different angle, illustrated that the use of critical incident to anchor reflection writing failed to enhance her reflective thinking. As she wrote in her journal, she and her partner did not encounter any critical incident at all, but some routine interactions with the two little girls they instructed. It also explained why she wrote one of the shortest journals in the study.

There really wasn't a particular incident that we had with our group of children. So I exactly did not know what to put in there. Because it only talked about incident, while I didn't have an incident that I have much to say about it. Our case was that the kids knew so much more than we thought they did about the computer.



### Summary

As examined in the previous chapter, computer-based reflection writing scaffolds, question prompts and writing process display, statistically significantly affected the level of reflection achieved in preservice teachers' reflection writing. This chapter intends to answer the final research question: How and why did question prompts scaffold and writing process display scaffold affected preservice teachers' higher level of reflection in their journal writing? Three overarching factors emerged from the data analyses including (a) the specific requirements conveyed in the scaffolds; (b) the structure of the scaffolds; and (c) the use of critical incident to anchor their reflective journal writing. The next chapter answers the research questions, discusses the implications of the research findings, and proposes a research agenda for future studies.

## CHAPTER 7

### SUMMARY, DISCUSSIONS AND CONCLUSIONS

#### Summary

The purpose of the study was two-fold. First, it examined whether computer-based scaffolds, question prompts and writing process display, enhanced preservice teachers' higher level of reflection as evidenced in their online journal writing on their practical teaching. Second, it explored how and why the computer-based scaffolds enhanced preservice teachers' higher level of reflection in their journal writing. Three Web-based treatments were designed for the purpose of the study. The no-scaffold treatment introduced the participants to the concept of a critical incident (Calandra et al., 2007), and asked them to reflect on an incident that happened in their practical teaching, so did the question prompts treatment and writing process display treatment. The question prompts treatment and the writing process display treatment were designed in light of the three types/forms of reflection (Killion & Todnem, 1991; Schön, 1987) and hierarchical levels of reflection (van Manen, 1977). For the question prompts treatment, specific and tailored questions related to the critical incident were provided to scaffold the participants' journal writing; whereas for the writing process display treatment, visual step-by-step writing guidelines related to the critical incident were provided to scaffold the participants' journal writing.

This study employed an explanatory mixed-methods design. For the quantitative phase of the study, the researcher adopted the reflection rubric developed by Ward and McCotter (2004) to measure the highest level of reflection achieved in participants' online journal writing. Analysis of variance (ANOVA) was performed to examine the group difference on the highest level of reflection achieved. For the qualitative phase of the study, follow-up interviews were conducted to explore how and why the group difference occurred.

The study was conducted at the College of Education of a major southern university in the United States. All participants were from five out of seven sections of IRED 320, Technology in the Classroom, in fall 2007. The total number of participants completing and also agreeing to participate in the quantitative phase of the study was 65. Sixteen participated in the qualitative phase of the study. The majority of the participants were white females. All of them were in their junior year, with majors in Elementary Education, Early Childhood Education, and Secondary Education.

In this chapter, each of the six research questions for the study will be introduced and discussed in the context of the literature. It will also discuss the implications of the research findings, and propose a research agenda for future studies.

### Research Questions and Summary of the Findings

#### *Effects of Scaffolds on Level of Reflection*

Quantitative question 1: will preservice teachers, who are exposed to computer-based question prompts while writing their online reflective journals, demonstrate a higher level of reflection in their writing than those in the control group?

Quantitative question 2: will preservice teachers, who are exposed to computer-based writing visual process display while writing their online reflective journals, demonstrate a higher level of reflection in their writing than those in the control group?

### *Results*

For the control group, 80% of writings fell into routine and technical level of reflection. For the question prompts group, 78.2% of writings fell into higher levels of dialogic and transformative reflection. For the writing process display group, 81.8% of writings fell into the two higher levels of reflection. Mean difference for the control group was 1.9 (SD=.8522), for the question prompts group was 3.0435 (SD=.8245), and for the writing process display group was 3.0909 (SD=.8112). ANOVA indicated a statistically significant effect of the questions prompts and the writing process display on preservice teachers' level of reflection in their journal writing,  $F(2, 62) = 13.741$ ,  $p = .000$ , and effect size  $\omega = .53$ . *Post hoc* multiple comparisons tests revealed that statistically significant difference was found between the control group and the question prompts group ( $p < .0001$ ), between the control group and the writing process display group ( $p < .0001$ ), and no statistically significant difference was found between the question prompts group and the writing process display group ( $p = .980$ ).

### *Effects of Scaffolds on Length of Reflection Writing*

Quantitative question 3: will preservice teachers, who are exposed to computer-based question prompts while writing their online reflective journals, write longer reflections than those in the control group?

Quantitative question 4: will preservice teachers, who are exposed to computer-based writing process display while writing their online reflective journals, write longer reflections than those in the control group?

### *Results*

Mean differences were 285 words (SD=32) for the control group, 455 words (SD=31) for the question prompts group, and 551 words (SD=39) for the writing process display group. ANOVA indicated that the overall effect of the scaffolds on the length of reflection writing was significant,  $F(2, 62) = 14.895$ ,  $p < .0001$ , and effect size  $\omega = .55$ . *Post hoc* multiple comparisons tests revealed that statistically significant difference was found between the control group and the question prompts group ( $p = .002$ ), between the control group and the process display group ( $p < .0001$ ), and no statistically significant difference was found between the question prompts group and the writing process display group ( $p = .117$ ).

### *Correlation Analysis*

Quantitative question 5: are there any correlations between the highest level of reflection achieved and the length of reflection writing?

### *Results*

Correlation analysis revealed that there was a positive relationship between the level of reflection and the length of journal writing,  $r = .344$ ,  $p < .05$ .

*Exploration of How and Why the Scaffolds Enhanced Level of Reflection*

Qualitative question 6: How and why do the selected computer-based scaffolding tools (i.e., question prompts and writing process display) affect or fail to affect preservice teachers' reflective journal writing?

*Results*

Three overarching factors emerged, including (a) the specific requirements conveyed in the scaffolds, (b) the structure of the scaffolds, and (c) the use of critical incident to anchor journal writing.

First, the preservice teachers appreciated the *specific requirements conveyed in the scaffolds* because the requirements made them probe the situations/problems in a more detailed fashion and in greater depth. They perceived that their reflection writing was easier because the scaffolds instructed them exactly what to write; and most importantly, the specific requirements helped them reflect on a critical incident considering various factors and in different ways.

Second, *the structure of the scaffolds* enhanced the preservice teacher participants' journal writing. They perceived that the scaffolds were conducive to their reflection writing because of the seamless transition embedded in the question prompts scaffold and the parallel juxtaposition of the writing process flow chart with the writing text box in the process display scaffold.

Third, the preservice teacher participants perceived that *the use of critical incident to anchor journal writing* worked best when they had the opportunity to practice authentic classroom teaching featured by frequent teacher-student interactions. In the participants' view, the critical incident sparked their recall of what happened in their

teaching, which made their ensuing in-depth reflection tangible. It also served as excellent guidance to their overall reflection writing process.

### Discussion

Both quantitative and qualitative analyses suggested that the use of computer-based scaffolds, question prompts and writing process display, significantly enhanced preservice teachers' higher level of reflection as evidenced in their online journal writing on their practical teaching. The quantitative results revealed that the treatment groups exhibited significantly higher level of reflection in their journal writings than the control group. Moreover treatment groups wrote significantly longer reflections than the control group. Correlation analysis indicated a positive relationship between the level of reflection and the length of reflection writing. The follow-up qualitative analysis revealed three major factors that might have contributed to the treatment groups' higher levels of reflection in their journal writings, including (a) specific requirements conveyed in the treatment scaffolds, (b) the structure of the scaffold, and (c) the use of critical incidents to anchor journal writing. The above findings are discussed in the following.

As reviewed in Chapter 2, NCATE (2006) has established standards that call for teacher candidates to demonstrate their reflection capability. Critical reflection has been touted the distinguishing attribute of reflective practitioners (Larrivee, 2000). How to leverage the affordances of reflective practice to help prepare qualified teacher candidates with highly critical thinking capability has been an actively debated topic. One school of researchers questioned whether it is realistic to develop preservice teachers' critical reflection ability (Calderhead, 1992; Cochran-Smith, 1991; Rudduck, 1989, March). These researchers claim that preservice teachers lack long-term classroom teaching

experiences in authentic school context, and have not fully developed their metacognitive skills crucially needed for critical reflection. Yet another group of researchers advocate that preservice teachers' reflective thinking capability is a developmental process (Hatton & Smith, 1995; Pultorak, 1996), and various contextual scaffolds can be utilized to enhance the development process (Koszalka et al., 2003). According to Yost, Sentner, and Forlenza-Bailey (2000), preservice teachers' ability to develop critical reflection is dependent on two conditions, (a) "supervised practical experiences" and (b) "personally meaningful knowledge base in pedagogy, theories of learning, as well as social, political, and historical foundation to which they can connect their experiences." (p. 47) Snow (2001) echoes that teachers' capacity to reflect on and analyze their knowledge emerges only after considerable knowledge has been accumulated and embedded into their teaching practice. The researcher agrees with the latter group of researchers.

Research reveals that, in addition to the supervised practical experiences and personally meaningful knowledge base, preservice teachers still need support or scaffolds so that they can connect their experiences with the various categories of knowledge base (Shulman, 1987) in their reflection writing. Teacher educators (Ma et al., 2008) in the College of Education where the study was carried out have developed a field experience model. The model includes the following four phases: teacher candidate preparation, laboratory experience, and articulation and reflection (Figure 27).



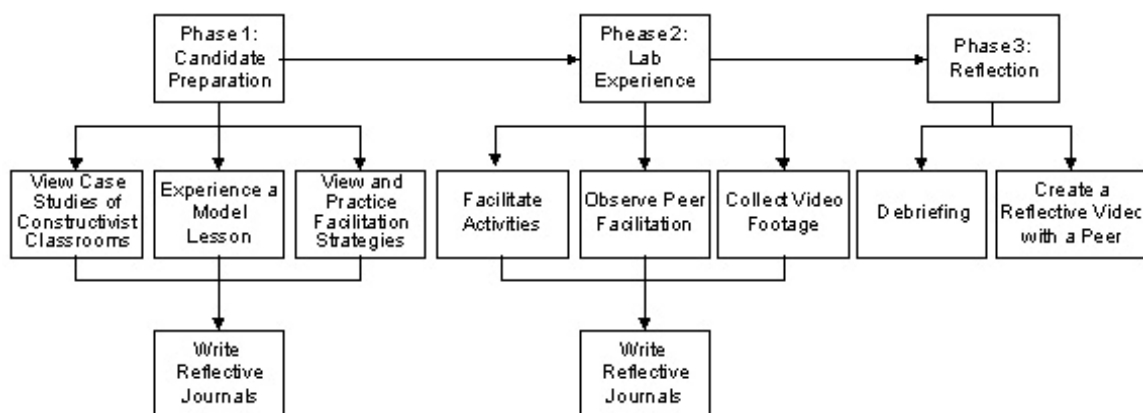


Figure 27. Field experience in a pedagogical laboratory: A process

The first phase is teacher candidate preparation that aims to provide teacher candidates with content, pedagogical, and technological knowledge needed for their supervised practical teaching. During the second phase of the pedagogical lab experience, preservice teachers facilitate technology-enhanced, student-centered learning, and keep a reflective journal on their practical teaching. The third phase of articulation and reflection requires preservice teachers to reflect on their facilitation experience and to practice their technological skills in creating digital videos. Though articulation and reflection is touted in the model, the results of preservice teachers' reflective practices were not promising. As Ma et al (2008) noted, many of the reflective journals and reflective iMovies produced by preservice teachers usually described what happened and expressed their personal beliefs yet provided limited elaboration or informed insights upon their supervised practical teaching experience.

Preservice teachers in the control group in the current study performed similarly mostly reaching lower levels of reflection such as routine reflection and technical reflection. Results from the researcher's preliminary study revealed that preservice teachers ran into a few issues when writing their reflective journals (Lai & Calandra,

2007), and they attributed their poor reflection writing to the following factors, including (1) limited understanding of the concept of reflection, (2) lack of reflection writing experience prior to college, (3) disconnection between theories and concrete classroom teaching experiences, and (4) lack of sufficient guidance from teacher educators. Thus, preservice teachers have failed to generate schemata through critical reflection writing experiences, and the lack of schemata have made it extremely difficult for them to achieve automaticity of critical reflection writing.

With this in mind, while designing the question prompts and the writing process display scaffolds using the critical incident technique (Flannagan, 1954), the researcher deliberately took into consideration the theoretical underpinnings of reflection and embedded them within the preservice teacher participants' actual reflection writing process. It was hoped that the question prompts scaffold and the writing process display scaffold could help them connect their theoretically informed and supervised practical teaching experience with their personally meaningful knowledge base. Both quantitative and qualitative results of this study have demonstrated that the preservice teachers in this study had the capability of reaching higher levels of reflection including dialogic and transformative/critical reflection in their writing, and the strategically embedded computer-based scaffolds in their reflection writing process played a critical role. Because of the computer-based scaffolds' immediate and substantial success in enhancing the participants' reflection writing, some preservice teachers suggested introducing them, after appropriate customization, to other teacher education courses.

Another interesting finding emerged from qualitative data analysis was that preservice teachers associated the questions and suggested writing processes in the

scaffolds as the specific requirements that they needed to follow. “I will only do what you require” mentality is quite epidemic among students. Without the appropriately designed questions to guide their reflection writing, preservice teachers with low prior knowledge of reflection felt both disoriented and unmotivated to write in-depth reflection. Preservice teachers’ subconscious acknowledgement of the scaffolds as reflection writing requirements served well the purpose of the study. The quantitative results indicated that preservice teachers in the treatment groups wrote statistically significant longer reflection. And more importantly, the longer preservice teachers wrote the reflective journal, the higher level of reflection they achieved in their writing.

#### Limitations and Delimitations

First, the treatment time lasted only 1 – 2 hours. Though appropriate for the current study, the findings were based on a one-time exposure to the computer-based scaffolds. Future research will be recommended to investigate the effects of using these scaffolds to support preservice teachers’ development over a longer duration.

Second, the current study investigated the effects of scaffolds on preservice teachers’ reflection writing in the context of authentic classroom practice teaching. More reflection contexts need to be examined including classroom observations, case study, and reading assignment.

Third, the researcher had no knowledge on whether preservice teachers in the study had previously received any reflection writing scaffold(s) from their professors. The researcher also had no knowledge on what kind of reflection writing scaffold(s) they had received prior to their treatment in the study.

Fourth, as an external researcher, the researcher had no control of preservice teachers' motivation in participating in the experiment.

Fifth, PASS-PORT was adopted in 21 teacher education programs. The sample was drawn from one undergraduate technology integration course in one teacher education program. The external validity of the study may be limited.

Sixth, due to time constraints, six preservice teachers from one participating section of IRED320 did not complete their reflection writing during the class time; instead, they finished the writing during their spare time. Although the rating scale of these six reflective journals (three in control group, one in process display treatment group, and two in question prompts treatment group) did not deviate from that of the rest of the 59 journals, the internal validity of the study may be limited.

Seventh, in the current study, the participants did not write their reflections in the authentic PASS-PORT. Instead, they wrote the reflections in a mockup system simulating PASS-PORT setting.

Eighth, one person involved in the study played the role of both the peer debriefer and the rater for coding the reflection writings.

Ninth, the current study requested the participants to use a critical incident to anchor their reflection writing. As qualitative data revealed, some participants associated the critical incident with something negative and some participants claimed that they did not encounter any critical incident in their practice teaching. Because of the misinterpretation of critical incident, the internal validity of the study may be limited.

### Recommendations for Future Research

Based on the results of the current study, this section will focus on recommendations for future research in the area of designing computer based scaffolds to enhance reflective practice in teacher education. First, this study only examined preservice teachers' highest level of reflection exhibited in one reflection writing without prior training on reflection. Given the same type of scaffolds, future studies may also examine the effects of time (a series of reflection writing) and prior training on reflection on preservice teachers' development of higher levels of reflection.

Second, diagnosis, calibrated support, fading, and individualization (Azevedo & Hadwin, 2005) are the attributes usually associated with scaffolding. Future research will be desired to research how to gradually withdraw computer-based scaffolding as preservice teachers gain the knowledge, skills, and confidence to be engaged in multifaceted reflective thinking.

Third, this study only examined the effects of the question prompts scaffold and the writing process display scaffold in enhancing preservice teachers' levels of reflection. As reviewed in Chapter 2, the literature is replete with the scaffolding strategies intended for enhancing preservice teachers' reflective practice, including templates, modeling, feedback, peer collaboration, and reflection-related resources. More research needs to be done on the effects of these scaffolds within the context of the current study. Particularly, more should be conducted to examine what combination of the scaffolds can better enhance preservice teachers' reflective practice.

Fourth, supervised practical experiences have been advocated as one type of condition for preservice teachers to develop their critical reflection capability (Yost,

Sentner, & Forlenza-Bailey, 2000). Prior to this study, to fulfill the field experience requirements, the preservice teachers in the College primarily went to public and private schools to observe how classroom teachers use technology. That may still be the situation for some teacher education programs. How can we develop preservice teachers' critical reflection capability in this given situation? How can we leverage the affordances of the critical incident technique in the given situation? What support or scaffolds can teacher educators or the systems provide to enhance their reflective practice on classroom observations?

Fifth, as one participant indicated in the qualitative phase of the study, preservice teachers' "what do you want mentality" is epidemic in their reflective practice. How can we change preservice teachers from passive reflective practitioners to proactive ones remains a challenge to researchers and teacher educators. Future research on preservice teachers' attitude change in reflection writing after their being constantly exposed to the computer-based scaffolds is highly desired.

Sixth, more research needs to be done to examine and explore the effects of teacher educators' preparation in reflection-related literature on developing preservice teachers' critical reflection capability. Preservice teachers' critical reflection capability is, to a great extent, contingent on teacher educators' knowledge, skills and experience on reflective practice and reflection-related literature. Some researchers (Pedro, 2005; Yost et al., 2000) have pointed out that teacher educators' limited exposure to teacher education literature including reflection presents a further obstacle to preservice teachers' development of critical reflection. In this study, this obstacle was evidenced by teacher

educators' unspecified reflection writing requirements which were not conducive to preservice teachers' critically reflective thinking.

Seventh, design-based research, a promising educational research paradigm, seems to be a methodology suitable to guide the research and design of technology-enhanced learning environments (Wang & Hannafin, 2005). The preliminary qualitative study and the current study together can be labeled as design-based research, because they tried to fulfill the three purposes that design-based research tends to serve: a) supporting the development of prototypical products, b) generating methodological directions for the design and evaluations of such products, and c) developing context-rich theoretical knowledge (Reeves, Herrington, & Oliver, 2004; The Design-Based Research Collective, 2003; van den Akker, 1999). However, design-based research is still an emerging research paradigm. Other than the overarching four-step guidelines outlined by Reeves (2000a) (see Figure 28), there is a lack of an established process on how to conduct this type of research at the individual study level (as reviewed in Ma & Harmon, in press). On the basis of the guidelines outlined by Reeves (2000a), Ma and Harmon (in press) developed a more detailed research and development process (see Figure 29), which may provide more specific guidance to researchers new to design-based research. That seems to be a good start. More research is highly desired in further developing detailed research processes to guide the research and design of technology-enhanced learning environments.

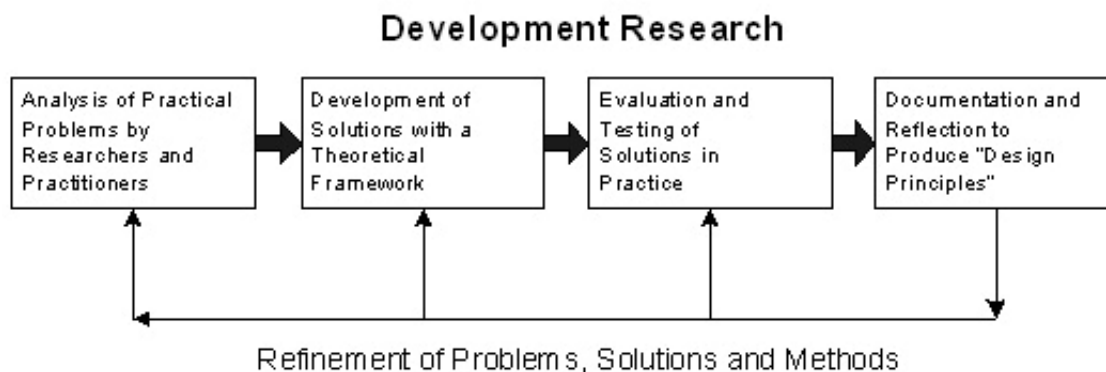


Figure 28. A development research process. Recreated from Reeves (2000a).

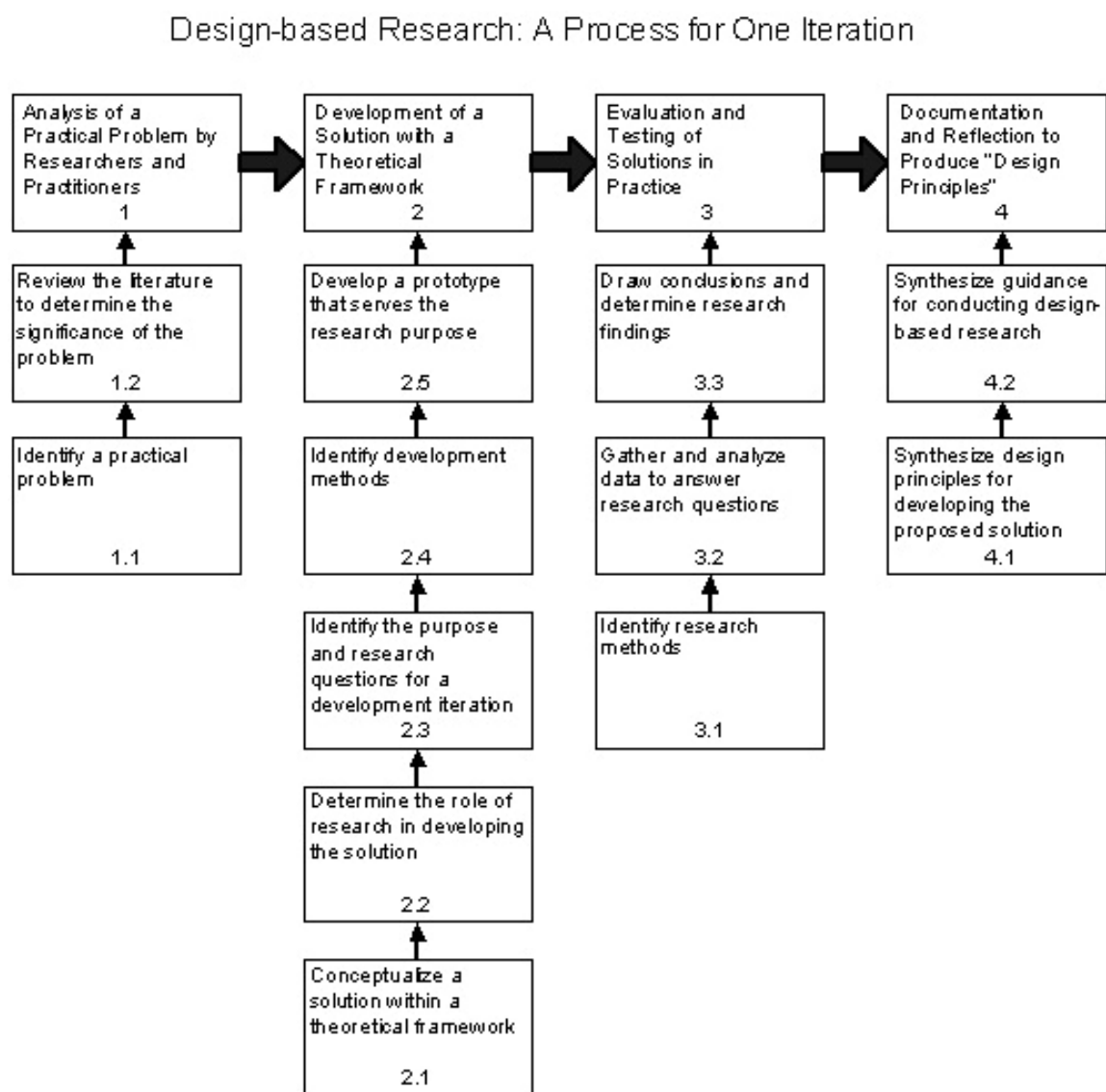


Figure 29. Design-based research: A process for an iteration.



## Conclusion

Critical reflection is touted the distinguishing attribute of reflective practitioners (Larrivee, 2000). Researchers suggest that a particular emphasis be placed on developing preservice teachers' critical reflection skills (Howard, 2003; Sparks-Langer & Colton, 1991; van Manen, 1977; Zeichner & Liston, 1987). In reality, the level of reflection in preservice teachers' reflective practice was primarily descriptive or technical rather than critical (Hatton & Smith; Surbeck, Han, & Moyer, 1991; Ward & McCotter, 2004). The same issue applied to the preservice teachers who used PASS-PORT to store their reflective journal writings on their field experiences (Lai & Calandra, 2007). Researchers suggest that various scaffolding strategies (Hannafin et al., 1999; Lin et al., 1999; Ping & Swe, 2004) can be embedded in technology-enhanced learning environments to enhance preservice teachers' reflective practice. However, the current PASS-PORT lacks any such embedded scaffolding mechanisms to support preservice teachers' journal writing. Question prompt and writing process display scaffolds were proposed and evaluated as a potential solution to this problem. As a result of the current study, considering limitations, the potential effectiveness of both scaffolds in enhancing preservice teachers' level of reflection was affirmed.

Recent years have witnessed an emergence of research and development in Web-based educational systems to help prepare highly qualified teacher candidates (for review on some of these systems, see Calandra, Lai, & Sun, 2004). However, the articulative/reflective attribute of meaningful learning (Jonassen et al., 2003) is not always evident in such systems (Calandra et al., 2004). Although there is considerable research on the potential for embedding scaffolding in these systems, scaffolds intended

to facilitate reflective practice in these systems also seem to be lacking. Accordingly, this study was intended as a building block for sustained, purposeful, design-based research on how to leverage the affordances of computer-based scaffolds to enhance preservice teachers' reflective practice in technology-enhanced educational systems. In producing this dissertation, the researcher hopes to add to the literature on teachers' professional development and the purposeful design of computer based scaffolding from both a theoretical and practical perspective.

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## Appendixes

### APPENDIX A

#### DATA GATHERING PROTOCOL FOR FACULTY

##### **Introduction**

Thank you for taking your time to participate in this study! I would like you to share with me your experience with pre-service teachers' reflection writing in PASS-PORT. There are two research questions that I want to address in this study: 1) what problems do preservice teachers usually have during their reflection writing? And 2) what strategies should be used in PASS-PORT to help preservice teachers with their reflection writing?

During the interview, I will first ask you to tell me about your experience with PASS-PORT and with pre-service teachers' reflection writing. Then, I would like to know the strategies you have used to help with their reflection writing. Finally, I would show you some strategies other people have used and ask for your feedback.

The study will take about one hour of your time.

##### **Initial Interview**

- Tell me about your experience in using PASS-PORT
  - How long have you used?
  - For what purposes?
  - Follow up with reflection writing
- Tell me about your experience in requiring your students to write reflection
- What problems have your students experienced in writing reflections?
  - Problems student perceived
  - Problems you perceived
- If they mention the problem, then ask "how have you addressed the problems?"
- What strategies have you used to help students with their reflection writing?
  - Strategies that worked
  - Strategies that did not work
- What other strategies do you think can help students with their reflection writing?

##### **Contextual Interview**

During my literature review, I found that researchers and practitioners used a variety of strategies to scaffold reflection writing. I would like to show them these strategies and get your feedback on how they would be embedded in PASS-PORT.

Show the examples and ask the following questions after explaining each example.

- Things like, things dislike
- What is missing?

## DATA GATHERING PROTOCOL FOR STUDENT

### **Introduction**

Thank you for taking your time to participate in this study!

I would like you to share with me your experience with your reflection writing in PASS-PORT. There are two research questions that I want to address in this study: 1) what problems do preservice teachers usually have during their reflection writing? And 2) what strategies should be used in PASS-PORT to help preservice teachers with their reflection writing?

During the interview, I will first ask you to tell me about your experience with PASS-PORT and with your reflection writing. Then, I would like to know the strategies your professors have used to help with your reflection writing. Finally, I would show you some strategies other people have used and ask for your feedback.

The study will take about one hour of your time.

### **Initial Interview**

- Tell me about your experience in using PASS-PORT
  - How long have you used?
  - For what purposes?
  - Follow up with reflection writing
- Tell me about your experience of reflection writing
- What strategies have your professors used to help your with your reflection writing?
  - Strategies that worked
  - Strategies that did not work
- What problems have you experienced in writing reflections?
  - What strategies have you used to help your reflection writing?
  - What other strategies do you think that can help you with your reflection writing?

### **Contextual Interview**

During my literature review, I found that researchers and practitioners used a variety of strategies to scaffold reflection writing. I would like to show them these strategies and get your feedback on how they would be embedded in PASS-PORT.

Show the examples and ask the following questions after explaining each example.

- Things like, things dislike
- What is missing?

### Strategy 1: Question prompts.

Ask students to think about a list of questions as they write their reflection

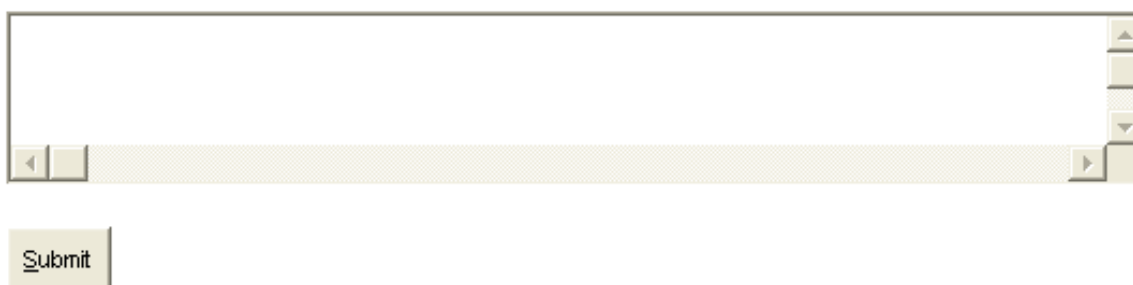
#### Example:

What experience do you have in the past that is similar to or different from this experience?

What do you like or dislike about this experience?

What learning and instructional theories may help make sense of the experience?

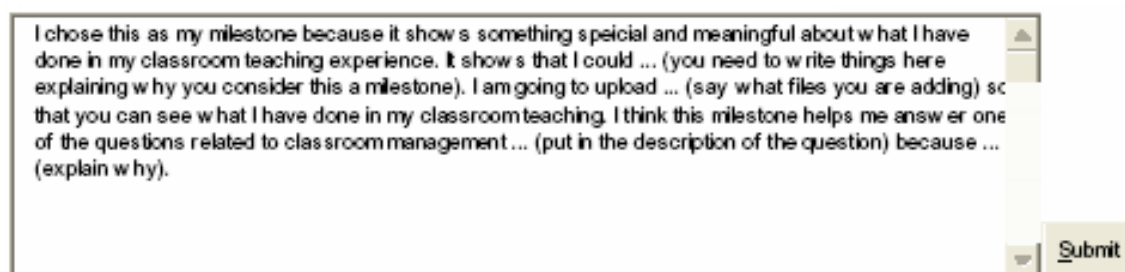
If you were the teacher, what would you do?



### Strategy 2: Reflection Writing Template

Provide a template for students to use while writing reflection

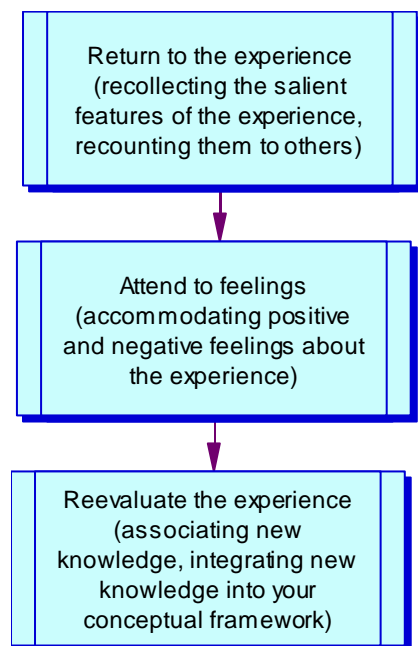
#### Example:



**Strategy 3: Process Display**

This strategy provides a visual aid illustrating the reflection process

Example:

**Reflection Writing Process**

A large, empty rectangular text input area with a light beige background and a thin grey border. It includes standard scrollbars on the right and bottom edges.

Submit

**Strategy 4: Modeling**

This strategy focuses on providing models or examples to guide students' reflection writing.

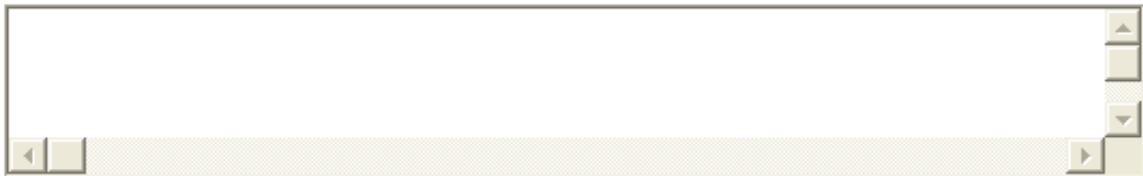
**Example:**

Please click the following links to read the sample reflections before writing your own:

<http://msit.gsu.edu/PDF/reflection/sample1.pdf>

<http://www.pt3.org/samples/reflectionwriting2.html>

<http://cilat.louisiana.edu/writingsample.html>



Submit

### Strategy 5: Resources

Resources may include information helpful for reflection writing.

#### Example:

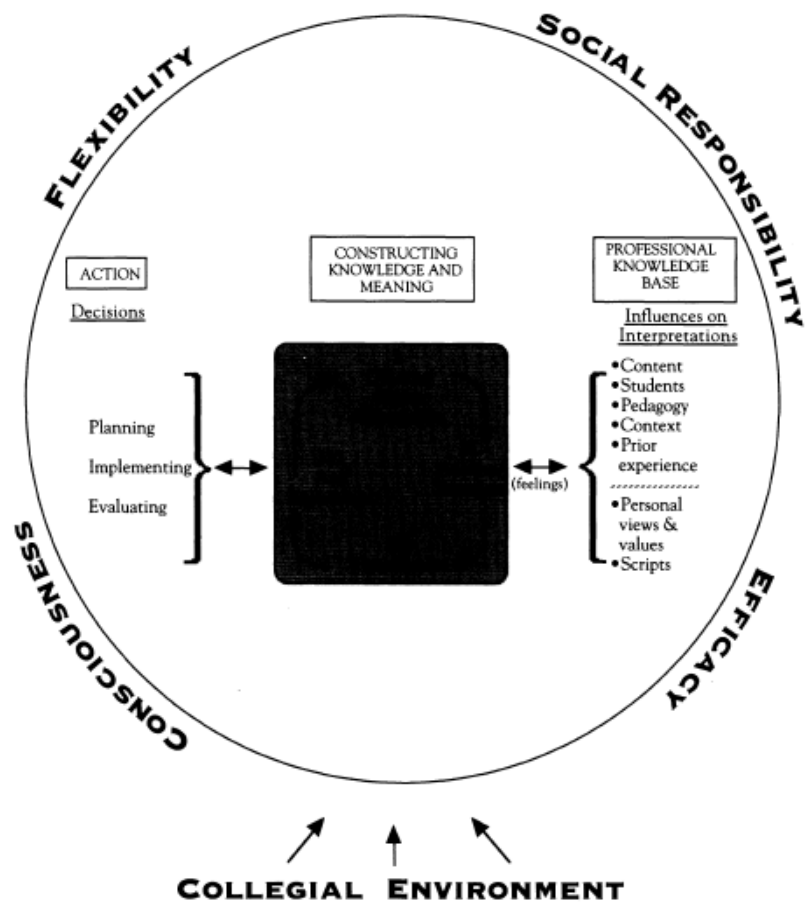
A reflection writing conceptual framework

Colton and Sparks-Langer (1993) develop a conceptual framework to guide the development of teacher reflection and decision making (see Figure 1). The framework is composed of three components: professional knowledge base, action, and constructing knowledge/meaning.

- *Professional Knowledge Base* component lists seven categories of knowledge in a reflective teacher: content, students, pedagogy, context, prior experiences, personal views and values, and scripts. The first six categories are self-explanatory. Scripts here include two types:
  - a. Ones that allow a teacher to behave automatically while focusing on more critical issues; and
  - b. Ones that guide the thinking process.
- *Action* component is characterized by three categories of decisions, all of which require mental processing:
  - a. Planning
  - b. Implementation, and
  - c. Evaluation
- *Constructing Knowledge/Meaning* component illustrates the conscious process of teacher reflection and decision making. Four major steps are involved in the conscious process.
  - a. The teachers personally involve in a specific experience and collect information about the experience from diverse areas;
  - b. The teachers analyze the information to develop mental representation that help them interpret the situation at hand;
  - c. Reflective teachers develop possible hypotheses after they have clearly defined the situation; And
  - d. The teachers implement an action plan after consideration of the consequences of each action.



**Figure 1**  
**Framework for Teacher Reflection (The Reflective Teacher)**



Amy Colton & Georgea Sparks-Langer 5/92

## APPENDIX B

### PERMISSION REQUEST FOR THE USE OF ARTICLE CONTENTS

From: Guolin Lai            Friday - March 2, 2007 12:46 PM  
To:     john.ward@millersville.edu, suzanne.mccotter@millersville.edu  
CC:     bcalandra@gsu.edu  
Subject: request for permission of the use of your article

Dear Dr. Ward and McCotter,

This is Guolin Lai, a doctoral student in the instructional technology program at Georgia State University. My advisor is Dr. Brendan Calandra (bcalandra@gsu.edu). Currently I am working on my dissertation prospectus. The purpose of my study is to examine whether or not the integrated computer-based scaffolding tools in an educational assessment system can significantly affect preservice teachers' reflectivity development as evidenced in their online reflective journal writing.

I came across your article "Reflection as a visible outcome for preservice teachers" published in the journal of Teaching and Teacher Education. I plan to adopt the reflection rubric you developed to rate the reflectivity level of my future participants' journal writing. And then conduct appropriate statistical analysis using the rating. Moreover, I plan to quote some of the exemplar reflection examples in your paper to serve as the criteria for a specific reflection level.

I am requesting your permission here for the fair use of the copyrighted materials in your journal article.

If you have any further questions, please feel free to contact me.

Sincerely

Guolin Lai  
Doctoral student in Instructional Technology program  
Georgia State University

## PERMISSION REQUEST GRANTED

From: "John Ward" <John.Ward@millersville.edu> Tuesday - March 6, 2007 4:19 PM  
To: <mstglx@langate.gsu.edu>  
CC: "Suzanne McCotter" <SMcCotter@millersville.edu>  
Subject: permission

Hello Goulin,

Thank you for the phone call and your interest in our article. Yes, you have my permission to quote freely from the article that Dr. McCotter and I wrote: "Reflection as a Visible Outcome." You are free to use our examples and our rubric as you need for your dissertation, teaching, and scholarship.

Best regards,  
John Ward

## APPENDIX C

### EXPERIMENT PROTOCOL

- The student investigator goes in the classes to briefly introduce the proposed study. All students willing to participate in the study will be asked to sign on the consent form prepared by the student investigator.
- Online reflective journal writing will take place after preservice teachers have finished their field experience of practice classroom teaching.
- Sixty students will be randomly drawn from those willing to participate in the study.
- Writing will take place in participants' class setting where each drawn student has an access to a laptop with wireless internet connection.
- All participants will be provided a URL where they will log in using their student ID. The system will then randomly and evenly assign the participants to three different web pages associated with different treatment conditions.
- In the web setting, the participants will be required to reflect on a story that happened during their practice teaching.
- The participants' one-time in-class reflection writing will be automatically captured in the database upon submission.

### INTERVIEW PROTOCOL

#### **Introduction**

Thank you for taking your time to participate in this study! I would like you to share with me your experience of using the scaffolding tools for your journal writing, as well as your perceptions of the scaffolding tools.

The study will take less than 30 minutes of your time.

#### **Interview Questions**

- What do you think about the scaffolding tool you used in your writing?
  - Did the tool improve your reflective writing
    - If yes, how and why
    - If no, how and why
  - Things you liked about the tool
  - Things you disliked about the tool
  - What is missing in the tool?
  - Suggestions

## APPENDIX D

### SAMPEL EMAIL REQUEST

Dear Dr. XXXX,

I am a doctoral student in the Instructional Technology program at Georgia State University. I am conducting an explanatory mixed methods study that requires the participation of student teachers.

The purposes of the study are twofold: (1) to examine whether or not integrated computer-based scaffolding tools in PASS-PORT, question prompts and visual writing process display, can significantly increase preservice teachers' levels of reflection as evidenced in their online reflective journal writing, and (2) to explore how and why the computer-based scaffolding tools can enhance preservice teachers' high levels of reflection as evidenced in their online reflective journal writings. I hope that you are willing for me to come in your class to briefly talk about my study and ask whether your students of IRED 320 for Fall 2007 would like to participate. Attached you can find consent forms which provide a brief description of the study.

By the way, the quantitative experiment will take maximally 2.5 hours of your students' time, and the qualitative interview will take less than 30 minutes of your students' time.

I look forward to your allowing me to come in your class(es). I would really appreciate it if you can.

Sincerely,

Guolin Lai

## APPENDIX E

### CONSENT FORM

#### **Informed Consent Form (quantitative)**

**Title:** Examining the effects of selected computer-based scaffolds on preservice teachers' levels of reflection as evidenced in their online journal writing

**Principal Investigator:** Brendan Calandra, Ph. D.

**Student Investigator:** Guolin Lai

#### **Introduction**

You are invited to participate in a research study because the course, IRED 320, you are taking requires you to write reflective journals about your practice teaching experiences. The purposes of the study are twofold: (1) to examine whether the selected computer-based scaffolding tools, question prompts and visual writing process display, can significantly increase preservice teachers' levels of reflection as evidenced in their online reflective journal writing, and (2) to explore how and why the computer-based scaffolding tools can enhance preservice teachers' higher levels of reflection as evidenced in their online reflective journal writings. A total of 60 participants from College of Education at University of Louisiana at Lafayette will be recruited for this study. Participation will require no more than a whole class time (around 2.5 hours).

#### **Procedure**

First, the student investigator will go to the classroom to introduce the proposed study. Sixty participants will be randomly selected from those willing to participate in the study and will be again randomly assigned to different treatment conditions. Moreover, the student investigator will inform you that 16 participants will be purposefully selected from those who will have participated in the quantitative experiment to participate in the one-time interview. Second, upon the collection of informed consent forms, the student investigator will randomly select 60 participants to participate in the quantitative experiment.

Reflective journal writing about your practice teaching will take place in your classroom where you will have an access to a laptop with wireless internet connection. After brief introduction from the student investigator about the simulated system, you will be provided a URL where you will log in using your student ID. The system will randomly redirect you to one of three treatment conditions. In the web setting, you will be required

to reflect on a story that happened during your practice teaching. Your one-time in-class reflection writing will be automatically captured in the database upon submission, including your student ID, treatment condition, and the reflection writing itself.

### **Risks**

There is no risk in participating in this study.

### **Benefits**

- Benefits to participants: the findings from the study will inform the development team as to what scaffolding tools need to be incorporated into PASS-PORT to enhance preservice teachers' online reflective journal writing.
- Benefits to society: this study will enrich the literature and be beneficial to researchers and practitioners in the field of both instructional technology and teacher education who are interested in using computer technology to help prepare highly qualified reflective teacher candidates.

### **Voluntary Participation and Withdrawal**

Participation in the study is voluntary. You can choose not to participate at any time. If you choose to withdraw from the study, we will not use any data we have collected from you to that point. Whatever you decide, you will not lose any benefits to which you are otherwise entitled.

### **Confidentiality of Data**

We will keep private the content saved in the database to the extent allowed by the law. The findings will be statistically calculated and reported in a statistical format. When the quotes of writing are needed to rationalize the statistical findings for presentation or journal publication, your student ID or name will not be revealed. Instead, Student A or B and so on will be used to refer to the owner of the quotes.

### **Contact Persons**

If you have questions about this study, please contact Dr. Brendan Calandra at 404-651-0205, or by email [mstbdc@langate.gsu.edu](mailto:mstbdc@langate.gsu.edu); or contact Mr. Guolin Lai at 337-255-8699, or by email [mstglx@langate.gsu.edu](mailto:mstglx@langate.gsu.edu). If you have questions or concerns about your rights as a participant in this study, you may contact Susan Vogtner from Georgia State University at 404-651-4689, or by email [svogtner1@gsu.edu](mailto:svogtner1@gsu.edu); or Dr. Evelyn Wills from University of Louisiana at Lafayette at 337-482-5607, or by email [ewills@louisiana.edu](mailto:ewills@louisiana.edu).

If you are willing to volunteer for this research, please sign below.

---

Subject

---

Date

---

Principal Investigator

---

Date

## CONSENT FORM

### Informed Consent Form (Interview)

**Title:** Examining the effects of selected computer-based scaffolds on preservice teachers' levels of reflection as evidenced in their online journal writing

**Principal Investigator:** Brendan Calandra, Ph. D.

**Student Investigator:** Guolin Lai

#### Introduction

You are invited to participate in a research study because the course, IRED 320, you are taking requires to write reflective journals about your practice teaching experiences. The purposes of the study are twofold: (1) to examine whether the selected computer-based scaffolding tools, question prompts and visual writing process display, can significantly increase preservice teachers' levels of reflection as evidenced in their online reflective journal writing, and (2) to explore how and why the computer-based scaffolding tools can enhance preservice teachers' higher levels of reflection as evidenced in their online reflective journal writings. A total of 8 participants will be purposefully selected for this study. Your one-time interview participation will last less than 30 minutes.

#### Procedure

Before the interview, the student investigator will individually contact the purposefully selected participants by email. Before the interview, informed consent forms will be collected and some demographic information about participants will be gathered. During the interview, you will be asked of a list of open-ended interview questions to solicit your experience of the experiment and your perceptions about the computer-based scaffolding tool. An audio cassette recorder will record your responses. The research procedure will be performed in a quiet office of the Center for Innovative Learning and Assessment Technologies at University of Louisiana at Lafayette.

#### Risks

There is no risk in participating in this study.

#### Benefits

- Benefits to participants: the findings from the study will inform the development team as to what scaffolding tools need to be incorporated into PASS-PORT to enhance preservice teachers' online reflective journal writing.
- Benefits to society: this study will enrich the literature and be beneficial to researchers and practitioners in the field of both instructional technology and teacher education who are interested in using computer technology to help prepare highly qualified reflective teacher candidates.



### **Voluntary Participation and Withdrawal**

Participation in the study is voluntary. You can choose not to participate at any time. You may choose not to answer certain interview questions. If you choose to withdraw from the study at any time, we will not use any data we have collected from you to that point. Whatever you decide, you will not lose any benefits to which you are otherwise entitled.

### **Confidentiality of Data**

We will keep participants' records private to the extent allowed by law. We will use a record number rather than participant name to label the audio-taped cassettes. The audio-taped cassettes will be locked in the file cabinet of the student researcher's room. Transcripts of the interviews will be digitally saved in the student researcher's access-protected laptop. The cassettes will be destroyed one year after the interviews are conducted. Participant name, voice and other facts that might point to the participant will not appear when we present this study or publish its results. The findings will be summarized and reported in a group form. Right after the interview, the researcher will ask the participant to find a fake name to represent him/her, and that fake name will be used when direct quotes are needed for publication.

### **Contact Persons**

If you have questions about this study, please contact Dr. Brendan Calandra at 404-651-0205, or by email [mstbdc@langate.gsu.edu](mailto:mstbdc@langate.gsu.edu); or contact Mr. Guolin Lai at 337-255-8699, or by email [mstglx@langate.gsu.edu](mailto:mstglx@langate.gsu.edu). If you have questions or concerns about your rights as a participant in this study, you may contact Susan Vogtner from Georgia State University at 404-651-4689, or by email [svogtner1@gsu.edu](mailto:svogtner1@gsu.edu); or contact Dr. Evelyn Wills from University of Louisiana at Lafayette at 337-482-5607, or by email [ewills@louisiana.edu](mailto:ewills@louisiana.edu).

We will give you a copy of this consent form to keep.

If you are willing to volunteer for this research, please sign below.

_____ Subject	_____ Date
_____ Principal Investigator	_____ Date

## APPENDIX F

### EXEMPLAR WRITING IN ROUTINE REFLECTION LEVEL

I had two third grade girl students. As we were making our movie, I was surprised to know just how much these girls already knew about computers. They did everything on the computer themselves, from typing, using the mouse, saving, and copy and pasting, and using the digital camera. They hardly let my partner and I touch the computer at all. In fact they were fighting over the computer much of the time, because they both felt like they knew what they were doing. I told them to take turns. The students went to the same school, and they told us that they had a lot of experience with computers in their school. They also played on them at home. This being said, I believe it is to a child's benefit that they learn how to work computers. These children amazed my partner and I at how much they knew at such a young age.

I can remember thinking how well the students knew how to navigate the internet. They knew how to search in Google, and what phrases or words they should be typing there. I allowed the students to navigate Google to find different pictures to include in their movie. I made sure the words and phrases they typed in would come up with appropriate pictures for their movie. I think that it was good for my partner and I to allow the children to take turns typing the information.

If I was caught in a similar situation in the future, where I had students making a movie, I would allow the children to do as much on the computers as possible. I learned that students these days really know more about computers than we did when we were their age. I believe that teachers are doing a great job at teaching their students about the importance of technology in the classroom.

## EXEMPLAR WRITING IN ROUTINE TECHNICAL LEVEL

The critical incident for me was when my partner and I were helping the two students to figure out how many rotations equaled 50 centimeters. First, my partner and I asked the two students what a rotation was; they provided us with the correct answer. Using the tape measure, the two students measured 50 centimeters on the challenge area to actually see what 50 centimeters looked like. Next, my partner and I asked the two students their guess on how many rotations they thought equaled 50 centimeters. They answered with 100 rotations, so my partner and I had them try it out. When the two students saw that 100 was too high, they changed their answer to 50 rotations. Again, this did not work, so they tried 10 rotations and 5 rotations. Until finally, when they tried 3 rotations, it worked. When it worked, the two students got very excited and jumped up and down with happiness because they were the ones to problem solve and try different things until they arrived at the right answer. I felt very successful as the teacher because I was able to help the students figure out the correct answer through questions that the children answered on their own.

I was thinking that these two students were very smart and would eventually come to the correct answer. I was also thinking that I needed to let the two students try different numbers on their own because they would get satisfaction out of coming up with the correct answer. I also felt confident in the two students' abilities to use trial and error.

We used trial and error for our problem solving. The two students' ages influenced our decision to use trial and error in getting the two students to arrive at the correct answer.

I was thinking that I helped these students figure out something on their own. I was thinking that I was patient and used the right questions that helped to guide the two students through the problem solving activity. If I am in a similar situation in the future, I will remember to remain patient and use questions that help the students to figure out the answers on their own because it will provide for a more authentic learning experience.

Through this incident, I have learned that first graders are capable of doing more things than I previously thought they were capable of doing. The two students that I had were very intelligent and made solving problems look like a breeze. I learned how to ask questions in a different way if the children are not understanding what you are asking the first time.

### EXEMPLAR WRITING IN ROUTINE DIALOGIC LEVEL

XXX [student name was omitted here] is a 7th grade gifted student. He was happy and relaxed to be at the robotics workshop. He had a previous experience with robotics. My partner gave Nikka the backstory to help him understand his first challenge. However, before the backstory, we both gave Nikka a chance to look over the physical makeup of the robot and ask questions while we showed him the basic anatomy of the robot. He understood everything about the robot and the backstory and he jumped in to trying to complete the challenge.

The incident I am about to describe was actually a hindsight moment, where I realized Nikka's learning style, his pace at solving problems, and his weaknesses as a learner. In hindsight, I saw that Nikka was an exceptionally fast learner and that he listens very well to directions given him. I also realized that my partner and I could have given Nikka a richer experience if we would have given a little more guidance in the following ways: 1) help him set the pace - he moved so fast through programming the robot that he made careless errors. This caused him to take longer to finish his challenges, due to many errors. 2) encouraged self-checking and review of steps. We could have asked him to verbally recount steps with us to verify accuracy of what he was actually doing with the robot. 3) encouraged him to take his time - let him know that this is not a competition but a relaxing enriching activity.

Belief change - This activity did not change my beliefs about technology integration into the curriculum, rather it strengthened them. I am a proponent of using technology to the utmost efficiency in the classroom and I am open to upgrading and changing that technology as often as necessary to continue to offer students the very best education possible. I feel that students can't integrate enough technology, due to the kind of world they will be asked to perform efficiently in. They will need every bit of what I can give them experience in.

I believe that Nikka had a chance to fully experience this activity to the maximum because he comes from a computer literate background and he is intellectually advanced. He is encouraged to be a problem solver at the gifted school he attends. Nikka is a target student for the robotics program.

## EXEMPLAR WRITING IN ROUTINE TRANSFORMATIVE LEVEL

I cannot recall a specific "aha" or "oops" incident, but I did notice that I had several "oops" moments that occurred throughout the camp and that all resulted from the same problem. My biggest problem, I think, on Saturday was that I interjected too many of my ideas into the discussions rather than letting the students have complete control over their script. I would often suggest things that I later noticed were not conducive to allowing the students' creativity to guide the process. I think that a large problem I have is that, because I am very creative and project-inclined, I tend to want to exercise control over projects that I am not part of. I conceive a vision of where I want something to go and often try to impose it subtly on others, which is NOT good teaching!

I usually came up with what I thought was a good idea and said it without thinking that maybe it would not fit the goals or visions of the participants. I would get too excited over the project and forget that we were making a movie for the students, not for me! I would often realize that I had made a suggestion that might have infringed on the students after I said it (which is rather too late to do much about it).

There was very little decision-making happening when I blurted out suggestions to the kids, but when I began to notice it happening often, I tried to curtail my enthusiasm (or obsessive control) and keep my ideas to myself, for the most part.

I often thought that I had made a mistake in contributing too much to the students' project and, essentially, trying to take control of a situation that did not belong to me. I should evaluate my ideas and whether or not they will help the student learn or simply satisfy my own idea of what an assignment (especially an art one) should become. I will pay more attention to how often I offer unnecessary suggestions in the future, as I do not want to be a teacher who expects students to think exactly like her.

These incidents basically caused me to evaluate whether the students' learning or how much I like the finished product of a lesson is important. Other, smaller, incidents offered food for thought in my assumptions of technology integration into the classroom, though. For instance, one of the students was clearly not impoverished and had a computer at home, but was not very comfortable with it because his interests ran more towards sports and hunting as opposed to inside computer work. I believe that mandatory computer use should be implemented into classrooms in order to assure that the hobbies and interests of a child do not endanger his or her ability to function in a largely technology-based society.