THE USE OF JOURNALING AS A MEANS OF REFLECTION FOR GREATER TECHNOLOGY IMPLEMENTATION AMONG TEACHERS

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Dissertation Prepared for the Degree of

DOCTOR OF PHILOSOPHY

UNIVERSITY OF NORTH TEXAS

December 2005

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Worrell, Paige Lea. The use of journaling as a means of reflection for greater technology implementation among teachers. Doctor of Philosophy (Educational Computing), December 2005, 163 pp., 5 tables, 8 figures, references, 86 titles.

The purpose of this multiple case-study was to determine whether the use of reflective journals during graduate coursework impacts the level of technology implementation in instructional settings for experienced teachers.

This study examined the relationships between: (1) levels of reflection demonstrated in journal responses, (2) the level of technology implementation, and (3) teachers' attitudes about technology implementation. The coding scheme used to determine levels of reflection in the journals was based on the framework of Leung and Kember. The LoTi questionnaire, developed in 1995 by Chris Moersch, was used to determine the levels of perceived technology implementation.

The goal of this study was to provide information that may be utilized to plan more effective technology staff development. By providing insights on how to evaluate written work consistently for reflective thinking and on teachers' perceptions of technology implementation, university programs and school districts can develop better strategies for technology professional development.

The findings suggest that teachers who demonstrated the characteristics of high levels of reflection also demonstrated characteristics of higher levels of technology implementation. Four of the five cases demonstrated a relationship among their scores on the Level of Reflection, Level of Technology Implementation (Loti), and Current Instructional Practice (CIP) measures.

This study adds to the research regarding evaluation of reflection, the use of journals for reflection, and the impact of this strategy on technology implementation. The results of this qualitative study illustrate the process of using the theoretical framework of Lueng and Kember to evaluate the levels of reflection in written journal responses during professional development programs. The findings suggest that the use of reflective journals, in the context of the action research process during technology training, has a positive impact on technology implementation for practicing teachers.

ACKNOWLEDGEMENTS

There are so many people who have encouraged and supported me through my doctoral work. Special thanks go out to my committee members, Cathleen Norris, Jim Poirot, and especially Ron Wilhelm, whose expertise and guidance proved invaluable during this process. I would like to acknowledge Leslie Moller, who offered guidance and encouragement during the early stages of this study. Thanks also to the many friends and fellow doctoral students who provided needed encouragement.

Special thanks also go out to Martha Peet whose help with the administration of the online composite survey made it such a success. Chris Moersch (developer of the LoTi) and Dennee Saunders at the National Business Education Alliance were very helpful with the administration of the LoTi questionnaire. The work of David Kember provided the foundation for the evaluation process used in the analysis of the participants' reflective journals.

I would also like to thank my colleagues at Texas A&M University – Texarkana for their encouragement, especially Bosede Aworuwa, Juaquita Hargus and Elaine Beason for their help evaluating the reflective journals.

Finally I would like to thank my parents, Rex and Barbara, and my son, Randy. Their unconditional love, encouragement, and support helped me maintain my sanity while working to complete my dissertation and achieve this long-term goal.

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CHAPTER 1

INTRODUCTION

The No Child Left Behind (NCLB) legislation requires that at least 25% of all Title II, Part D funds be used to provide ongoing, sustained, high quality professional development for educators. The need for high quality professional development has been cited in much of the literature about technology implementation over the past decade (i.e., Lemke and Coughlin, 1998; Rodriguez, 2000; NEA, 1998). In a report to the Texas Legislature (2004), the Texas Education Agency (TEA) outlined the progress toward the goals of the Long Range Plan for Technology, 1996-2010. Texas teachers are moving forward, but only 93 out of more than 7,000 teachers reporting through the Texas School Technology and Readiness (STaR) chart have reached the Target Technology level defined by the Educational Technology Advisory Committee (TEA, 2004b).

Scholars also suggest that before the benefits of technology implementation in teaching and learning will be evident in student achievement, consistent and on-going technology professional development must be supported and implemented at every school (Mehlinger, 1997; Renyi, 1996; Rodriguez, 2000; Russell et al., 2003). Grant (1996), states that "the goal of professional development for technology should help teachers become more productive professionals, and to empower them to make sense of how Mastery of technologies can be useful to them, in their teaching and as a tool for professional growth" (p. 3). Many teacher preparation programs "focus on how to use technology rather than on how to teach with technology and integrate it into

everyday teaching" (Russell et al., 2003), and current professional development practices focus on one-shot technology training (Renyi, 1996). Therefore, teachers are not provided sustained professional development and support when new technologies are being integrated into classroom instruction.

Adding to the literature, public opinion also supports the view that technology implementation can positively impact teaching and learning. According to Solmon and Wiederhorn (2000), "Overall, District Technology Coordinators (DTC's) representing 61.7% of students say teachers in their districts view technology as a powerful tool for helping them improve student learning, rather than just another fad being mandated by those above them" (p. 8). According to NetDay (2004), today's students also believe that technology has a positive value in all aspects of their lives. Many jobs require employees to be computer literate and adaptable to rapidly changing technology and schools should prepare students to meet these challenges. By providing more effective training to meet the needs of teachers and their school districts, teachers can be a part of the process to better prepare their students to meet the challenges of the Information Age.

In 1999, the National Center for Educational Statistics (NCES) reported that 98% of U.S. schools had computers and 95% of schools were connected to the Internet. Of the 95% of schools with Internet access, 34% included classrooms, not only the library and administration offices of the schools. In the early nineties, the International Society for Technology in Education (ISTE) led the way in establishing national technology standards for teachers and students. A federal grant program, Preparing Tomorrow's

Teachers to Use Technology (PT3), helped fund the development of these standards. As of 1998, thirty-eight states maintained technology requirements for either teaching candidates or for teacher preparation programs (Zehr, 1998). The state of Texas adopted the Technology Applications Essential Knowledge and Skills (TEKS) in 2001 (TEA, 2004). The standards address technology skills that students at all grade levels must meet and that all classroom teachers are required to address in their instructional practices. In the state of Texas, teachers are held accountable for the implementation of technology. Standards have been developed by the State Board for Educator Certification for that purpose (TEA, 2004).

The components of technology professional development need to be explicitly defined and measurable. According to Lemke and Coughlin (1998), the Milken Exchange on Education Technology identified important components that must be established to effectively integrate technology into the classroom curricula. Such components consist of: the learners, learning environments, professional competency, system capacity, community connections, technology capacity, and accountability. Although all components are important and access is still a barrier, this study focused on professional development aspects: the learners, learning environment and professional competency. The learners in the context of technology implementation refer to both teachers and their students.

A large part of the in-service teacher population has only begun to use computers within the last decade. Most of these teachers' technology use has been instituted through one-shot professional development opportunities (Renyi, 1996). In

1995, Christopher Moersch developed the Levels of Technology Implementation (LoTi) scale in an effort to accurately measure authentic classroom technology use. The instrument identifies eight levels of technology implementation from Nonuse to Refinement. When examining differences among educator groups, Moersch (2002), noted administrators manifested predominantly an awareness level of technology use while teachers exhibited predominantly an exploration level of technology implementation. Both the administrator and the teachers' use levels fall in the lower end of the scale. The lower level results are to be expected in the absence of ongoing and consistent support for teachers implementing the use of technology in their classrooms (President's Committee of Advisors on Science and Technology, 1997).

To raise these low levels of technology use, teachers need ongoing professional development and leadership support to rise to the challenges that the myriad of changes in technology brings. However, experienced teachers need more than a few hours a year to allow them not only to learn how to use the technology but also to have sufficient time to reflect on how technology can help improve student learning (Rodriguez, 2000). To truly benefit from professional development, teachers need opportunities for hands-on experience in using a new skill, developing a unit using that skill, and implementing the new unit in the classroom (Guhlin, 1996; Sparks, 1998; Yocam, 1996). In addition, there must be a continuum that allows learning to occur in the classroom, over time, before a change in practice will occur (Rodriguez, 2000).

To underscore the need for ongoing professional development, Mehlinger (1997) estimated that it takes more than thirty hours of training, plus added time for practice,

in order to see the actual adoption of new technologies (i.e., computers, multimedia, PDA's, electronic textbooks). The National Education Association (1998) recommended continuous professional development for education employees in the use, integration, and applications of technology to enhance instruction. The experienced teacher, given the proper support and opportunities, can provide knowledge about the learning process that is rich with experience. The teachers, if allowed the time to implement and reflect upon the use of technology in the classroom, and provided the opportunity to share those experiences, can expand our body of knowledge on technology integration (Rodriquez, 2000). Follow-up support, as well as opportunities for on-going reflection on the new procedures is essential to ensure change in professional development practices and increasing technology implementation (Yocam, 1996).

The purpose of reflection, as defined and supported by Dewey in *How We Think* (1933), is to promote reflective thinking in teachers to help them clarify their purposes, focus their methods, and improve the quality of their teaching. Dewey defines reflective thinking as "active, persistent, and careful consideration of any belief or supposed form of knowledge" (p. 9). Reflective teaching has been defined more recently in one educational psychology textbook (Eggen & Kauchak, 1997) as: "an approach to teaching characterized by a thorough understanding of students, the way they learn, what motivates them, and continual introspection about the most efficient ways of organizing and implementing instruction." In contrast to one-shot professional development opportunities, critical reflection has been shown to increase the use of new knowledge and create change in practice over time. Recent studies have shown

that keeping a journal, known as "journaling," can increase critical reflection and support the integration of new knowledge with prior experiences (Bain et. al., 1999; Francis, 1995).

Professional development remains a major concern for teachers when it comes to effective implementation of technology integration. Effective teacher training must be developed, supported, and implemented before the benefits of technology integration will be evident in student achievement. In-service technology training occurs in many forms; among them are courses for credit, workshops, peer to peer and onsite technology personnel. However, after attending a technology in-service training, teachers are often left to go back to the classrooms to try to find time in their already overscheduled workday to implement instruction based on the new information they received in professional development offerings. Such limited professional development results in teachers' sporadic use of technology and minimal integration of technology into the daily curriculum instruction. Despite having computers available in their schools, teachers are underutilizing computers in their classrooms (Marcinkiewicz, 1994). Thus, further research is needed to help professional development facilitators provide opportunities for teachers to develop critical reflection skills that will allow them to carry new technology into the classrooms for practical applications.

Purpose of the Study

The purpose of this exploratory multiple case study was to determine the relationship between practicing teachers' use of reflective journals during graduate coursework and their level of technology implementation and attitudes toward

technology use in instructional settings. The study also explored whether or not teachers with different levels of reflection exhibited different attitudes toward technology use and self-efficacy along with any factors they perceive as relevant to successful technology implementation.

Research Questions

The following questions guided this study:

1. What is the relationship between a teacher's level of reflection about technology implementation, as evidenced in journal entries during a professional development course, and the teacher's level of technology implementation in her or his own classroom?
2. What is the relationship between a teacher's level of reflection about technology implementation, as evidenced in journal entries during a professional development course, and changes in the teacher's attitudes and self-efficacy regarding technology implementation in the classroom?
3. What factors, as perceived by the teachers and evidenced in their journal entries and survey responses, support the implementation of technology?

Significance

Technology is changing society and influencing teaching and learning practices. Professional development practices must provide teachers with the tools needed to sustain long-term, situated learning (Rodriguez, 2000). Sagor acknowledges that "when we hold these twin beliefs—that schools are about student learning and that learning

occurs primarily through the efforts and talents of teachers—then it becomes clear that school reform should focus on nurturing and developing the teaching profession" (2000, p. 1). This study sought to add to the research about the use of reflective journals in technology professional development programs and the impact that journaling may have on technology implementation. The researcher further sought to understand the complexities involved in the evaluation of reflective journals and to add to the research on development of a consistent reflective journal evaluation protocol for use by education faculty and professional development personnel.

Assumptions

In the research conducted, the following assumptions were important to the validity of the data being analyzed:

1. Participants will understand the survey questions.
2. Participants will respond honestly to the survey questions.
3. The surveys to be used are appropriate for the purposes of this study.

Definitions

For the purpose of this study, the following definitions were used for clarifying the descriptors used for data analysis:

Action research: Any systematic inquiry conducted by teacher researchers to gather information about how they teach and how well their students learn. This information is gathered with the goals of gaining insight, developing reflective practice,

effecting positive changes on educational practices and improving student outcomes (Mills, 2001).

Professional development: Any conscious action taken by teachers to improve their knowledge of content, skills, or instructional practices situated within the context of their learning environment.

Reflection: A critical analysis of teachers' instructional practices and the effects on student learning that result from those practices. Reflection goes beyond simple thoughts of lesson plans and the use of instructional materials to the embedded assumptions on which perceptions and beliefs are founded.

Technology implementation: The integration of technology into the learning environment, which includes teacher use for productivity, teacher use for instruction, and student use for demonstration of learning content and processes.

Limitations

The participants in this study were Texas teachers who completed an online graduate program at the University of North Texas for technology applications certification preparation. The program consisted of four 3-credit-hour courses that focused on the State Board for Educator Certification (SBEC) standards for grades 8-12 and a 3-credit-hour practicum that concentrated on All-Level standards. The reflective journals described in this study were required as part of the coursework for the all-level practicum course. This study involves a convenience sample of five participants' out of 65 who completed the coursework in which journals were required.

Delimitations

The researcher designed the graduate course (the all-level practicum) in which the participants were required to keep reflective journals as part of the action research process. The researcher was also the instructor for three of the five participants who provided their reflective journals for use in this study. Due to previous experience conducting action research on her own practice and keeping a reflective journal during the process, the researcher brings certain biases to the study. Every effort was made to ensure objectivity, but the constructivist philosophy of the researcher and the belief that reflection is a key element of sustainable learning may have shaped the way in which the researcher interpreted the teachers' responses in the reflective journals during analysis.

CHAPTER 2

LITERATURE REVIEW

Introduction

Researchers agree that technology implementation can improve the learning opportunities for students and increase the quality of instruction in learning environments (i. e. Byrom, 1998; Griffin, 2003; Scheffler & Logan, 1999). Two key factors required for successful technology implementation have emerged from the literature: access to technology in the classroom and time for teachers to learn not only the technology skills required to use the technology but also how to implement technology for instructional purposes (i. e., Norris et al., 2003; Rodriguez, 2000).

Many barriers to technology implementation have been identified. Lack of time for professional development, supportive leadership, technical support, and adequate resources (access) constitute the most common barriers (Griffin, 2003; Rodriquez, 2000; Norris et al., 2003). The integration of instructional technology is a slow, time-consuming process that requires support and encouragement from all stakeholders (Byrom, 1998). Research has shown that professional development must meet the needs of teachers to ensure the effective implementation of technology to improve instruction in our schools (i. e., Griffin, 2003; Mehlinger, 1997; Rodriquez, 2000.) The question that is not answered in the literature is how to design and evaluate consistent, on-going technology professional development that can be situated in practice. This study will focus on the promotion of reflection in practitioners as an attribute of

professional development programs for in-service teachers and the resulting effects on the teachers' technology implementation in the classroom.

Technology Implementation

Technology has the capability to bring about change in the classroom, such as changes in the way a teacher teaches, changes in the way students learn, and changes in the interaction between student and teacher (Scheffler & Logan, 1999). Moersch (2002) defines the use of technology as an "interactive learning medium because it has the greatest and lasting impact on classroom pedagogy and is the most difficult to implement and assess" (p. 2). The challenge for teachers is not only to use technology to achieve certain isolated tasks but also to integrate technology that supports purposeful problem-solving and experiential learning activities (Moersch, 2002). Even though new teachers have had more exposure to technology use than have more experienced teachers, Russell et al. (2003) believe "this exposure results in higher confidence levels with technology but does not translate into higher levels of use of technology in the classroom" (p. 308).

Moersch (1999) believes that measuring teachers' level of technology use can quantify how they are using technology in their classroom and describe the academic achievement of students that results from teachers' instructional technology practices. Moersch has developed the Level of Technology Implementation (LoTi) framework to measure the degree to which teachers implement instructional technology. The LoTi is a self-report instrument based on the Concerns Based Adoption Model (CBAM) and is "aligned conceptually with the work of Hall, Loucks, Rutherford, and Newlove (1975);

Thomas and Knezek (1991); and Dwyer, Reinstaff and Sandholtz (1992)" (Moersch, 1995). In *Next Steps: Using LoTi as a Research Tool*, Moersch (2001) describes eight distinct levels that range from (0) nonuse to (6) refinement, with level (4) integration being divided into two distinct levels: a) mechanical and b) routine. Each level reflects different stages of classroom technology implementation. As a teacher progresses from one level to the next, a series of changes to the instructional curriculum is observed. The instructional focus shifts from being teacher-centered to being learner-centered, so that the technology is no longer the focus of the instruction, but a tool to extend the students' understanding of the concepts being explored (1995). Each of the levels of technology implementation is defined in detail in Appendix D.

According to the Texas Education Agency (TEA), the Educational Technology Advisory Committee developed the Texas School Technology and Readiness (STaR) chart around four key areas of the Texas Long Range Plan for Technology: teaching and learning, educator preparation, administration and support, and infrastructure. The STaR chart indicators place a campus at one of four levels of progress: early technology, developing technology, advanced technology, or target technology (TEA, 2004b). The Levels of Technology Implementation (LoTi) is aligned with the Texas STaR chart, in which LoTi level 1 corresponds to early technology, level 2 corresponds to developing technology, level 3 corresponds to advanced technology and levels 4a – 6 correspond to the target technology level (Learning Quest, Inc., 2005). The Texas STaR chart describes the teaching and learning target technology level as the teacher serving as a facilitator and co-learner and students having on-demand access to all appropriate

technologies, along with a seamless integration into all core content areas (TEA, 2004c).

According to the LoTi Web site (http://www.loticonnection.com/lotiresearch.html), the LoTi is being used in more than 30 dissertation studies with both qualitative and non-experimental research designs (e. g., case studies, interviews, and correlational studies). The dissertation abstracts (provided on the Web site) cover a wide range of topics, including identifying components of successful staff development programs, student achievement, and technology integration. One study abstract (Larson, 2003) reported an internal consistency of (r=.85) with (n=10). Due to the small sample size in this case study; definitive empirical conclusions could not be drawn, but the LoTi was used to select the participants in order to ensure that participants with both above and below median levels of technology implementation were represented in the qualitative study.

Griffin (2003) reported an overall reliability coefficient of .94 and the reliability of the subscales ranged from 0.59 - 0.86. The instrument was used to determine that educators at different levels of technology implementation differed in their perceptions and utilization of technology training methods.

Stoltzfus (Unpublished) completed a preliminary analysis of the LoTi survey to validate the in-service teacher version in a study that addressed the internal consistency, content validation and construct validation. The Standards for Educational and Psychological Testing (1999) defines content validation as how well survey items appear to sample the entire range of the criteria or trait being measured. Construct

validity is a measure of how accurately a survey score represents a person's position on a construct. The results of this validation study confirmed content validity for each of the three areas of the survey: Level of Technology Implementation (LoTi), Personal Computer Use (CPU), and Current Instructional Practice (CIP). The areas of PCU and CIP were reported as statistically reliable (Moersch, private communication, February 10, 2005).

In the 2004 *Progress Report on the Long-Range Plan for Technology 1996-2010,* the TEA reported data from over 7,000 Texas campuses. In the two key areas relating to teachers: Teaching and Learning and Educator Preparation, fewer than 2% of the campuses have reached the Target Technology Level (TEA, 2004b). According to Learning Quest, Inc., data collected from 20 states during the 2003-2004 school year indicated only 11% of the 47,955 LoTi questionnaire participants are at the Target Technology level (LoTi level 4b) or above (2005). Although the percentage of participants at that level increased from 6% during the 2001-2002 school year, "the majority of technology use nationwide continues to position itself in the LoTi level 0-2 range" (Learning Quest, Inc., 2004).

According to the National Center for Education Statistics (NCES), part of the Department of Education, teachers with more hours of professional development felt better prepared to use computers for classroom instruction than teachers with fewer hours of professional development. When comparing perceptions in correlation to time spent in professional development activities, NCES reported that the teachers who received more than thirty-two hours of professional development in the use of

computers within the last three years were more likely to report they felt well prepared to utilize computers in their classroom than those teachers who received zero to thirty-two hours of professional development. Teachers without current technology professional development were more likely to report that they were not at all prepared to use technology in their classrooms compared to those teachers who had received one or more hours of professional development (NCES, 2000).

According to Lemke and Coughlin (1998), in *An Analysis of the Status of Education Technology Availability and Usage in the Public Schools of Virginia*, 35% of teachers surveyed reported that they were very well prepared or prepared for using technology in the classroom. Despite that percentage, only one in five rated themselves as an advanced user of technology. Teachers believed they were becoming more comfortable with using technology for their own productivity/management purposes but did not necessarily understand how to integrate technology into the curriculum at a high level. According to the report, "most of the teachers interviewed were frustrated by the lack of appropriate and relevant technology training, authentic models for how to integrate technology, and technical assistance with using and troubleshooting technology" (p. 168). Moersch (1995) noted observations that staff development opportunities for teachers to explore the potential of computer technology are oftentimes insufficient and misdirected… [they are] used for isolated activities unrelated to a central instructional theme, concept, or topic… [and are] used to sustain the existing curricula rather than as a catalyst for change" (p. 40).

Professional Development

The 2003-2004 Texas StaR chart data indicate that only 1.6% of more than 7,000 campuses reporting have reached the Target Technology level in the Educator Preparation area. That level is defined as a demonstration of regular technology-supported learner-centered projects. There is vertical alignment of Technology Applications Texas Essential Knowledge and Skills (TEKS) and anytime, anywhere use of online resources. Administrators ensure integration of appropriate technology. All educators meet State Board for Educator Certification (SBEC) standards and 30% or more of the budget is allocated for professional development (TEA, 2004b).

The professional development literature suggests that a successful professional development environment must provide teachers situated learning experiences that are grounded in classroom practice and opportunities to reflect on one's own practice and student achievement in an environment of ongoing support, including technical, administrative, emotional and intellectual (e.g., Mills, 2001; Reys et al., 1997; Rodriquez, 2000).

According to Russell (1995), the six stages through which educators' progress while learning new technology are: stage 1 – awareness, stage 2 – learning the process, stage 3 – understanding and application of the process, stage 4 – familiarity and confidence, stage 5 – adaptations to other contexts, and stage 6 – creative application to new contexts. Russell also states, "The relevance of the computing experience can influence the way in which the learner applies the technology in a particular situation" (p. 173). Russell found that students learning to use email as a communication tool passed through these stages as they moved from anxiety or

frustration with the technology to comfortable use of email. The Stages of Adoption Model illustrates the need for on-going professional development due to the learner's need to reinvent the innovation (teaching with technology) in order to make it his or her own (Knezek & Christensen, 1999).

In her doctoral dissertation, Christensen (1997) used the Stages of Adoption of Technology instrument that she developed based on Russell's six stages needed for adults to become confident technology users in an effort to determine the impact of needs-based technology integration education on teacher and student attitudes towards information technology. In a study of approximately sixty elementary school teachers in Texas who received needs-based technology integration instruction, Christensen (1997) reported that 12 of the 22 teachers in one school moved up at least one category in the one-year pre/post Stages of Adoption of Technology self-assessments. Those teachers were offered support during technology training and implementation. She did note that it takes longer for attributes "such as confidence and acceptance" (p. 93) to show measurable changes. She concluded that technology training that occurs over time, with support from all stakeholders appears to foster meaningful use by teachers in the classroom. She also found that "teacher instruction in needs-based technology integration, combined with significant classroom utilization, fosters positive student attitudes toward information technology" (p. 91).

In his examination of how teachers implement computer technology, Mills (2001) found that "technology training activities…needed to focus more on instructional strategies and methods to integrate technology in the classroom than on training activities to increase skills in the operation of computer hardware and use of software

applications" (p. 287). For his study, Mills developed an instrument for analysis of technology integration and implementation in classrooms. The instrument, which is based on the Concerns Based Adoption Model (CBAM), used computer technology standards appropriate for the participating school district. The 18 standards-based components were organized into three phases: using and operating technology in the classroom, facilitating and managing classroom technology, and technology integration. Mills reported that paired samples correlations were computed when components were grouped by phase and significant differences on the *t*-test ($p < .05$) were indicated for all three phases. Mills stated, "Differences among the groups in this study at the beginning of the school year were delineated more by attributes of technology integration than by technology use and operations" (p. 287); therefore, technology proficiency was not found to be a contributing factor for quality technology integration.

Graham et al. (2004) described a redesign process in their technology course in the teacher preparation program at Brigham Young University. Their process reportedly moved the course from a focus of learning technology skills, to learning how to integrate technology (p. 130). That design exhibits a direct relationship with the Levels of Technology Implementation as described by Moersch (1999), in which teachers have been shown to move from teacher-centered instruction to student-centered instruction as they move through the levels. The barriers faced in the redesign process described in Graham's study, are similar to the ones evident in the professional development literature: technology skill level (student and faculty) and curriculum change difficulty (p. 131). Both of these barriers were addressed in the redesign process in order to achieve the shift in learning that occurred. A change in technology professional

development practices--from one-shot skills workshops to ongoing, reflective learning environments--represent one possible solution to overcoming barriers.

The common theme evident in the literature suggests that ongoing support, including access to technology, in situated learning experiences, for teachers and their students and opportunities for reflection must be present for technology implementation to be successful (e.g., Reys et al., 1997; Rodriguez, 2000; Mills, 2001). A compilation of the important components of effective professional development programs, gathered from the literature, that yield successful technology implementation is illustrated in Table 1. The components are grouped into three distinct categories: ongoing support, situated learning experiences, and opportunities for reflective practice to occur.

Table 1

Compilation of Criteria for Successful Professional Development Programs

Compilation from literature	Reys et al. 1997	Rodriguez 2000
Ongoing support	Long-term effort (at least 2 years), encouragement to make small changes and to learn from them	sufficient time ongoing process built-in evaluation

(*table continues*)

Table 1 (*continued*).

Compilation from literature	Reys et al. 1997	Rodriguez 2000
Ongoing support (*continued*)	Technical assistance as well as emotional and intellectual support networks	administrative support technical assistance adequate resources
Situated learning	Professional development grounded in classroom practice	a connection to student learning, curriculum-specific applications
	Pedagogy of professional development congruent with pedagogy desired in classrooms	Variety of learning experiences, hands-on technology use
	Focus on teaching for understanding through personal learning experiences	
Opportunities to share and reflect	Opportunities that stimulate and promote intellectual growth	Active participation of teachers, new roles for teachers

(*table continues*)

Table 1 (*continued*).

Compilation from literature	Reys et al. 1997	Rodriguez 2000
Opportunities to share and reflect (*continued*)	Collegial atmosphere in which teachers share views and experiences	collegial learning

Mezirow's theory of transformational learning is cited repeatedly in the adult education and higher education literature as a foundation for professional development practices (e.g. Merriam, 2004; Kember et al., 1999). Transformative learning (Mezirow, 1991, 1997, 2000) is the process of effecting change by helping adult learners become autonomous thinkers. Mezirow (2000), states, "Making meaning involves learning within established frames of reference and learning to transform them. We transform our frames of reference by becoming critically reflective of assumptions" (p. 115) and making changes based upon new knowledge or perspectives. The classroom is an important frame of reference for teachers. Professional development must assure the relevancy of new information (technology) in that frame of reference. Mezirow (1997) also suggests that "new information is only a resource in the adult learning process. To become meaningful, learning requires that new information be incorporated by the learner into an already well-developed symbolic frame of reference, an active process involving thought, feelings, and disposition" (p. 10).

Speck (1996) notes that the "transfer of learning for adults is not automatic and must be facilitated. Coaching and other kinds of follow-up support are needed to help adult learners transfer learning into daily practice so that it is sustained" (pp. 36-37). If the goal of professional development is to effect a change in practice (improve teaching

and student achievement) and if reflecting on one's own practice is part of that process, we need a clear definition of reflection and the associated evaluation criteria. Unfortunately, the literature provides a variety of measures to evaluate reflective thinking instead of a clear, reliable measurement tool that would allow faculty the consistency needed for accurately evaluating reflection. His study focused on the levels of reflection demonstrated during a technology professional development program in order to investigate relationships and attributes of successful technology implementation (as described by Moersch, 1995, 2001) and contribute to the clarity of the instruments used for evaluation.

Reflection

Teacher education programs have included the goal of developing more reflective teachers for many years and many refer to the foundational work of John Dewey, who espoused reflective thought for learning. In *How We Think* (1933), Dewey promotes reflective thinking in teachers in order to help them clarify their purposes, focus their methods, and ultimately improve the quality of their teaching:

> Reflective thought is valuable for it emancipates us from merely impulsive and merely routine activity. It enables us to direct our activities with foresight and to plan according to ends-in-view, or purposes of which we are aware...It converts action that is merely appetitive, blind, and impulsive to intelligent action (p. 17).

Dewey defines reflective thinking as "active, persistent, and careful consideration of any belief or supposed form of knowledge," which includes a "conscious and voluntary effort to establish belief upon a firm basis of evidence and rationality" (p. 9). The reflective

process "involves a state of doubt, hesitation, perplexity, mental difficulty, in which thinking originates, and an act of searching, hunting, inquiring to find material that will resolve the doubt" (p. 12).

In *The Reflective Practitioner* (1983), Schön proposes a model of professional education based on Dewey's notion of reflection and its purpose in practice. "Knowing-in-action" is described as what we know how to do in the everyday practice of teaching. When a situation arises that interrupts our knowing-in-action--new technology--the practitioner reflects on the problem while in the "midst of action, without interrupting it," engaging in "reflection-in-action" to identify and then select viable and feasible solutions. Needs-based professional development can provide teachers the opportunity to reflect-in-action during the course of normal instructional occurrences.

"Reflection-on-action" occurs outside of the instructional situation, after class, providing an opportunity to analyze and evaluate the effectiveness of the solution chosen. The process requires reflection on prior knowledge and may bring about a change in knowledge-in-action. Through "reflection-on-practice," the practitioner can "surface and criticize tacit understandings" of actions or experiences and "make new sense" of them (p. 61). Schön's work suggests ongoing, situated professional development should provide time for reflection-on-practice to support teachers during the process of technology implementation.

Rodgers (2002) suggests that reflection has suffered from a loss of meaning in contemporary literature, which impedes research on the effects of reflective teaching. Reference to the interchangeability of the terms --reflection, inquiry, and critical thinking-- illustrates a further impediment to facilitating communication about, and

research on, reflective teaching. In an attempt to restore clarity to the question of what it means to reflect on one's teaching Rodgers discusses four criteria (based on Dewey) that demonstrate the process of moving from theory to practice.

1. Reflection as a meaning-making process based on Dewey's belief that education is a reconstruction or reorganization of experiences after thought is given to one's perception of the experiences and the relationships among them;
2. Reflection as a rigorous way of thinking that moves the learner through a process that mirrors the scientific method in which the learner must then act according to the new meanings he or she has derived from the thought process;
3. Reflection in community provides the opportunities for clarity in the understanding of one's own experiences through the discipline required to effectively communicate understanding and incorporate others' perceptions about an experience with one's own;
4. Reflection as a set of attitudes is based on Dewey's awareness of "the role that affect plays in learning" indicating that one must remain "open-minded, entertaining many interpretations of his or her experience so that one does not limit one's understanding and the actions that flow from it" (p. 365).

She concludes her discussion with the supposition that "because reflection is a systematic, rigorous, disciplined way of thinking, with its roots in scientific inquiry… it can be practiced, assessed, and perfected" (p. 865).

Action research is a problem solving process, which requires reflection, research, planning, and action. Collaborative action research gives focus and clarity to today's overburdened teacher and the school community. "Considering the incredible demands

on today's classroom teachers, no activity is worth doing unless it promises to make the central part of a teacher's work more successful and satisfying" (Sagor, 2000). Sagor suggests that action research lends meaningful data in support of research-based theories in an era of standards and data-driven education. Action research also involves the educator in a professional endeavor to becoming a reflective teacher and in presenting research-based data to other educators in several types of venues. Sagor also suggests that teachers who participate in action research develop a deeper understanding of their students, the learning process, and the learning environment. "Through careful problem-solving and self-reflection, action research empowers teachers to recognize political, practical, and personal problems related to practice and to take action to resolve these problems" (Capobianco, 2004). With the technology available to support that type of learning and sharing, immaterial of space and time, the possibilities are endless. Teachers can share, review, and assess each others plans and ideas. Each classroom is its own small learning community, but it is part of the larger school community and, in turn, part of the even larger network of learning communities (e.g., Capobianco, 2004; Mills, 2001; Sagor, 2000).

Many studies describe the use of reflective journals in educational environments as an important strategy to improve critical thinking skills by providing the opportunity for teachers, both pre-service and in-service, to reflect on and share actual experiences (e. g. Collentine, 2002; Spalding and Wilson, 2002). The strategy not only allows for the validation of prior knowledge, it also allows teachers to apply that knowledge in unique situations for new learning (Patton, Woods, & Agarenzo, 1997.) Baker and Shahid (2003) believe novice teachers learn most powerfully by reflecting continuously on the

informed experiences and by engaging in dialogue about their reflections in a safe environment. They reported that having their education students respond to weekly prompts increased the depth and quality of those students' reflections. The researchers reported, "They seem to be learning not simply from doing, but through thinking carefully about what they have done" (p. 11). According to the literature, the use of reflective journals is one strategy that has been used in pre-service situations that strive to promote Schön's "reflection-on-practice."

Reflective Journals

Even though the literature supports the assumption that reflective writing can promote reflective thinking, there is limited research that establishes guidelines for evaluating reflection during in-service professional development. Many studies reported using journals for reflection, but there is no indication of a common language for description, criteria or evaluation of the reflection. There is confusion in the literature about the purposes of reflective journals and the evaluation methods used to assess them. The studies described below illustrate the different assumptions that are made when evaluating reflective journals.

In her master's thesis, Collentine (2002) describes the results of using reflective journal writing during a medical radiography program as increasing students' self-esteem and enabling better transfer of the material from the classroom to the clinic. She also reports improved communication between the instructor and the students. A basic assumption was evident in her literature review:

> Critical thinking is defined by Ennis (1985) as "reasonable and reflective thinking that is focused upon deciding what to believe or do" (p. 45).

> Miller and Babcock (1996) describe critical thinking as 'purposeful thinking that takes into consideration focus, language, frame of reference, attitudes, assumptions, evidence, reasoning, conclusions, implications and context when they matter in deciding what to believe or do' (p. 8).

By using adult learning strategies for developing critical thinking and relating them to reflective thinking, she demonstrates the assumption that the terms have become synonymous. The journals referred to in her study were used for reflection, but they were assessed using a checklist for critical thinking skills. The assessment noted whether or not each of the six categories was demonstrated: interpretation, analysis, evaluation, inference, explanation and self-regulation were evidenced in the journal writing (Collentine, p. 32). The observations noted for the six categories included: categorization and clarifying meaning (interpretation); examining ideas, identifying and analyzing arguments (analysis); assessing claims and arguments (inference); stating results and justifying procedures (explanation); and self-examination and self-correction (self-regulation).

When their graduate-level, secondary teacher education students displayed confusion over the weekly journal writing assignment, Spalding and Wilson (2002) documented a study to identify pedagogical strategies that promote reflective thinking. Based on the premise that "Dewey reminded us that reflective habits of mind must be taught" (p. 1412) they describe the strategy of teaching and evaluating reflection. The authors reported, "We actively taught reflection by using a typology of reflection and a common language in our feedback to students" (p. 1412). A four category typology of

reflection, which is based on Valli's framework of reflection in/on action, personalistic, deliberative, and critical reflection, was used for evaluation in the study (p. 1401). The typology is described as 1) Reflection in/on action, which concerns one's own personal teaching performance; 2) Deliberative, which contains a range of teaching concerns, including students, the curriculum, instructional strategies, and the rules and organization of the classroom; 3) Personalistic, which considers one's own personal growth and relationships with students; and 4) Critical, which is the social, moral and political dimensions of schooling.

When teaching the typology, they presented all four categories of reflection to the students as "equally important and [each category] as more valuable and appropriate for some purposes than others (Hatton & Smith, 1995)… and encouraged students to generate reflections of all four types over the course of the semester" (p. 1396). From the data of 34 students, 4 case studies that were typical of demonstrated growth in reflection over the course of the semester were presented. One student, Ella, was described as having moved from disapproving to critiquing; at the beginning her journal writings were too "personalistic…her writing conveyed a tone of complaint", but at the end of the journal writing period, she was critically assessing her experiences and making reference to the topics being addressed in the program when making suggestions to improve the experience (p. 1403). Entries from another student, Grant, showed that his reflections moved from descriptions of events to linking theory to practice. In all four cases, the interaction between student and instructor seemed to be a key factor in the process of growth in reflection. As the instructors provided feedback on the journals, they asked questions such as: "Thanks for your evaluation of Mrs. Y's

classes in terms of kinds of time. How will you use? [*sic*] Can you give me an example?" demonstrating the interactions needed to facilitate learning about reflection (p. 1408). This study illustrated strategies for teaching reflection and the importance of student/teacher interaction, but did not clarify an evaluation process that could be used consistently by faculty.

In a study aimed at gaining a "greater understanding of the process of journal writing in reflection, Bain et al. (1999) used a five-point level of reflection scale to evaluate student journal responses: reporting, responding, relating, reasoning, and reconstructing. The first level, reporting, is a description or "re-telling" of an experience. The second level, responding, is an expression of a feeling or an observation, without inferences being made or specific details present. If personal meaning is expressed about the experience which connects to prior experience, then the response is a level three, relating. When relationship between theory and practice is explored, the response is a level four, reasoning. When a student formulates a personal theory of teaching, or takes a position on an issue, the level of reflection is considered to be reconstructing (p. 60). Bain et al. reported that "of the 23 students (66%) who were reflecting at level 2 or 3 in their first entry, 12 had moved up to level 4 or 5 on their last entry, while 11 remained at level 2 or 3" (p. 63).

This review of the literature illustrates a need for research to identify a common method to evaluate reflection in technology professional development programs. In an effort to determine whether students were engaged in reflective practice, Kember et al. (1999) also proposed a scheme for estimating the quality of reflective thinking demonstrated in reflective journals. "The coding scheme described…is principally

derived from Mezirow (1991), of which chapter 4 is most central to defining reflective thinking" (p. 20). The 1999 coding scheme proposed by Kember et al. that describes seven levels of reflection is represented in Table 2.

Table 2

Kember 1999 Coding Scheme

Levels of Reflection	Definition
Habitual action	That which has been learned before and through frequent use becomes an activity which is performed with little conscious thought. [riding a bicycle or using a keyboard]
Introspection	Refers to feelings or thoughts about ourselves but does not encompass deciding how or why these feelings developed. A level of recognition or awareness. [liking or disliking someone or something]
Thoughtful action	Makes use of existing knowledge without attempting to appraise that knowledge, so learning remains within pre-existing schemes and perspectives. It can be described as a cognitive process that relates to Bloom's taxonomy (1979) categories of knowledge, comprehension, application, analysis, and synthesis.
Content	Reflection on what we perceive, think, feel, or act upon. [what we think]

(*table continues*)

Table 2 (*continued*).

Levels of Reflection	Definition
Process	Reflection on how we perform the functions of perceiving, thinking, feeling, or acting and an assessment of efficacy in performing them. [method or manner in which we think]
Content and process	Involves both in the same reflective thought.
Premise	Involves becoming aware of why we perceive, think, feel, or act as we do. [requires evidence of a significant change of perspective]

In *Development of a Questionnaire to Measure the Level of Reflective Thinking* (2000), Kember et al. revised the previous categories as they continued to refine evaluation measurements for reflection. They describe the works of Mezirow, in which reflective thinking is essential to his model of transformative learning for adults, as:

> Mezirow separates reflective action from non-reflective action. He identified three types of non-reflective actions: habitual action, thoughtful action, and introspection. There were two levels of reflective action of which the lower or less critical level was sub-divided into content and process reflection. This terminology is taken from Dewey (1933) who used the term critical reflection to refer to deeper, more thoughtful and more profound reflection. Mezirow labels the more critical form of reflection premise reflection (p. 383).

Based on the assumption that this instrument "should concentrate upon assessing outcomes in terms of the level of reflective thinking displayed," only four constructs were identified and evaluated in the Reflection Questionnaire used for the study; Habitual action, Understanding, Reflection, and Critical reflection (Kember et al., 2000, p. 383).

The Reflection Questionnaire, described above, was completed by 402 health science undergraduates at a Hong Kong university in a study examining the relationship between student approaches to learning and reflective thinking (Lueng & Kember, 2003). The study found that there is a "clear relationship between approaches to learning and reflective practice: two frameworks which have not commonly been associated in the literature" (p. 70). The deep approach to learning, in which the student sought the underlying meaning intended by the author (of a text), was shown to "correlate with [the] understanding, reflection, and critical reflection" (p. 65) scales of the reflection questionnaire. The surface approach, in which the student concentrates on surface features and details of the text, shows a "significant positive correlation to the habitual action scale of the reflection questionnaire, but not to the others" (p. 65).

When the original coding scheme was used to assess written reflections from a period of clinical placement, the four assessors participating in the pilot study, reached a level of agreement indicated by a Cronbach alpha value of 0.74. The authors report, "This exceeds the alpha value of 0.70 suggested by Murphy and Davidshofer (1991) as acceptable in estimating the reliability of rating scales." (2003, p. 28). After revisions from a 7-level scheme to a 4-level scheme, the criteria in a Reflective Questionnaire, Leung and Kember (2003) reported Cronbach alpha values for each scale ranging from

0.58 to 0.74, which indicates a moderate reliability as it is "well known that the alpha values are affected by the number of items in a scale (Lord & Novick, 1968 as cited in Leung & Kember, 2003)" (p. 65). In reference to the Reflection Questionnaire described earlier, Kember et al. (2000), suggest "another use for the instrument would be examining the interrelationships between scores on the scales with scores on the scales measuring other constructs related to the teaching and learning environment (p. 393).

Although the reflection questionnaire was used as a self-analysis instrument for evaluation of nursing program students, the description and definition of the categories provided demonstrated a reliable framework for evaluating levels of reflection in journals used during educator professional development programs (D. Kember, personal communication, December 28, 2004).

The current study is based on the evaluation of participant journals using a framework from the categories for the levels of reflection described in the Leung and Kember (2003) study and clarified during a private conversation with D. Kember. During the conversation, he further described the criteria used for coding reflective journals. When asked about the purpose of the revision, Kember stated that the limitation of the 1999 category scheme of "seven categories were too fine-grained. A simpler scheme with fewer categories would be easier to follow for those without detailed knowledge of the literature on which the categories were based" (D. Kember, personal communication, December 28, 2004). Referring to the reflection questionnaire (Leung and Kember, 2003), which indicated a good fit to a four-factor model when tested with confirmatory factor analysis, and seeking consistency between the quantitative and qualitative ways of determining levels of reflection, the four-category scheme for

determining levels of reflection in written work was developed. The four-level framework and the criteria used as a coding framework for the analysis of the journals in this study are illustrated in Table 3. This framework offers both a definition of each level and guidelines for determining the characteristics and dimensionality within the reflective journals and was explored in the case study analysis.

Table 3

2003 Lueng and Kember Coding Scheme

Level of Reflection	Definition/Description
Habitual action (This is not reflective.)	a) Procedures are followed without significant thought b) Student provides a superficial response to the prompt without an attempt to reach understanding of the concept c) Paraphrases or summarizes the readings without a sense of meaning of the underlying constructs
Understanding (This is not reflective.)	a) Concepts are understood as theory without being related to personal experiences or real applications b) No understanding of how the concepts might be applied in practice c) Reliance upon what was in the textbook or lecture notes d) No examples of how theory relates to practice
Reflection (This is reflection in/on practice.)	a) Application of concept to practice and related to personal experience b) Concepts will be interpreted in relation to personal experience c) Specific situations of practice will be discussed in relation to concepts and theories being taught. d) Personal insights will go beyond book theory

(*table continues*)

Table 3 (*continued*).

Level of Reflection	Definition/Description
Critical reflection (This is defined as Mezirow's "premise reflection".)	a) Implies undergoing a transformation of perspective over time b) Review of presuppositions from conscious and unconscious prior learning and their consequences c) Must be evidence of a change in perspective over a fundamental belief d) Shows evidence of; • A process for diagnosing existing conceptual frameworks • A period of disequilibrium and conceptual conflict which makes students dissatisfied with existing conceptions • Reconstruction in which a new conceptual framework is formed

Summary

Professional development remains a major concern for teachers when it comes to effective technology implementation. Teacher education programs have included the goal of developing more reflective teachers for many years and many refer to the foundational work of John Dewey, who espoused reflective thought for learning. Even though the literature supports the assumption that reflective writing can promote

reflective thinking, there is limited research that establishes guidelines for evaluating reflection during in-service professional development. This study sought to explore the relationship between the use of reflective journals and technology implementation and to illustrate the process of evaluating reflection in written work.

CHAPTER 3

RESEARCH METHODOLOGY

Introduction

The purpose for conducting this qualitative multiple case study was to determine whether educators with the same technology training differ in their level of technology implementation based upon the level of reflection demonstrated in journals written during their capstone course in a graduate-level technology applications certification program. The study also explored teachers' self-efficacy and attitudes about technology use relevant to their levels of reflection and/or levels of technology implementation. Describing the process of evaluating the reflective journals for determining levels of reflection demonstrated is also a large part of gaining insight into the use of reflective journals in promoting technology implementation. This chapter describes the research questions, research design, the role of the researcher, sampling (participants), data collection, instrumentation and data analysis, the verification process and ethical considerations relevant to this study.

Research Questions

The following questions guided this multi-case study:

1. What is the relationship between a teacher's level of reflection about technology implementation, as evidenced in journal entries during a professional development course, and the teacher's level of technology implementation in her or his own classroom?
2. What is the relationship between a teacher's level of reflection about technology implementation, as evidenced in journal entries during a professional

development course, and changes in the teacher's attitudes and self-efficacy regarding technology implementation in the classroom?

3. What factors, as perceived by the teachers and evidenced in their journal entries and survey responses, support the implementation of technology?

Research Design

This qualitative multiple case study sought to answer questions about the use of reflective journals during a graduate professional development course and the relationship between teachers' level of reflection and their technology implementation and perceptions about technology use. The key aspect of qualitative research is to gather information from individuals on their experiences, perceptions, and understandings of the specific issues related to the phenomenon being studied. Strauss and Corbin (1998) claim that "qualitative methods can be used to obtain the intricate details about phenomena such as feelings, thought processes, and emotions that are difficult to extract or learn about through more conventional research methods" (p. 11).

There are many differences in case study research depending on the researcher, the purpose of the study, the people involved and the theories being developed or tested. Case-study methodology allows the researcher to answer the "how" and "why" questions of specific phenomenon, usually within the context of the participants working environment. Yin (1984) describes three forms of case study: exploratory, explanatory, and descriptive. In exploratory case studies, the research questions are determined after fieldwork and data collection has been undertaken. Explanatory case studies are conducted when causal relationships are being examined making use of pattern-matching techniques for multivariate cases. Descriptive case studies are used

when a descriptive theory is evident in the research and cause-effect relationships are investigated. The five cases analyzed in this study constitute an exploratory multiple case study because the research questions were developed after the participants' completion of coursework in order to investigate the relationships between teachers' ability to reflect on knowledge gained during the practicum courses and the impact of that new knowledge on their abilities and attitudes regarding technology incorporation in their instruction.

Role of the Researcher

In a case-study using qualitative methodology the investigator presents an interpretation of how the participants perceive a specific phenomenon. The researcher was the key instrument for gathering information and the researcher's perspective was a lens into the interpretation and analysis of that information. The researcher in this study possesses a strong background in teaching and technology implementation in the learning environment. As mentioned in the delimitations section of Chapter 1, the researcher designed and taught the practicum course referred to in this study. The researcher utilized the information in the literature review along with an intimate knowledge of the action research process and learning environment of the course when analyzing the data in this study.

Participants

The participants in this study were all certified teachers working in Texas public school districts. All participants had completed the four courses required for the Texas Technology Applications Certification (grades 8-12) and had participated in the

practicum course required for the All-Level Technology Applications Certification at UNT during fall 2003.

The participants were selected from a group of students who completed CECS 5800 (Technology Applications Practicum) fall 2003 at the University of North Texas (UNT). The course was the practicum (or capstone course) offered in the Technology Applications Certification Program, by the Department of Technology and Cognition within the College of Education at UNT. The course was part of an online program of study designed to prepare Texas teachers for the State Board for Educator Certification (SBEC) Technology Applications Certifications. The program consists of four courses that combine learning technology skills and technology integration strategies and was aligned with the Technology Essential Knowledge and Skills (TEKS) student standards. The five participants in this study were enrolled in the practicum course.

The first four courses of the program address the technology applications standards required by the SBEC for the grades 8-12 level and include the following concepts: desktop publishing, the Internet, video and multimedia skills. For two of the courses, the participants created a unit of study that integrated technology and content relevant to their teaching assignments. The other two courses provided the participants opportunities to experience learning that can occur when students create a multimedia project that represents their understanding of content objectives. The program was designed to model project-based learning which provides learning experiences that integrate technology and are student-centered.

During the practicum course the participants conducted action research while implementing a unit of study that integrated technology applications in core curriculum

areas with a particular emphasis on assessment that informed their students. Mills defines action research as any systematic inquiry conducted by teacher researchers to gather information about how they teach and how well their students learn. Information was gathered with the goals of gaining insight, developing reflective practice, effective positive changes on educational practices and improving student outcomes (2003).

In order to promote reflection in practitioners, participants in this study were asked to keep a journal during the action research process in order to reflect on their actions regarding the use of technology in instruction and the relationship between their coursework and their classroom practice. Copies of the journals were analyzed for this study to determine teachers' levels of reflection during technology implementation.

Data Collection Procedures

Methods of data collection for case-study research vary based on the topic under investigation and may include interviews, recorded (written or verbal) responses, document analysis and/or written surveys. According to Creswell (2003) "the researcher makes an interpretation of the data. This includes developing a description of an individual or setting, analyzing data for themes or categories, and finally making an interpretation or drawing conclusions about its meaning" (p. 182).

An application for the Approval of Investigation Involving Human Subjects was submitted to, and approved by, the University of North Texas Institutional Review Board (IRB) before data acquisition took place. Data were collected from January–April 2005. In January, the researcher sent email requests for participation to all persons that completed the Technology Applications Certification Program at the University of North Texas. There were approximately 65 individuals who met the criteria for this study.

Repeated attempts to contact the population were made between January and April 2005. In a final attempt to gain more participants, an honorarium was sent to twenty TACP participants whose physical addresses were known. As an offer of compensation to the participants for the time required taking both surveys all participants who completed the study participation requirements were compensated with a chance to receive one of five technology-related items (i.e., 2 USB flash drives, and 3 eZedia software programs) for use in their classroom. Five of the sixty-five qualified participants agreed to participate and provided their journals.

Instrumentation and Data Analysis Procedures

This study investigated the levels of technology implementation one year after participants completed a graduate-level technology professional development program for teachers. Data derived from surveys on teacher attitudes, demographics, technology use and participants' reflective journals, were used to investigate a cause-effect relationship between the levels of reflection and the levels of technology implementation. The researcher analyzed survey and journal data both quantitatively and qualitatively.

For the quantitative analysis of the journal reflections, a 4-level coding scheme, developed by Leung and Kember (2003), was used in this study. The four levels of reflection include: habitual action (1), understanding (2), reflection (3), and critical reflection (4). The first two levels are non-reflective and consist of superficial responses to the prompts and comprehension of the theories being discussed during the course. Level 3 is reflective and is demonstrated by responses that describe personal applications of the theories in practice and relate to personal experiences and prior

knowledge. Level 4 is represented by a change over time in personal beliefs and reconstruction of a new conceptual framework that results in a change in teaching practices. The latter level is defined as Mezirow's "premise reflection" (1991), which implies undergoing a transformation of perspective over time.

Four college of education faculty coded each journal, including the researcher, based on the coding scheme (see Appendix B). The researcher was also the course instructor for three of the five participants. The three other raters were college of education faculty at Texas A&M University – Texarkana, who use written reflections as course requirements for various courses taught in their respective education programs. All four faculty (herein referred to as raters) demonstrate a high level of technology implementation during instruction and provide opportunities for their students to implement technology during their field-based learning exercises. Each rater was provided with the coding scheme that defined each level (see Appendix B) along with information about the weekly course topics/concepts and journal prompts (see Appendix C). Kember argues that "attempting to assess levels of reflection of sections within a paper or journal entry was not a fruitful exercise," therefore recommending "that the normal procedure in assessing the level of reflection is to examine the whole paper to find the highest level of reflection" (C. Moersch, personal communication, February 10, 2005). The researcher assumed there was knowledge to be gained by evaluating the weekly sections of the journals and provided each faculty member with a brief overview of the coding scheme and asked the raters to code each section individually, then to consider the journal as a whole and provide a rating of the overall level of reflection for use in further data analysis.

Each journal was divided into fifteen sections, with each section depicting one week during the semester. Using Kember's 4-level model, all four raters evaluated each section for the appropriate level of reflection demonstrated in the responses. Although the general categories were selected before data analysis began, the researcher used the descriptions of each level of reflection, as defined by Kember, to illustrate the characteristics of each level. Evidence of the participants' feelings and actions, in addition to the interpretations of the faculty members evaluating the journals, was helpful in defining the various dimensions associated with each characteristic.

Although the weekly journal responses could be coded for levels 1 – 3, the overall coding to determine whether level 4 had been reached had to be determined for the journal as a whole. In the analysis process, each of the four raters reviewed the document twice, the first time looking at the individual prompt/response and the second time to evaluate the journal in a holistic manner. The overall level of reflection for each journal was negotiated in a discussion after all raters completed the section coding process. During the discussion, teachers' responses were reviewed in order to determine the degree of change evident in their perceptions over time. The evidence required for a rating of 4, critical reflection, consisted of demonstration of a questioning of foundational beliefs in the way the participant perceived her teaching practices or a description of a change in those practices. All raters were in agreement with the final journal ratings used during further data analysis.

Interrater reliability statistics were computed using Cronbach's Alpha. Murphy and Davidshofer (1991) suggest an alpha value 0.70 is acceptable in estimating the reliability of rating scales. Schmitt (1996) has argued that alpha levels above 0.50 can

be accepted as a moderate estimation of reliability in cases of small scales or the presence of multidimensionality. The alpha values in this study ranged from 0.39 to 0.85, with two of the five journals having alpha values greater than 0.8 and two greater than 0.64. The journal with the alpha value of 0.39 was used in the study to illustrate the process of evaluation which will be explained within the appropriate discussion. Reliability analysis results for each journal obtained for this study are illustrated in Figures 1-5.

		Mean	Std Dev	Cases
1.	RATER1	2.6875	.7932	16.0
2.	RATER2	2.4375	.6292	16.0
3.	RATER3	3.5625	.5123	16.0
4.	RATER4	3.0000	.5164	16.0

Reliability Coefficients

N of Cases = 16.0 N of Items = 4 Alpha = .6492

Figure 1. Cronbach Alpha - Teacher B's Journal

		Mean	Std Dev	Cases
1.	RATER1	3.1000	.8756	10.0
2.	RATER2	3.0000	.0000	10.0
3.	RATER3	3.2000	.6325	10.0
4.	RATER4	3.1000	.5676	10.0

Reliability Coefficients

N of Cases = 10.0 N of Items = 4 Alpha = .6566

Figure 2 . Cronbach Alpha - Teacher B_2's Journal

		Mean	Std Dev	Cases
1.	RATER1	2.4667	.8338	15.0
2.	RATER2	1.8000	.6761	15.0
3.	RATER3	2.4000	.7368	15.0
4.	RATER4	2.7333	.5936	15.0

Reliability Coefficients

N of Cases = 15.0 N of Items = 4 Alpha = .8140

Figure 3 . Cronbach Alpha - Teacher C's Journal

		Mean	Std Dev	Cases
1.	RATER1	3.0000	.7845	14.0
2.	RATER2	2.7857	.8018	14.0
3.	RATER3	2.8571	1.0995	14.0
4.	RATER4	2.7143	.4688	14.0

Reliability Coefficients

N of Cases = 14.0 N of Items = 4 Alpha = .8543

Figure 4 . Cronbach Alpha - Teacher P's Journal

		Mean	Std Dev	Cases
1.	RATER1	1.8125	.9106	16.0
2.	RATER2	1.0000	.0000	16.0
3.	RATER3	1.5625	.8921	16.0
4.	RATER4	2.6250	.5000	16.0Reliability Coefficients

N of Cases = 16.0 N of Items = 4 Alpha = .3958

Figure 5 . Cronbach Alpha - Teacher G's Journal

After the evaluation of the weekly journal responses and the final holistic evaluation, the journals were rated with an overall level of reflection in unanimous agreement by all raters. The results are illustrated in Table 4.

Table 4

Participant's Level of Reflection

JOURNAL	LEVEL OF REFLECTION
Teacher B	4
Teacher B_2	3
Teacher C	2
Teacher P	3
Teacher G	1

In addition to the journals, the participants completed two online surveys to provide more information about attitudes and technology implementation. Both of the surveys utilized in this study contained questions adapted from previously validated surveys. The LoTi survey, described in chapter 2, was used to determine the level of participant technology implementation at a post-program time interval of one year. The LoTi Survey measures three areas of classroom technology practices among teachers: Level of Technology Implementation (LoTi), Personal Computer Use (PCU), and Current Instructional Practices (CIP). The survey consists of 50 items, 40 of which represent the LoTi area and the eight levels of technology implementation. The PCU area is represented by five items and the CIP area is represented by five items. The items in the CIP measure the degree to which the teachers' instructional practices are student-centered (Moersch, 1995).

The second survey was used during the practicum course as a pre/post measurement that consisted of a compilation from three separate instruments: The

Stages of Adoption of Technology, the Educational Technology Infusion and Teaching Methodology, and the Self-Efficacy Teaching and Knowledge Instrument for Teachers using Technology.

The Stages of Adoption of Technology (Christensen, 1997) is a single item self-assessment instrument of adoption of technology, based on earlier work by Russell (1995). There are six possible stages in which educators rate themselves: stage 1 - awareness, stage 2 – learning the process, stage 3 – understanding and application of the process, stage 4 – familiarity and confidence, stage 5 – adaptation to other contexts, and stage 6 - creative application to new contexts.

The Educational Technology Infusion and Teaching Methodology (Infusion) instrument looks at the frequency at which technical assistance, instructional assistance and teacher and student behaviors relating to technology use occur. The Self-Efficacy Teaching and Knowledge Instrument for Teachers using Technology (Self-Efficacy) instrument is a self-report measure for confidence in the use of technology for personal and instructional purposes. Both of these instruments are available from the Insight Web site at: http://insight.southcentralrtec.org/index.php. Insight is the SouthCentral RTEC Instrument Library and Data Repository which is a cooperative partnership between Southwest Educational Development Laboratory and the Texas Center for Educational Technology. On the instrument, teachers indicate, on a 5-point Likert scale, the degree to which they agree or disagree with statements about teachers' comfort, confidence, and understanding of teaching with technology. The instrument was tested by the researcher during the practicum course in fall 2003 and resulted in a Cronbach alpha for Infusion of 0.91 with 19 items and for Self-Efficacy was 0.92 with 14 items.

The qualitative analysis of the journals was a two-part process. First, the level of reflection was determined by using the 4-level coding scheme developed by Leung and Kember (2003). The four levels of reflection are: habitual action (level1), understanding (level 2), reflection (level 3), and critical reflection (level 4). Each level has descriptors that distinguish the characteristics of the level. For example, in order to determine if a response was reflection (level 3), evidence of the following descriptors must be present in the journal response: application of concept to practice and related to personal experience; concepts were interpreted in relation to personal experience; specific situations of practice were discussed in relation to concepts and theories being taught; and personal insights will go beyond book theory. The researcher used the descriptors during the coding process to identify and develop the dimensions of each level while looking for patterns or behaviors exhibited in the responses at each level.

Journals were divided into fifteen sections, with each section depicting one week during the semester. All four raters coded each section based on their interpretation of the descriptors for the appropriate level of reflection demonstrated in the responses. Differing interpretations of the participant's responses were discussed following the coding phase of the data analysis. During the discussion, rater 2 described her interpretations of the responses for each level as: (level 1) a summary of the text or a description of action, (level 2) evidence of comprehension, (level 3) personal application and interpretation, and (level 4) evidence of analysis that reconfirms or changes basic pedagogical beliefs. This was confirmed as "very similar" to the interpretations of the coding levels by the other raters. With all raters in agreement of their interpretations of

the coding scheme, the discussion moved to the differing interpretation (coding) strategies.

Raters 1 (the researcher) and 3 each considered the weekly responses in parts (separate thoughts or sentences), instead of as a whole, which was also how raters 2 and 4 considered each response. After rating each part of the response, two raters (1 & 3) considered the majority of rating for all parts to be the level of reflection for the weekly response. This discussion revealed that differences arose from the raters' interpretation of the significance of what was written and whether the weekly passage was coded as a whole or in parts. The differences of the interpretations were illustrated using a response to the weekly prompt: "What do you see as your strengths and weaknesses when looking at accountability for designing your instruction?" to which one teacher replied:

> My strength in designing instruction is in the areas of developing higher order thinking activities and in developing authentic assessments. I have used unit based lessons and rubrics for several years.
>
> A weakness that I have noticed since the onset of this class is in the area of feedback and self assessment. I need to make time in each lesson for feedback as outlined in this course. Ongoing continual feedback is something that I will try to incorporate in my lessons from now on. In addition, the checklist I created for my unit plan was a successful way to incorporate peer and self assessment. I had never used a checklist before and was surprised to see how the students responded and used it for improving their reports.

The ratings for this response were split, with raters 1 and 3 rating the response as critical reflection (level 4), while raters 2 and 4 rated the response as reflection (level 3). During the raters' discussion, it was determined that when the response was considered as a whole, it was interpreted as understanding of the content with application to practice. When it was considered in parts, many of the parts were interpreted as being evidence of critical reflection. Raters 1 and 3 both referenced the statements: "Ongoing continual feedback is something that I will try to incorporate in my lessons from now on" and "I had never used a checklist before and was surprised to see how the students responded and used it for improving their reports" as evidence of a change in practice, leading the raters to score this response as critical reflection.

Although each section was coded separately and there was some discrepancy among the raters' interpretations, all were in agreement with the overall ratings for the Level of Reflection demonstrated in each journal. During the discussion about the overall level of reflection for each journal, the participant's responses were reviewed in order to determine the degree of change evident in their perceptions over time. It was determined by the raters that a journal would receive a rating of critical reflection (level 4) if the responses demonstrated evidence of the questioning of foundational beliefs in the way the participant perceives her teaching practices with a description of a complete change in those practices. If this evidence was not present, the journal was rated at the level indicated by the frequency of the coding for all responses. All faculty raters were in agreement with the final journal ratings for the level of reflection. Each of the five journals will be discussed as individual cases.

Second, the content and objectives of the practicum course provided a coding structure of three specific areas associated with successful professional development: action research, assessment, and leadership. The three areas constituted the basis for the course design used by the researcher when the course was developed and are described below. Patterns emerged during the qualitative analysis that provided a dimensional aspect for each area. The emergent patterns are presented in each case and examined within the cross-case discussion.

Action research is a cyclical process that provides a framework for reflecting on one's own practice. The steps for the process were taught during the course to encourage the teachers to define a problem that they were facing in the classroom, use their new knowledge about the use of technology as a means to improve instruction, plan a unit of instruction, implement the instruction, and then reflect on the process in order to improve instruction during the next cycle.

The goal of assessment is to provide students with the opportunity to demonstrate their understanding of a topic during the instructional process. The teachers in the practicum course were encouraged to consider what and how they wanted their students to be able to demonstrate understanding during and at the end of the instructional unit. The leadership area of the practicum was included in the course to encourage the teachers to take a leadership role in their schools and communicate the issues faced when implementing technology in the classroom with their colleagues.

A component of action research is collaboration and sharing of information in order to validate one's practice. The initiation of collaborative practices is one aspect of

the leadership role. All of the objectives for the practicum were presented as part of the action research process and many examples of the process were presented to the participants during the course.

Feelings and behaviors that were expressed by the participants were coded to add dimensionality within the course content structure; action research, assessment, and leadership. These feelings and behaviors were compared with the characteristic descriptions of the levels of reflection and the levels of technology implementation. The emergent patterns are presented in each case and examined within the cross-case discussion.

Verification Process

In order to ensure accurate representation of the participants, Creswell (2003) recommends eight primary strategies in order of frequency of use and ease of implementation (p. 196):

- Triangulate different data sources of information
- Use member-checking to determine the accuracy of the findings
- Use rich, thick description to convey findings
- Clarify the bias the researcher brings to the study
- Present negative or discrepant information that runs counter to themes
- Spend prolonged time in the field to develop an in-depth understanding of the phenomenon
- Use peer debriefing to enhance the accuracy of the account
- Use an external auditor to review the entire project

Several of these processes were used for verification of this study. The researcher clarified her relationship to the participants and the content of the journals used in this study. She was the instructor for three of the five participants and the designer of the practicum course for which the participants kept reflective journals as a requirement for the course.

The use of the Kember coding scheme to determine the level of reflection demonstrated in the participants' journal responses and the three areas of the course content provided a structure for the data analysis. The NVivo software package was used during the qualitative analysis of the journals and allowed the researcher to gain an impression of the dimensions within the general structures (levels of reflection and course content areas). The researcher also asked three colleagues from the college of education faculty at Texas A&M University – Texarkana to rate the level of reflection demonstrated in the journals to verify the accuracy of the results of the coding process.

The results of both surveys were used to triangulate the data by matching experiences described in the journals to behaviors associated with various levels of technology implementation and attitudes about the use of technology. The researcher provided a rich description of technology implementation practices and examples of the reflective processes. Any negative or discrepant information was also included to allow readers to determine the trustworthiness of the researcher's interpretations and conclusions.

Ethical Considerations

As part of the data collection process, each participant was advised of the purpose of the study and assured that the information would be stored in a secure

location and destroyed after two years. Any information about a participant or participant's place of employment that was a part of the final report was kept confidential by omitting the names. The names of the participants were not used in the final report, only the first letter of the last name. A final copy of the report will be provided to any of the participants, if requested.

The results of the data analysis from the five participants are presented in a multiple case study format. In each case the researcher discussed the coding process for assessing the level of reflection rating assigned to each journal and the qualitative analysis of the journal in relation to the course content and the participant's expressions of their understanding of technology implementation with descriptions of their practice. In the cross-case section, the researcher discussed the common themes that emerged to describe the dimensions within the levels of reflection and the levels of technology implementation.

CHAPTER 4

FINDINGS

The purpose of this qualitative multiple case study was to determine whether a relationship was evident between the levels of reflection and the levels of technology implementation in five practicing teachers who completed the Technology Applications Certification Program in the Department of Technology and Cognition at the University of North Texas. The following research questions were examined in this study:

1. What is the relationship between a teacher's level of reflection about technology implementation, as evidenced in journal entries during a professional development course, and the teacher's level of technology implementation in her or his own classroom?
2. What is the relationship between a teacher's level of reflection about technology implementation, as evidenced in journal entries during a professional development course, and changes in the teacher's attitudes and self-efficacy regarding technology implementation in the classroom?
3. What factors, as perceived by the teachers and evidenced in their journal entries and survey responses, support the implementation of technology?

In the first section of this chapter the researcher presents the findings of the individual case studies and in section two the results of the cross-case analysis are presented. In each section, the data will be analyzed from two perspectives: the Level of Reflection based on the Kember coding scheme, and the teachers' perception of the practicum course objectives and assignments as recorded in their journals. The researcher also presents the teachers' interpretations of the course objectives in

relation to descriptions of what was happening in their classrooms in terms of technology implementation. The three categories of the course objectives were: action research, assessment, and leadership, with action research established as the overarching theme of the course.

Data were obtained from the two self-assessment surveys about attitudes, self-efficacy and technology implementation practices and used to provide another dimension to the qualitative analysis. The two self-assessment surveys helped the researcher identify factors and behaviors that may be relevant to successful implementation of technology in the classroom. The LoTi survey instrument measured three areas of classroom technology practices among teachers: level of technology implementation (LoTi), personal computer use (PCU), and current instructional practices (CIP). The second survey provided insight to the participants' attitudes and self-efficacy for teaching with technology. Each participant's measures will be discussed within the case in relation to the expected behaviors for each measure.

All participants completed the same professional development program that consisted of five graduate-level courses aligned with the State Board for Educator Certification standards for Technology Applications in the state of Texas. All participants were practicing teachers or instructional specialists employed in Texas public schools and were seeking an additional Technology Applications Certification. Demographic data from the both online surveys were compared with information reported on Academic Excellence Indicator System (AEIS) 2003-2004 reports to compare the sample population with a representative sample of Texas educators. Variables such as gender,

highest degree held, and years of teaching experience were examined. The comparison of the two data sets is illustrated as percentages in Table 5.

Table 5

Comparison of Sample Population to AEIS 2003-2004 Report

Variable	Sample Population	AEIS 2003-2004 report
Gender		
Male	0.0%	22.7%
Female	100%	77.3%
Years of Teaching Experience		
One to Five	0.0%	29%
Six to Ten	0.0%	18.9%
Eleven to Twenty	60%	24.8%
More than Twenty	40%	20.9%
Highest Degree Held		
No Degree	0.0%	1.1%
Bachelors	20%	76.4%
Masters	80%	22.0%
Doctorate	0.0%	0.5%

Comparison of the demographic data of the sample population to the overall state teacher population demonstrates the five participants possessed more teaching experience and pursued more post-graduate coursework than the typical Texas teacher population. Because the participants were practicing teachers enrolled in graduate level

coursework that required a minimum of five years experience, slight differences in years of teaching and degrees held were expected. Each of the five participants' data is presented in the following case studies. For confidentiality, only the initials of the last name, along with the word "Teacher" (e. g., Teacher B), are used to distinguish among the participants.

Individual Case Studies

The following case studies present information about the teachers' practice, results of the various measures used in this study, and an in-depth analysis of the teachers' journal. Each teacher was considered as a separate case for the purposes of this study.

Teacher B

Teacher B is an experienced teacher (27 years) with more than 30 hours of technology professional development within the last two years, prior to and including the study period. She earned a master's degree and is an instructional specialist for several elementary schools in a large public school district in Texas. As an instructional specialist, she works with many teachers to help them develop and implement technology-enhanced lessons. She works individually and in small groups with teachers and was present in a support or co-teaching capacity during instruction.

Level of Reflection for Teacher B

When determining the levels of reflection demonstrated in Teacher B's reflective journal, the researcher noted occurrences of responses for each level as identified by the four raters. The responses were coded by week to determine individual instances of

each level of reflection and to explore the characteristics and dimensions of the levels. The frequencies of the codes for each level of reflection are presented along with representative journal responses illustrative of the dimensions of the particular level of reflection. There were no instances of coding for habitual action (level 1). There were 16 instances (26.67%) coded at understanding (level 2), in which the participant demonstrated an understanding of the theoretical concepts presented during the course. The following journal entry is an example of the evidence coded as understanding:

> How can you determine if the use of technology will improve student learning? In a unit plan with a specific action research question, assessments must be built into the unit that is ongoing. These ongoing assessments allow time for student self adjustment as well as information on modifications that may be made in the next cycle. This class will help me to get started on finding answers. By looking at where a student is currently and where the teacher and school want the student to be, technology can be incorporated along with other instructional strategies to improve student learning (Teacher B Journal, 2003).

Most of the ratings in this journal, 28 instances (46.67%) were coded at reflection (level 3). For this level, the raters looked for evidence that described applications of newly learned concepts in participants' practice. The following journal entry is an example of the evidence coded as reflection:

> I have decided to forgo the personal goals that I submitted and my plan for doing my action research on the use of Microsoft Office products on the elementary level. Instead, I have arranged to do my unit plan with [a colleague,

name omitted] on the use of a word processor to improve the students' writing skills. We met together with the 4th grade teachers at [one, name omitted] elementary and discussed the 2nd six weeks of school. The 4th grade teachers will teach non-fiction writing and study planets during this six weeks. My unit plan will encompass research on planets, writing, revising, and inserting graphics.

This revision does change my personal goals; however, it will be more authentic than the research plan I had concerning Microsoft Office in the Elementary classrooms. If I had completed the research on Microsoft Office products, it would not lead to anywhere. [A district official, name omitted] has clearly defined our districts policy on Microsoft Office products. This new action research plan is one that many of the school's in our district need to improve writing skills. This is action research, so I do not feel that I am too lost, I would rather have a project that I can effectively share with my district (Teacher B Journal, 2003).

There were also nine instances (25%) coded at critical reflection (level 4), which demonstrated a change in practice. The following journal entry is an example of the evidence coded as critical reflection:

The biggest accomplishment I have made through using action research is to look deeper into my own practices as an educator collaborating with other educators to find new methods for presenting instruction to students. The networking with the fourth grade team was welcomed and needed (Teacher B Journal, 2003).

Teacher B's journal demonstrated a reflective nature that met the requirements for an overall rating level of reflection of critical reflection (level 4). According to Kember (2005, personal communication), critical reflection occurs over time, therefore the journals were re-evaluated. For this second evaluation the raters used a holistic approach to determine if the critical reflection process was sufficiently described in the journal. There were nine instances of critical reflection in the journal in which she demonstrated signs of questioning her beliefs and comparing them with others. There was a strong sense of depth in her responses that illustrated the dimensions of the critical reflection process. The following entry was coded as critical reflection with evidence of a "diagnostic" dimension within the critical reflection category.

> I feel that overall I have not effectively convinced my colleagues (five other specialists) that we must do more on our level for the elementary computer labs. For instance, I feel that our curriculum for our department is incomplete and desperately lacking (Teacher B Journal, 2003).

The following entry was coded as recognition of a "need for change," which represents the "reconstruction" dimension of the critical reflection process.

> I implemented my plan this week. The students were excited about the project. As the week progressed, I understood more about action research. There are a few things that I will change in my next cycle (Teacher B Journal, 2003).

An objective of action research is to focus on a problem, research a possible solution, implement the solution, and reflect upon the results. The cyclical process encourages self-reflection on practitioner actions for continuous improvement in

practice. The cycle is mirrored in the transformative aspects of the critical reflection process. The following journal entry is representative of this process:

> A weakness that I have noticed since the onset of this class is in the area of feedback and self assessment. I need to make time in each lesson for feedback as outlined in this course. Ongoing continual feedback is something that I will try to incorporate in my lessons from now on. In addition, the checklist I created for my unit plan was a successful way to incorporate peer and self assessment. I had never used a checklist before and was surprised to see how the students responded and used it for improving their reports (Teacher B Journal, 2003).

All of the cited entries evinced the teacher was engaging in critical reflection. She described frustrations, a deep understanding of her practice and changes she was making that were representative of a "transformation" occurring in her practice. Because of those descriptions, the raters believed she had completed the critical reflection process, therefore evaluated the overall journal as critical reflection (level 4).

Course Objectives: action research, assessment, and leadership of Teacher B

When the practicum began, Teacher B expressed her plans for the semester in her reflective journal in which she wrote "….Goals for this class will be centered on my thoughts as a leader in my district concerning the implications of curriculum for students." She set out to "understand the process of action research…review and firm my thoughts on Microsoft Office products for grades K-6" (Teacher B Journal, 2003). During the second week of the course, she expressed "frustration" with her administrator's lack of understanding about the needs and use of technology.

> I had to install Microsoft Office on an ACT 4 lab, by principal request. Still he could not justify why to use Microsoft instead of AppleWorks. Another principal had a server installed this summer, but did not understand in the least how to use it or set it up. He thought all schools needed servers. Most of our labs utilize a file sharing machine for storage since they do not have a server. Frustration about the ignorance of administrators about technology use is more than I can handle in an action research project for this semester.
>
> In looking over my journal for the last two weeks, and since I am not directly in the classroom, I ask how can I effectively improve the quality of technology education for our students in the district. This question addresses the first question for this journal entry. I see a pattern concerning Microsoft Office products and their use in the elementary setting has popped up, not only with the returning Edison schools, but with [the SAE Foundation partnership school]. Since I did develop lessons for these products in my previous CECS 5020 class, I might use them in my action research. [What can I do to improve the areas I am concerned about?] (Journal prompt) Which leads me to [the] second question for this journal entry, I would like to see if Microsoft Office products are more advantageous than AppleWorks (Teacher B Journal, 2003).

Her response to the journal prompt that week also demonstrated a connection between the course objectives and her experiences at work with concerns about using technology to improve student achievement. "Frustration" is a dimension of critical reflection and usually indicates the beginning stages of a change in practice. At that stage she was trying to define a problem that was occurring in her practice and that

could reasonably be addressed during the semester, which is essential to the action research process.

Action Research for Teacher B

Teacher B demonstrated her understanding of the action research process and the relationships among action research, assessment, and leadership. By the fourth week of the semester, she was starting to focus more on improving student learning instead of the "frustrations" with the different philosophies of the administrators. Her response illustrates how the reflection that occurs during an action research process refocused her actions during times of conflict. Her remarks also illustrate the beginning process of critical reflection, which, according to various investigators, must occur before a transformation can begin to take place in practice.

> I have decided to forgo the personal goals that I submitted and my plan for doing my action research on the use of Microsoft Office products on the elementary level. Instead, I have arranged to do my unit plan with [an elementary teacher, name omitted] on the use of a word processor to improve the students' writing skills. We met together with the 4th grade teachers at [one, name omitted] elementary and discussed the 2nd six weeks of school. The 4th grade teachers will teach non-fiction writing and study planets during this six weeks. My unit plan will encompass a research on planets, writing, revising, and inserting a graphics.
>
> This revision does change my personal goals; however, it will be more authentic than the research plan I had concerning Microsoft Office in the Elementary classrooms. If I had completed the research on Microsoft Office

> products, it would not lead to anywhere. [A district official, name omitted] has clearly defined our districts policy on Microsoft Office products. This new action research plan is one that many schools in our district need to improve writing skills. This is action research, so I do not feel that I am too lost, I would rather have a project that I can effectively share with my district (Teacher B Journal, 2003).

Her use of "authentic" in the passage, which represents a dimension of the assessment component of the course, demonstrates her understanding of the importance of the coursework and her conscious effort to integrate the new knowledge into her practice. The passage also illustrates her understanding of how technology was used as a tool or strategy for instructional purposes, not as the main goal of the learning, which is a behavior associated with higher levels of technology implementation. Her unit plan provided a student-centered approach that focused on the writing process, not the technology, demonstrating her attempt to improve student achievement through technology implementation during instruction.

> Through my action research, I have learned that collaboration with the elementary teacher does make for better student performance when a class comes into the lab. I realize that the change and effort will have to initially come from me. Collaboration is taking more time on my part, but the benefits are well worth the time. Hopefully, once teachers become comfortable with collaborating, they will be able to initiate some of the activities. Currently I am coming up with the lesson ideas. For professional development, I am meeting with teachers by

grade level. The teachers are sharing their objectives for a particular month or learning deficit and I am working on giving them possible integration activities.

The biggest accomplishment I have made through using action research is to look deeper into my own practices as an educator collaborating with other educators to find new methods for presenting instruction to students. The networking with the fourth grade team was welcomed and needed (Teacher B Journal, 2003).

The characteristics of action research include recognizing and defining a problem that is occurring in practice. Teacher B expressed "frustration" with administrator philosophies about the use of technology, but realized that she could not control that situation. At that point, she re-focused her attention toward a problem that she did have control over, which was helping the elementary teachers improve student learning with technology implementation strategies. Her realization represents both the beginning stages of the action research and of critical reflection processes, thus demonstrating the importance of reflection in learning. Her implication that the use of technology can support the teachers and students as they work toward the school district's goal of improving student writing skills reinforces her self-rating on the Stage of Adoption of Technology measurement.

Assessment of Teacher B

Assessment was the second course objective and peer-review was used as the major strategy during the course. Teacher B's responses demonstrated her excitement with the strategy and her intentions of using peer-review as an assessment tool for her students. She also described the use of rubrics and exemplars in her instructional unit in

relation to the use of a "self-assessment strategy" for the students and criteria for what she wanted the students to know at the end of the instructional unit. Her assessment strategies represent the dimensions of self-assessment and peer-assessment within the course content objective.

During the 5th and 6th week of the semester, Teacher B began to exhibit signs of excitement toward the unit she was implementing and the students' response to the learning experience. She also expressed the benefit of collaboration (as a learner) during her action research process. She had a meeting with her peers the previous week to review each other's instructional units before implementation began and incorporated the peer review activity into her instructional unit. Her actions and reflections demonstrate a direct link between her experience and her understanding of that experience as a benefit for student learning.

> On Tuesday night, I asked for peer review of my action plan from [name omitted] cohort and made quite a few changes. I am much happier with my changes and feel that the face to face peer review was much more helpful than the written peer review that I received later in the week. Below are some changes that I made:
>
> - I simplified and clarified my question and changed from 3 writing assignments to just one.
> - I defined what non-fiction meant and clearly stated why I chose this writing assignment.
> - I modified my reflections to state the present and not what I want to happen.

> My unit plan will encompass writing. In designing standards of assessment for this unit, I will use the conventions rubric that [my, name omitted] ISD uses. This is an established standard for our district. I will also create a checklist for the word processing aspect of the unit. This will allow for self adjusting and peer review [by the students]. Peer review of my unit plan was positive. I enjoyed reading other units as well. Action research is truly our individual plans (Teacher B Journal, 2003)!

In this response, Teacher B demonstrates the use of peer-review as an assessment strategy that she has experienced, and that she believes will be useful for her students to use. This is an example of a transfer of her new knowledge to her practice in an attempt to provide improved instruction for her students.

She continued her description of assessment in her week 6 entry:

> The individual performance task that I am planning in my unit is actually multifaceted. I want the students to research, organize, and type a nonfiction report. Students will have many tasks to complete for this project. I will supply worksheets to assist the students with research. The fourth grade teachers will assist students in the writing phases. They have agreed to stay in the computer lab and help students as needed in organization of their nonfiction report. I also need for the students to produce a good word processing document with an inserted graphic. I will review word processing techniques and show a sample (exemplar) of a non-fiction report (Teacher B Journal, 2003).

This response also demonstrates a shift in her leadership role. The teachers were now staying in the computer lab in a co-teaching capacity. This behavior suggests that Teacher B initiated collaborative relationships with the other teachers.

Leadership

Peer-review also emerged as a dimension of leadership in conjunction with collaboration, as a strategy to improve student achievement with technology implementation. Her excitement about various collaborations, both with her graduate student peers and her teaching colleagues demonstrated her understanding of collaboration within the context of her role as a leader in the use of technology to improve student learning.

Teacher B highlights how collaboration can be used as a "leadership tool" to improve technology implementation. In her response to the week 8 journal prompt that asked how providing a workshop for other teachers could improve student learning, she described behavior associated with the beginning stages of the critical reflection process and an understanding of how technology implementation could be accomplished in her schools.

> My unit plan was a true united collaboration in a foreseen need of student improvement. With workshops, teachers can become more familiar with best practices in technology [implementation]. Through sharing and brainstorming, teachers can grow with their knowledge of technology use. When a teacher becomes a confident user of technology, they are able to impart that knowledge onto those they teach. Human nature is to avoid areas where we feel inferior. A

> teacher that is not confident in the use of technology will not use technology in the education process.
>
> Keeping information on best practices to one's self is counter-productive to education. Some people feel that if they keep information to themselves, then they have power over someone else and more job security. I feel totally opposite. I believe that in sharing information, we build a united front and can have more impact on the learning environment. Students need the skills and applications of technology to be prepared for the demands in the future. Sharing, collaborating, and educating teachers through workshops will better prepare teachers, so they can expose their student's to life's expectations (Teacher B Journal, 2003).

This response suggests that she has a good understanding of the strategies that can increase technology implementation. She began to share her knowledge of technology with other teachers to improve the learning environment.

Technology Implementation of Teacher B

Teacher B completed the practicum and her reflective journal in December 2003. In February 2005 she completed the two surveys used in this study. Her responses to the Stages of Adoption of Technology survey suggest that she perceives herself to be creative with the application of technology to new contexts and was able to use it as an instructional tool within the curriculum, which is the highest stage of adoption of technology. Her self ranking was supported by her expressed behaviors in the journal responses. Her LoTi survey responses suggest that she was very confident with the implementation of technology consistent with the state standards, "best practices" for

instruction, and provides a student centered curriculum in her Current Instructional Practice (CIP). Her Self-Efficacy and Teaching Methodology survey results suggest her comfort level while teaching with technology was very high. According to her survey responses, she primarily uses student-directed projects that encourage self-directed student learning and continuously tries new approaches suggested by research/experts to discover new ways of teaching her curriculum.

Teacher B's reported level of technology implementation at the time of the survey (February, 2005) was level 5 (expansion), which is described by Moersch (2001) as:

> Technology access is extended beyond the classroom. Classroom teachers actively elicit technology applications and networking from business enterprises, governmental agencies (e.g., contacting NASA to establish a link to an orbiting space shuttle via the Internet), research institutions, and universities to expand student experiences directed at problem solving, issues resolution, and student activism surrounding a major theme/concept. (p. 24)

Many instances were noted in her journal, written during the fall 2003, in which she demonstrated behaviors associated with high levels of technology implementation. The connections she expressed between the knowledge from her coursework and the practical applications in the classroom support the researcher's judgment of her high level of technology implementation. Most of her journal responses were illustrative of a LoTi level of 4b [integration (routine)] which is described by Moersch (2001) as:

> Technology-based tools are integrated in a routine manner that provides rich context for students' understanding of the pertinent concepts, themes, and

processes. At this level, teachers can readily design and implement learning experiences (e.g., units of instruction) that empower students to identify and solve authentic problems relating to an overall theme/concept using the available technology (e.g., multimedia applications, internet, databases, spreadsheets, word processing) with little or no outside assistance. Emphasis is again placed on student action and on issues resolution that require higher levels of student cognitive processing and in-depth examination of the content (p. 24).

Summary of Teacher B

The premise of technology implementation implies a change in practice as teachers integrate technology to improve student learning. The characteristics of critical reflection imply that a transformation takes place over time. The purpose of the practicum course was to provide the teachers with a structure to reflect upon their practice during the process of change. Throughout her journal, Teacher B used various descriptors that clarified the dimensions of the three course content categories.

The responses in her journal represent behaviors that reinforce her efforts to collaborate with other teachers to implement technology in all areas of the curriculum. She also demonstrated a solid understanding and appropriate applications of the course content. The unit lesson plan she developed and described in her journal provided opportunities for her 4th grade students to express their understanding of the writing process by creating a non-fiction report, using a variety of technology tools. The unit required students to research a topic, organize information, and express their understanding of the writing process using words and graphics. She provided assistance for the technology requirements, but writing was the focus of the learning experience.

The unit plan was an example of Teacher B's use of technology to enhance content learning.

The analysis of Teacher B's survey responses and journal entries suggests she demonstrated reflective behaviors during her coursework that may have had an impact on her level of technology implementation. She clearly demonstrated a level of technology implementation that corresponded to the LoTi level of 4B integration (routine) in her journal writing during the fall 2003. She also demonstrated a complete process of critical reflection. Her growth in and understanding of technology implementation was evident in her reflections throughout the semester. She began to lead by example and demonstrated a change in the way she worked with the classroom teachers directly to design learning experiences for the students in which technology was implemented seamlessly as a tool or strategy for learning rather than as the focus of learning. Her behavior was indicative of higher level technology implementation. Her responses to the LoTi questionnaire indicated she had achieved a higher level of technology implementation, level 5 (expansion), suggesting that she continues to change her teaching practices.

Teacher B_2

Teacher B_2 is an experienced teacher (10-20 years, according to the survey range), with more than 30 hours of technology professional development within the last two years, prior to and including the study period. She earned a master's degree and is working toward a doctoral degree. She teaches health and physical education at the middle school level in a public school district in Texas. She reported that her students use computers for instructional purposes "a few times a week" and she has "one to

two" computers in her classroom. She has three years experience as an Intel "Teach to the Future" trainer and works with many teachers to help them develop and implement technology enhanced lessons.

Level of Reflection of Teacher B_2

When determining the levels of reflection demonstrated in B_2's reflective journal, the researcher noted the occurrences of responses for each level of reflection as identified by the four raters. The frequencies of the codes for each level of reflection are presented along with representative journal responses illustrative of the dimensions of the particular level of reflection. There were no instances of coding for habitual action (level 1). There were only 2 instances (5.5%) coded at understanding (level 2), in which the participant demonstrated an understanding of the theoretical concepts presented during the course. There were not any representative journal entries for this rating because each instance was a single coding occurrence in which only one rater coded this level while the other three raters coded the same section reflection (level 3).

Most of the ratings, 21 instances (58.3%) were coded as reflection (level 3). For this level, the raters looked for evidence that described applications of newly learned concepts to participants' practice. The following journal entry is an example of the evidence coded as reflection:

> After reading the rough drafts, I graded the grader for their constructive critiques and also graded the rough drafts for the same elements as did their peers. I saw that the students are still not understanding [*sic*] how to integrate the facts into their stories without making abrupt inserts, so I decided to write my own story. Prior to handing back their rough drafts, I read my story to the class. I had them

> once again list the information they heard that they would include as an effect, statistic, or history fact. They listed fourteen different facts. They were also asked to critique the story, not knowing I had written it. They made very good suggestions and critiqued in a very positive way. Many of the suggestions will be made part of the story. I think they now have a better idea of what they need to do to correct their own story, so I handed back their rough draft. Their final paper will be due next week (Teacher B_2 Journal, 2003).

There were also 16 instances (26.67%) coded as critical reflection (level 4), that demonstrated a change in practice. The following journal entry is an example of the evidence coded as critical reflection:

> A really interesting question was asked of me today. One of my students asked if it was alright if they use a bibliography software program to prepare their bibliography. I said yes because they were using resources at hand to do a mundane task. But I'm not sure how I really feel about it. Should they memorize the form of a bibliography or just know the information they need to collect and that the purpose is to give credit where credit is due? After all their bibliography form is MLA through high school and then it changes to APA for college work. Why is that? I'll have to ask an English teacher to explain the difference to me (Teacher B_2 Journal, 2003).

All of the cited entries evinced the teacher was in the early stages of the process of critical reflection, but did not demonstrate a depth of description representing a culmination of the process in order to be considered as an overall level of critical reflection. Teacher B_2's journal was incomplete, she omitted the final 4 weeks of

responses. The holistic analysis suggested that if those responses had illustrated the completion of the critical reflection process, her journal would have been rated as critical reflection (level 4). Instead, the four raters judged her overall rating to be reflection (level 3).

Course Objectives: action research, assessment, and leadership of Teacher B_2

When the practicum began, Teacher B_2 expressed her goals for the semester in her reflective journal:

> Goal 1: Develop authentic assessments for at least 2 of my Health units during this semester.
>
> Goal 2: Share this concept with at least 2 of my co-workers.
>
> Goal 3: Survey the students about assessments and do one experimental comparative assessment to evaluate the effectiveness (Teacher B_2 Journal, 2003).

After the first week, she began questioning her beliefs and practice in terms of student assessment. The following journal response illustrates the beginning stages of action research and critical reflection since both require a reflective study of one's practice.

> My first impression of the course curriculum and the concept of authentic educative assessment is, "Why haven't we been doing it this way?" This all seems like common sense. This type of assessment would certainly facilitate higher order thinking in our students and teach them how to self-assess, a novel idea. My next thoughts were; how do I do this without a tremendous amount of work? Should I ever give a "conventional" test again? When should I use one or the other? and [*sic*] How will I ever have time? (Teacher B_2 Journal, 2003).

In her week 3 response, Teacher B_2 began to recognize that all aspects of the course, including her assignments, were designed to be part of the action research process and should be inter-related. Her collaborative efforts with the Adventure Learning Program (ALPS) teacher and the art teacher have provided their students with a collaborative learning experience that integrated art, technology, writing, and health.

> The unit plan assigned in lesson 3 was difficult for me to get a handle on while I was so involved in the project on which my Health classes were working. So I decided to incorporate it into the project. The plan is to use the 4th & 5th grade Alps students to make a game that will cover the objectives of the drug awareness curriculum. This game along with the children's book from my 5th period class project will be included in a kit for all 5th grade classes in the school district. I need to talk to the Elementary schools to find out what and when they learn about drugs. I also need some feedback from the Alps teacher (Teacher B_2 Journal, 2003).

Her behavior was characteristic of higher levels of reflection and demonstrates her understanding of how technology can be used to provide student-centered learning experiences.

Action Research of Teacher B_2

Teacher B_2 demonstrated her understanding of the action research process and the relationships among action research, assessment, and leadership when attempting to improve student achievement using new assessment strategies. She expressed "frustration" when she tried to address too many problems before she re-focused her attention on integration of learning experiences to create the Drug awareness kits for

the elementary schools. Her re-focusing represents both the characteristics of the action research and critical reflection processes, thus demonstrating the importance of reflection in learning.

She provided a good analogy of action research in her week 5 response in which she questioned the connections between her coaching strategies and her teaching methodology. Her reflections on the course readings elicited the following response:

> When reading this chapter, I wrote down several thoughts that a classroom teacher might think.
>
> 1) I was missing the whole technology integration aspect of this course until now. I've decided that technology better be a part for teachers to have time to integrate this assessment strategy into the curriculum. (I wrote that thought on the first page of this chapter, then read my own thoughts on page 119 under the subheading Feasible.)
>
> 2) On page 107, I was reminded of coaching strategies that I use when coaching basketball. How can I integrate those strategies into the classroom? After all, we, as coaches, feel that we need to be better than the competition for the most part, so that we will have a winning record, cumulative assessment. But we also feel that if we improve some aspect of the game each time we play, we have succeeded, whether we win or lose. I think that is what applies to learning in the classroom. I just wish we had time to work in the classroom, like we do in athletics. Coaching HS BB, we practice approximately 13 hours per week and played two games; middle school practices approximately 8 hours per week with

one game; in the classroom, we get approximately 4 ½ hours per week including testing or assessment. There's that time thing again (Teacher B_2 Journal, 2003).

This excerpt demonstrates a reflective look at personal experience when considering new information. By reflecting on her personal experiences, Teacher B_2 was able to incorporate the new knowledge in a manner that had direct application to her practice. This continued with her statement:

3) When reading page 108, I began to think about all our preseason games that don't really count when it comes down to district and getting into the playoffs; UIL competitions also have many practice meets before the "real deal." I'm not talking practice for the TAKS test, what if we had time to let our students practice before they had to apply the knowledge?

4) On page 116, the sentence that reads "The test of understanding involves neither repetition of information learned nor performance of practices mastered" reminded me that as a Math teacher, I often felt guilty when I gave my students problems unlike those they had practiced. We definitely need to change our curriculum goals, if we want to teach application and understanding of the knowledge. There were some students who couldn't even do the simple problems, what do we do with them when the state says they have to take Algebra?

5) I like the team concept on page 126 and I also think that is the only way we can change enough to actually allow students to learn for understanding. It seems to be a step in the right direction, but will be a challenge for teachers

> who were not taught using this method (just as technology is a challenge) (Teacher B_2 Journal, 2003).

She also demonstrated characteristics of reflection (level 2) when she referenced one of the readings assigned in the course and reflected on the assessment aspect of the project her students were completing. The reference to prior knowledge and experience illustrates reflective practices and transfer or application of knowledge to new situations. Her expression of "guilt" when testing her students on problems that are "unlike those they had practiced" caused her to reflect on curriculum issues and to conclude that there was a "need to change our curriculum goals, if we want to teach our students application and understanding of the knowledge."

The cyclical characteristic of action research was demonstrated in her description of an event that occurred during her unit of instruction:

> After grading the Drug topics each student had to research, I decided that I needed to give them more feedback, so I showed them a good sample of work that had been turned in, and then I asked them to think about their own research that had been turned in and evaluate where they might have done better. I also made folders containing a good work sample and instructions on writing their bibliography. They could use the folders whenever they had free class time. They were given the opportunity to correct their notes as part of their future paper, but I haven't taken them up for the second time. I'm looking forward to seeing how many take advantage of this opportunity (Teacher B_2 Journal, 2003).

This excerpt demonstrates her application of action research in which she defined a problem in her practice and drew upon research and prior experience to formulate and carry through with a solution.

Assessment of Teacher B_2

Peer review was described in Teacher B_2's journal as a strategy for assessment, which reinforces the researcher's interpretation of peer review as one dimension of the assessment category. The following excerpt also demonstrates the application of Teacher B_2's new understanding of assessment in her practice. This application identifies another demonstration of a change in her foundational beliefs about the concept of assessment, which represents the beginning stages of critical reflection.

> I tried to think about how I would assess this project so that all 8th grade students would have the best chance of succeeding on their drug project. Peer review was an option that I thought would be helpful on the paper, so I added that to my rubric for this project. It will take a bit more time, but hopefully will be worth it for the majority of students involved. I also began to look at things in a different light, as far as really helping students to succeed. I am lucky that I don't have to contend with finishing a certain curriculum, even though I am supposed to cover all the TEKS. But what if by spending a little more time, the students would be able to take some real life skills, such as researching, citing works, and writing a really good paper into their other classrooms and on into their future educational endeavors.

In response to the week 3 journal prompt, "How do I provide effective and ongoing feedback?" Teacher B_2 demonstrated evidence coded as "reconstruction,"

which is a dimension of the critical reflection process. The following excerpt from her journal illustrates her understanding of the concept of using feedback for instructional purposes and a direct application to her practice.

> Before this class, I felt that I was doing a great job in the classroom. I was finding ways to integrate technology, I was modifying and differentiating, and I was using current findings in my lessons, which I practically had to write myself because we were using 13 year old books. But I did not consider feedback to my students as essential to the learning process. I was really bad about using testing as an end, although I would give a retest or throw out a question if nobody understood it. Thinking back, I am amazed that my students learned at all, because I didn't see the need to give them feedback on their own performance. I know that I often learn best when I make a mistake, but then come to understand why it was a mistake, [and] I even quoted this in class. But I didn't see the connection. I am changing the way I give feedback and I think if more teachers would be made to think about the way we give feedback, more of them would come to realize, like I did, that I was not giving the feedback to the students in a way that would help them realize how to accomplish the tasks I set forth for them to do.
>
> After grading the Drug topics each student had to research, I decided that I needed to give them more feedback, so I showed them a good sample of work that had been turned in, and then I asked them to think about their own research that had been turned in and evaluate where they might have done better. I also made folders containing a good work sample and instructions on

> writing their bibliography. They could use the folders whenever they had free class time. They were given the opportunity to correct their notes as part of their future paper, but I haven't taken them up for the second time. I'm looking forward to seeing how many take advantage of this opportunity (Teacher B_2 Journal, 2003).

By providing the students with an example of "good work" and providing them with the opportunity to reflect on their work and how they might improve, she demonstrated a change in her practice. This behavior also demonstrates a transfer of her learning experience to practice by providing her students with the same learning experience. Her awareness was evidenced by her statement, "I know that I often learn best when I make a mistake, but then come to understand why it was a mistake."

She continued to describe instructional events in which she not only provided her students the opportunity to use the peer-review strategy for self-assessment, she also modeled the process and provided feedback in the form of examples of "good work." This behavior illustrates the formative dimension of assessment used to inform students during instruction.

Leadership of Teacher B_2

Peer-review also emerged as a dimension of leadership in Teacher B2's journal. By initiating a collaborative working strategy with her colleagues, she demonstrated characteristics of a leadership role to increase technology implementation at her school. The use of peer review strategies during the collaborations supports the researcher's interpretation of this dimension.

Her recognition of the use of collaborative projects for student learning demonstrates the dimensions of higher level technology implementation and her conscious effort to integrate strategies learned during her coursework with her current practice. Another dimension of leadership is the "ability to encourage others" to ask questions and seek advice. During her week 2 response, Teacher B_2 describes an event that confirms she exhibited that characteristic:

> A teacher at our school, who is a very good listener for troubled at-risk students, asked me if I had a project that a certain student could participate in. She had talked to her mother and her mother was very concerned that she was not involved in school activities and was worried that she would fall in with the wrong crowd and start getting in trouble. So I asked this student if she would be interested in helping with the after school computer graphics club? She seemed very interested and said she would (Teacher B_2 Journal, 2003).

Her willingness to share new information with the campus technology coordinator also demonstrates an involvement with the larger learning community.

During the second week of the semester, she continued to closely examine her professional concerns, which was a demonstration of the beginning stages of the action research process. She focused on using the strategies for technology implementation that she was reading about in her coursework, which represents a transfer from theory to practice.

> Cooperative Learning for Teachers - why not? [*sic*] We believe in the concept for our students, why don't we participate in it as a teacher? Relieve some of the drudgery, let people do what they are best at, and learn from each other. Wow -

> what an idea! To me, all of the articles are saying," Work together, make your profession better, make your students better, and make your schools a better place to work and learn, and back it up by keeping track of the results of new methodologies for teaching. Technology is my thing, how can I use my expertise to help teachers develop into tech-savvy teachers in their own classroom? …I talked to [two colleagues, names omitted] about doing a collaborative project in their classes. [One teacher, name omitted] has Alps (Advanced Placement) 4th - 6th grades at all schools. [The other teacher, name omitted] has 6th grade Art at the Middle School. She and I are also thinking about an after school Computer Graphics program for 6th grade students. This would be a pilot program, so we would use select students (Teacher B_2 Journal, 2003).

Her application of the concept of "collaboration" illustrates the strategy for both leadership and student learning. The researcher noted that "collaboration" and "cooperative learning" are terms that have been used interchangeably both in the literature and by practicing teachers. The issue was discussed by the researcher's students and colleagues in terms of a shared learning experience that provides learners with the opportunity to work together toward a common goal.

Technology Implementation of Teacher B_2

Teacher B_2 completed the practicum and her reflective journal in December 2003. In February 2005 she completed the two surveys used in this study, her responses to the Stages of Adoption of Technology survey suggest that she perceived herself to be creative with the application of technology to new contexts and was able to use it as an instructional tool within the curriculum, which is the highest stage. Her

LoTi survey responses suggest that she was very confident with the implementation of technology as described by the state standards. Her current instructional practice (CIP), a section of the LoTi, was rated as "confident" with "best practices" for instruction, and with a student-centered curriculum. Her Self-efficacy and Teaching Methodology survey results suggest her comfort level while teaching with technology was very high.

Teacher B_2's reported level of technology implementation at the time of the survey (February, 2005) was a level 4b [integration (routine)], which is described by Moersch (2001) as:

> Technology-based tools are integrated in a routine manner providing rich context for students' understanding of the pertinent concepts, themes, and processes. Teachers readily design and implement learning experiences (e.g., units of instruction) with little or no outside assistance and empower students to identify and solve authentic problems relating to an overall theme using the available technology. Emphasis is placed on student action and issue resolution requiring higher levels of student cognitive processing and in-depth examination of the content (p. 23).

In response to the week 8 journal prompt; "What are areas of concern about using technology to improve learning?" Teacher B_2 expressed frustration with the perceived barriers to technology implementation. As part of her coursework, Teacher B_2 conducted a technology needs assessment for teachers on her campus and refers to the results of the assessment as well as her discussions with other students in the practicum course in the following response:

After looking at many of the technology assessments, I have determined that access is crucial and other schools seem to have more of it. There are still ways we can use technology to enhance a lesson, but without adequate access, we cannot allow the students to "learn by doing" as often. Besides access, another limitation to technology use is teacher training. One of the big discrepancies in teacher training is that it does not apply to the curriculum in a subject area. It is much too general. Therefore, along with addressing the access issue, the teacher training module should be addressed. We do [*sic*] have a technology trainer on each campus, and they are teaching all of the teachers who volunteer. Although this is a step in the right direction, it is simply not enough, if we want technology to be the tool of the future, which it is in the rest of the world. By making teachers aware and comfortable with the technology tools, we will be providing students with opportunities for higher level thinking in a constructionist environment.

After recently writing a paper on technology's impact on education, my biggest concern is lack of access. At my middle school, we have no computer lab for general teacher use, and most of us have only one computer in the classroom. With this project, I am having a really hard time getting it done in a timely manner with technology. The research took at least 2 days longer due to lack of Internet access and the typing is taking forever. It takes an 8th grade girl an average of 3 class periods to type a 2 page paper, therefore it takes a class of 25 girls 15 days to type their papers. What do the others do in the interim? Good question; it has been an organizational nightmare. Now during the project

> phase when we should be putting it all together and using those critical thinking skills, we're all too tired to care. The teachers I interviewed and surveyed have the same problem. It is just too much hassle to use technology at this time. No wonder there is no [*sic*] impact (Teacher B_2 Journal, 2003).

The researcher noted seven references to the "lack of student access" to the technology and three references to "inadequate teacher training" for technology implementation. Those references support her response to the LoTi survey question about barriers to technology implementation in which she chose the option that included lack of access and teacher training.

Summary of Teacher B_2

The responses in Teacher B_2's journal described behaviors that reinforce her efforts to use student-centered collaborative projects while collaborating with other teachers to implement technology in all areas of the curriculum. She also demonstrated a solid understanding and application of action research, the need for authentic assessment, and characteristics of leadership. The unit lesson plan she developed and described in her journal provided opportunities for several students, in various classes, to use technology in a manner that provided an in-depth examination of the concept of "drug awareness." The unit required students to create collaboratively a product that required them to research a topic, organize information, and express their understanding of the topic using stories and graphics. She provided assistance for the technology requirements, but understanding the concept was the focus of the learning experience.

Analysis of Teacher B_2's survey responses and journal entries suggest that she demonstrated reflective behaviors during her coursework that may have had an impact on her level of technology implementation. The connections she expressed between the knowledge from her coursework and the practical applications in the classroom support the researcher's judgment of her high level of reflection. Most of her journal responses were illustrative of higher level technology implementation. In February 2005, her responses to the LoTi questionnaire reinforced her demonstrated level of technology implementation, level 4B. This result suggests that she maintains the change in her teaching practices that were described in her journal. According to her LoTi survey responses, she primarily uses student-directed projects that encourage self-directed student learning and she continuously tries new approaches suggested by research/experts to discover new ways of teaching her curriculum. Her survey results are supported by her expressed behaviors in the journal responses

Teacher B_2's growth in and understanding of technology implementation was evident in her reflections throughout the semester. She demonstrated characteristics of transformation (a dimension of critical reflection) in the way she worked with other classroom teachers to design learning experiences for the students. This behavior suggests she was going through the critical reflection process, but did not complete the transformation. Her behavior was also indicative of higher level technology implementation because she placed the emphasis on student action, which required higher cognitive processing, during the peer-review process used during the story writing unit.

Teacher P

Teacher P is an experienced teacher (23 years) with more than 30 hours of technology professional development within the last two years, prior to and including the study period. She earned a master's degree and is an elementary teacher in a large school district in Texas. She enjoys working with the other teachers to create technology rich learning experiences for the students. She reports that her students use the "three to five" classroom computers "a few times a week."

Level of Reflection of Teacher P

When determining the levels of reflection demonstrated in Teacher P's reflective journal, the researcher noted occurrences of responses for each level as identified by the four raters. The frequencies of the codes for each level of reflection are presented along with representative journal responses illustrative of the dimensions of the particular level of reflection. The individual ratings and the holistic evaluation of the journal suggest an overall rating of reflection (level 3). The frequency of occurrence for instances of each level of coding and representative journal response are discussed below.

There were 6 instances (11.54%) of coding as habitual action (level 1), in which the participant demonstrated rote responses to the journal prompt. The following journal entry is an example of the evidence coded as habitual action:

> I have review research action plans. We used to call them units. The format is a little different but they are still units. This looks more like a unit that is going to be published and sold with all the necessary information and material for

implementing the unit. With this in mind, I can do this (Teacher P Journal, 2003).

There were 5 instances (9.6%) coded as understanding (level 2), in which the participant demonstrated an understanding of the theoretical concepts presented during the course. The following journal entry is an example of the evidence coded as understanding:

> The action research plan was hard to develop. I had to decide what the most important goal I want to meet was. Once I reviewed the peers' action research plans, I understand more of what was expected of me. I need to work on my units. I need to focus on what I want the students to learn and how I am going to assess these standards I develop for them. We had our chat. We all got acquainted and had a good discussion on leadership. We agreed that leadership is very important to the system (Teacher P Journal, 2003).

The majority of the ratings, 35 instances (67.3%) were coded as reflection (level 3). The raters looked for evidence that described applications of newly learned concepts to participants' practice. The following journal entry is an example of the evidence coded as reflection:

> I am focusing on the TEKS in science. The TAKS science test is now given in the fifth grade. I want to make sure that my students have a firm foundation. Some of the concepts of science are grade leveled and never studied in detail in other grades. The participants will be K-2 students, student teachers, and classroom teachers. We will have a checklist of the TEKS. As the student masters that TEKS, we will expand to the next one. With the checklist, teachers will be more

> efficient in their presentation. Sometimes we overlook some the TEKS because we don't remember if we taught them. Once we have gathered our data, we will involve the other classroom teachers to our findings, will encourage, and demonstrate how we conducted the research. We will ask for peer evaluations of our findings. At that point, we will modify or expand our objectives (Teacher P Journal, 2003).

There were also 5 instances (9.6%) coded as critical reflection (Level 5), which demonstrated the beginning of change in her practice. The following journal entry is an example of the evidence coded as critical reflection:

> I have been sharing my experiences through my students and telling and showing what I have learned. The teachers come to me when they have a problem instead of our busy tech director. I depend too much on paper and pen assessments. I am willing to incorporate technology into every aspect of the curriculum (Teacher P Journal, 2003).

All of the cited entries evinced the teacher was in the early stages of the process of critical reflection, but did not demonstrate a depth of description representing a culmination of the process in order to be considered as an overall level of critical reflection. The holistic analysis resulted in a rating of reflection (level 3).

Course Objectives: action research, assessment and leadership of Teacher P

When the practicum began, Teacher P expressed her goals for the semester in her reflective journal:

- to better integrate my classes with technology,

- to develop an on-going scope and sequence for the technology classes I teach,
- to make technology more than just a game,
- to become organized, and
- to be able to teach more fellow teachers some of the new innovations in technology I have learned (Teacher P Journal, 2003).

The goals illustrate her curiosity and excitement for learning about the use of technology and sharing new information with other teachers. Her goal of making "technology more than just a game" suggests a "frustration" with the improper use of technology.

Action Research of Teacher P

She began the semester by reflecting on her practice and questioning her actions. This behavior was representative of the beginning stages of action research in which one determines a problem to be addressed. The following excerpt illustrates the process within the context of technology implementation:

> I teach K-2 computers. I try to follow the TEKS the best I can. I have researched other states' guidelines on what is expected of K-2 students. Our TEKS are very vague as to what Kindergarten should know versus what first and second should know. I have used Learning.com with these classes to make the student more familiar with the components of the computer and to gain mouse control. I have asked my teachers to bring stories the students have written so that we could use them in our class. It is still early this year, but my teacher said she would work on having something for us to focus on. I want to use the Internet for

more things except for online coloring and puzzles. I do know that these activities help with mouse control, but every week (Teacher P Journal, 2003)?

During the second week of the semester, Teacher P expresses concerns about improving student achievement and describes actions that she can take to address her concerns:

> My main concerns are the computer level each child has, planning time for the students to have extra computer time, and the TEKS. I have a hard time trying to follow the TEKS when they are so general (K-2). I have so many things I want to accomplish and so little time. I want my students to be exposed to all phases of technology. I am stressed that my schedule does not allow me to fully develop my students' ability. I know that if I had the time, my students could do so much more. I have no doubts that technology will improve my students' achievement.
>
> The main thing I need to do is plan and plan again. This will allow time for the students to work on the computer. I have borrowed some technology books from the ESC. This has helped me to organize my ideas about what I need to teach at the right time. I can improve the time factor by rearranging my priorities. I need to focus more on my students and less on these book fairs and magazine sales. Discipline is also a factor. This is a tough class, they are a very social minded class and education is not on their agenda. The computer has made a positive effect on their discipline (Teacher P Journal, 2003).

Her perception that the "computer has made a positive effect" in the area of discipline supports the research that suggests more student-centered learning activities and

higher level technology implementation strategies create authentic learning experiences that involve students in their learning. She did not describe any events to support her perception in this instance, but she did express her understanding about her priorities and re-directed her focus to the students.

Her level of understanding was further illustrated when she expressed surprise about the course objectives. She demonstrated the "personal insights" characteristic of reflection by considering the coursework in relation to her experience, even extending her experience as she acknowledged a different perspective:

> This course is not what I thought it was going to be. I thought we would develop some units that integrated technology. I was unaware that it was a self-assessment of my teaching abilities. I know areas that need improvement. I never thought about them as an action research project (Teacher P Journal, 2003).

In her responses, she demonstrated a solid understanding of action research, the need for authentic assessment and characteristics of leadership.

Assessment of Teacher P

Her reflections on the relation of action research to her practice continued during the third week of the semester, when she was teaching her students how to self-assess their learning. The experience and her reflections about it provided a foundation for various other learning situations throughout the semester.

> I had the students evaluate how they lined up. I asked them if they lined up correctly and how did they know. They used the rules to decide what was

wrong or right with our line. Then I told them this is a way to evaluate their line. They are in Kindergarten. Working on their vocabulary [*sic*].

…In my classroom, I try to give on-going feedback to my students. They need to know as soon as possible what is expected of them. I show them how to improve by showing what they did and what was suppose to happen. I have been asking my students how they can improve (this is based on prior instruction). This way the students can self-assess themselves, with a little guidance from me. This really helps when we are lining up for different activities (Teacher P Journal, 2003).

The responses demonstrated Teacher P's understanding of both reflection and assessment and the direct application to her practice. By using the previous example with her students, she was able to introduce other rubrics and exemplars for them to use during technology-related instructional activities.

I like to use benchmark papers from the first of the year throughout the year. I am going to have an example of a PowerPoint, newsletter, and a spreadsheet. I want the students to include in the PowerPoint examples of photos they have taken with a digital and a regular camera. This will allow the students to use more technology related equipment. With the photos, the students should be able to create a colorful newsletter.

I am going to have the exemplars reflect how well the students can research and reflect their findings through a PowerPoint presentation, a flyer or a Publisher newsletter, and an Excel spreadsheet. These three types of evidences

should reflect the level of technology understanding each student has (Teacher P Journal, 2003).

Through the use of benchmarks throughout the year and by providing guidance in the use of rubrics and exemplars that provide the students with a visual illustration of what they need to do, she has demonstrated high levels of technology implementation. Even though she did not describe the research objective, she was asking the students to use technology as a tool to accomplish "real life" tasks with skills that can be used for other learning situations.

Teacher P's responses demonstrated her understanding of assessment. Her descriptions of classroom application using peer review as an assessment tool and learning experience for the students. She also described the use of exemplars in her instructional unit in relation to the use of a self-assessment strategy for the students and criteria for what she wanted the students to know at the end of the instructional unit. Her assessment decisions represent the dimension of self-assessment and peer-assessment within the course content objective.

Leadership of Teacher P

Higher levels of technology implementation are closely tied to teaching methods and encourage "best practices" in which technology is used as a tool to achieve various learning objectives. Teacher P illustrated her understanding of the connection between the self-assessment dimension of her own action research and her role as a leader in technology implementation on her campus.

I became more aware of on-going assessment of my teaching methods. With this change, I tried to change teacher attitudes toward technology. The

other teachers were receptive to using computer applications to enhance their students' learning.

> I can see where action research can help our teachers teach the students more effectively. We can take the TEKS that the students are weak in and create an action research for those activities. The computer is like a toy for the students. We can ask them to do anything and they will do it on the computer; whereas with paper and pen they would not do it (Teacher P Journal, 2003).

Many responses in Teacher P's journal continued to describe behaviors that reinforce her efforts to use student-centered collaborative projects while collaborating with other teachers to implement technology in all areas of the curriculum.

Technology Implementation of Teacher P

Teacher P's growth in and understanding of technology implementation was evident in her reflections throughout the semester. She began to lead by example and began to demonstrate a change in the way she worked with other classroom teachers to design learning experiences for the students in which technology was implemented seamlessly as a tool or strategy for learning, not making technology the focus of learning.

> Some of the concepts of science are grade leveled and never studied in detail in other grades. The participants will be K-2 students, student teachers, and classroom teachers. We will have a checklist of the TEKS. As the student masters that TEKS, we will expand to the next one. With the checklist, teachers will be more efficient in their presentation. Sometimes we overlook some the TEKS because we don't remember if we taught them. Once we have gathered our

> data, we will involve the other classroom teachers to our findings, will encourage, and demonstrate how we conducted the research. We will ask for peer evaluations of our findings. At that point, we will modify or expand our objectives (Teacher P Journal, 2003).

Her behavior was indicative of higher level technology implementation. She also demonstrated her understanding of the action research process and the relationships among action research, assessment, and leadership during collaborations with other teachers.

The researcher also noted five references to the "lack of time" for planning the use of technology during instruction and three references to "collaboration" needed to improve teacher training for technology implementation. Those findings support Teacher P's response to the LoTi survey question about barriers to technology implementation in which she chose the option that included lack of time and adequate teacher training.

Summary of Teacher P

Throughout her journal, Teacher P used various descriptors that provided the researcher with emergent patterns that clarify the dimensions of the three course content categories. The characteristics of action research include recognizing and defining a problem that is occurring in practice. Teacher P discussed using action research in collaboration with other teachers to improve teachers comfort levels with using technology as a learning tool. This represents both the beginning stages of the action research and critical reflection processes demonstrating the importance of reflection in learning.

Teacher P completed the practicum and her reflective journal in December 2003. In February 2005 she completed the two surveys used in this study. Her responses to the Stages of Adoption of Technology survey suggest that she perceives herself to be creative with the application of technology to new contexts and was able to use it as an instructional tool within the curriculum, which is the highest stage of adoption of technology. Her self ranking was supported by her expressed behaviors in the journal responses. Her LoTi survey responses suggest that she was very confident with the implementation of technology consistent with the state standards, "best practices" for instruction, and provides a student centered curriculum in her current instructional practice (CIP). Her Self-Efficacy and Teaching Methodology survey results suggest her comfort level while teaching with technology was very high. According to her survey responses, she primarily uses student-directed projects that encourage self-directed student learning and continuously tries new approaches suggested by research/experts to discover new ways of teaching her curriculum.

Many instances were noted in her journal, written during the fall 2003, in which she demonstrated behaviors associated with high levels of technology implementation. The connections she expressed between the knowledge from her coursework and the practical applications in the classroom support the researcher's judgment of her high level of technology implementation. Most of her journal responses were illustrative of a LoTi level of 4b [integration (routine)].

The unit lesson plan she developed and described in her journal provided opportunities for her kindergarten students to express their understanding of the research process and content by creating products using a variety of technology tools.

The unit required students to research a topic, and create PowerPoint presentations and newsletters to convey their understanding of the topic and spreadsheets to organize the information. This unit was an example of the use of technology to enhance the content learning. Teacher P's reported level of technology implementation at the time of the survey (February, 2005) was a level 5, expansion. This result implies that her practice had continued to grow in this area.

Teacher C

Teacher C is an experienced teacher (10-20 years, according to the survey range) with more than 30 hours of technology professional development within the last two years, prior to and including the study period. She earned a master's degree and is a business teacher at the high school level in a public school district in Texas. She reports having "more than five" classroom computers and "daily" student computer use.

Level of Reflection of Teacher C

When determining the levels of reflection demonstrated in Teacher C's reflective journal, the researcher noted occurrences of responses for each level as identified by the four raters. Teacher C's journal was coded as understanding (level 2), because the raters believed there was not enough evidence to suggest the participant had demonstrated an application of theory and course concepts in her practice. The frequencies of the codes for each level of reflection are presented along with representative journal responses illustrative of the dimensions of the particular level of reflection. There were 9 instances of coding for habitual action (level 1), which is not a

reflective level. This level is demonstrated by rote responses to the journal prompts. The following journal entry is an example of the evidence coded as habitual action:

> Feedback is fact not opinion. It should be specific and descriptive. Feedback does not offer guidance…it gives results. Providing effective and ongoing feedback is a great challenge. One method for meeting this challenge is to provide scoring rubrics (Teacher C Journal, 2003).

There were 20 instances (35.7%) coded as understanding (level 2), in which the participant demonstrated an understanding of the theoretical concepts presented during the course. The following journal entry is an example of the evidence coded as understanding:

> *Professional Development Activities* – This class has returned my focus to technology professional development. At [my last school, name omitted] I was in charge of presenting technology professional development and stayed very current. As I was hired as a Math teacher at [my school] I have been working more on TAKS training. I am glad to be back in the realm of technology!
>
> *What have I learned through my action research?* – My action research has reminded me of what I already knew…technology can enhance curriculum but it requires a lot of time! I need to "test" my projects and always be open to and looking for ideas to improve my projects (Teacher C Journal, 2003).

Most of the ratings, 25 instances (44.64%) were coded as reflection (level 3). The following journal entry is an example of the evidence coded as reflection:

> Such an important topic…I have seen this firsthand. I taught several night computer classes at my last school. They were free to the public. Talk about a

> great public relations tool! It helped the community see that we were preparing the students for real life experiences. It also raised their expectations which in turn "forced" some teachers to overcome their fear of technology and begin to incorporate it with their teaching practices. (Teacher C Journal, 2003).

There were no instances coded as critical reflection (level 4). Although there were some instances coded at reflection (level 3), the responses were too superficial and did not offer enough description of her practice to justify an overall level rating of reflection. All of the cited entries evinced the teacher was in the second level of reflection (understanding). According to Kember (2005, personal communication), this level is not considered reflective because there is not a direct connection between theory and practice. At this level, concepts are understood without being related to personal experience or specific applications.

Course Objectives: action research, assessment and leadership of Teacher C

Teacher C began the semester with goals to improve one of her classes:

> My first goal is to develop three new projects for my Desktop Publishing class. These projects need to teach desktop publishing principles in a "fun" way with the limited technology and software that is available. My second goal is to find and install software for the Desktop Publishing students (or walk the students through the installation—it would be a great experience for them!). I plan to research and find freeware or inexpensive software. My third goal is to apply for a grant through the Tech Prep Consortium. The grant money is needed for software, hardware and supplies for my Desktop Publishing Class (Teacher C Journal, 2003).

Many of her responses were superficial and related information from the text materials from the course.

Action Research of Teacher C

Although she expressed confidence in her knowledge of action research and technology implementation, Teacher C did not describe any events relating to her action research activities. She reported that her action research "reminded me of what I already knew…technology can enhance curriculum but it requires a lot of time!" In response to the journal prompt about meeting her goals, she stated:

> I have more than three new activities for my desktop publishing classes. They have enjoyed the lessons and I plan to continue to try to find new and exciting projects. I have not purchased materials or equipment yet due to lack of funds…I did apply for the Tech Prep grant…and had to re-submit my application with corrections. My student helped write the proposal which gives them some ownership…a great thing in itself even if we do not receive the funds!! (Teacher C Journal, 2003).

Teacher C offered no response that described a specific problem to be addressed; therefore, no dimensions of action research were noted in her journal.

Assessment of Teacher C

The journal prompts asking "What are the types of assessment" and "How can I use assessment to help my students learn?" garnered the following response:

> Assessment can be a written test, a product, or demonstration of a skill learned (as a starting point). A variety of assessments will ensure that the

> student is adequately assessed. Students should be given a variety of learning experiences to meet their different learning styles.
>
> As I assess what I am doing and have peers review my plans, I can only improve my practices. This should result in increased student achievement. Assessment should help me find the good things I am doing [*sic*] the things that need more work from myself. As I assess the result [*sic*] should be more valid projects with instructions that are easier to understand. All of this should be beneficial to my students (Teacher C Journal, 2003).

Her response repeats some of the main ideas of the assigned course readings, but did not offer any specific events or descriptions of application in her practice. Many of her responses left the researcher with questions that address the how, why and what.

Assessment was the second course objective and peer-review was used as the major strategy during the course. Teacher C's responses demonstrated her use of this strategy to get help from her co-teacher during the semester, as she was working on an "elementary unit" while her experience was with teaching at the high school level. Her statement that "peer-review is important for students too" represents an understanding of the concept, but she provides no description of an application. The use of portfolios for assessment was another concept discussed during the course and Teacher C's statement that "they should contain the student's best work" demonstrates a misconception of the concept.

Leadership

Teacher C demonstrated confidence in her knowledge of the concepts and her leadership skills. Statements such as "I feel I am definitely a leader" and "I have a take-charge manner. If I see something that needs to be done I do it" are examples of confidence in her role as a leader. She believes that "If my students are talking about the exciting projects in my class the other teachers will hopefully want to try something in order to get the same enthusiasm for their classes," but did not offer a description of those projects. She expressed her confidence in that area in many of her responses, but "being open to questions" and "share my experiences" were the only dimensions of leadership she described.

Technology Implementation of Teacher C

Teacher C's reported level of technology implementation at the time of the survey (February, 2005) was a level 2 (exploration), which is described by Moersch (2001) as:

> Technology-based tools generally serve as a supplement to the existing instructional program (e.g., tutorials, educational games, simulations). The electronic technology is employed either as extension activities or as enrichment exercises to the instructional program and generally reinforces lower cognitive skill development (e.g., knowledge, comprehension, application).

The researcher did not find any discussion of instructional objectives in the responses referring to the student projects, and therefore could not interpret any dimensions of technology implementation in Teacher C's journal.

Summary of Teacher C

Her responses to the Stages of Adoption of Technology survey suggest that she perceives herself to be creative with the application of technology to new contexts and was able to use it as an instructional tool within the curriculum, which is the highest Stage of Adoption of Technology. The researcher believed that Teacher C's self ranking was not supported by her expressed behaviors in the journal responses. Her Current Instructional Practice (CIP) was rated as somewhat confident with the implementation of technology and she was at the exploration (level 2) on the LoTi measure. Her Self-Efficacy and Teaching Methodology survey results suggest her comfort level while teaching with technology was very high. According to her survey responses, she primarily uses student-directed projects that encourage self-directed student learning and continuously tries new approaches suggested by research and experts to discover new ways of teaching her curriculum. Her perceptions were not supported by her journal responses or the LoTi survey results.

Her survey responses and journal entries suggest that she did not demonstrate reflective behaviors during her coursework, which was also interpreted as low level technology implementation. Without a more detailed description of her reflections and her practice, the researcher interpreted Teacher C's journal as low level reflection and her practice at a low level technology implementation. The researcher's conclusions were supported by the results of the Level of Technology Implementation (LoTi) survey.

Teacher G

Teacher G is an experienced teacher (10-20 years, according to the survey range) with more than 30 hours of technology professional development within the last

two years, prior to and including the study period. She earned a master's degree and is technology curriculum coordinator at an elementary school in Texas. She enjoys working with the other teachers to create technology rich learning experiences for the students. She reports that when working with the teachers, students use the "more than five" classroom computers "daily."

Level of Reflection of Teacher G

When determining the levels of reflection demonstrated in Teacher G's reflective journal, the researcher noted occurrences of responses for each level as identified by the four raters. Her journal was coded as habitual action (level 1), because the raters believed there was not enough evidence to suggest the participant had demonstrated a level of understanding. The frequencies of the codes for each level of reflection are presented along with representative journal responses illustrative of the dimensions of the particular level of reflection.

Most of the ratings, 33 instances (55%) were coded for habitual action (Level 1), which is demonstrated by rote responses to the journal prompts. The following journal entry is an example of the evidence coded as habitual action:

> *How can providing a workshop for other teachers' improve student learning?* - By increasing teachers' knowledge of technology, I can enhance the possibility that they will be more comfortable letting their students utilize technology tools in the curriculum (Teacher G Journal, 2003).

There were 9 instances (15%) coded as understanding (level 2), in which the participant demonstrated an understanding of the theoretical concepts presented during the course. There was not a definitive journal entry representative of the evidence

required for coding understanding, as each of these instances were a single occurrence not in agreement with the other raters coding those sections as level 1.

There were 19 instances (31.67%) coded as reflection (level 3). The following journal entry is an example of the evidence coded as reflection:

> I feel like this course was not long enough for the action research to have produced many results. However, I do feel that I can use action research in my teaching and in evaluating my own progress as an educator (Teacher G Journal, 2003).

There were no instances coded as critical reflection (level 4), which demonstrated no change in practice. The majority of the responses in the journal consisted of superficial answers to the journal prompts. Superficial is described as rote memorization of textbook material. There was very little reference to what was happening in her classroom, and connections between course concepts and personal experience were almost non-existent. The holistic analysis resulted in the researcher interpreting the responses as characteristic of the habitual action (level 1), a non-reflective level.

Course Objectives: action research, assessment and leadership of Teacher G

Teacher G began her journal by stating her goals for the semester:

1. To successfully create and upload a teacher Webpage for my courses
    a. Student access to assignments
    b. Parent access to course information
    c. Administrator/staff access to course/teacher information
2. To provide content rubrics prior to each project my students begin.

a. Offer meaning to activity

b. Define necessary elements of the project

c. Give students guidelines for performance (Teacher G Journal, 2003)

She expressed her concerns about the use of technology to improve student achievement in her first week's response:

- I am concerned about inappropriate use of time/resources
- I want to better monitor what my students access and how they use it (Teacher G Journal, 2003)

Her responses often repeated some of the main ideas of the assigned course readings, but did not offer any specific events or descriptions of her application. Many of her responses left the researcher with questions that address the how, why and what because they did not describe the context of the learning.

Action Research of Teacher G

In reference to the action research project, Teacher G described the unit of study and the learning objectives in the following response:

> The plan incorporates art, science, math and technology to determine how the rockets compare when created and tested…I hope students' learning can be reinforced by the technological tools they use in this project…We chose to include a Webpage element so the 4-8 students could showcase their work via a digital portfolio (Teacher G Journal, 2003).

Although she expressed confidence in her knowledge of action research and technology implementation as very high, Teacher G did not describe any events relating to her action research activities. She reported "I would love to see action research

utilized and I see a definite use for it in my district!" In response to the journal prompt about meeting her goals, she stated:

> I know that I have improved and I think the goals are still being worked on; the only way technology use can be improved is if teachers/administrators buy into it (Teacher G Journal, 2003).

Assessment of Teacher G

Many of her responses were superficial and related information from the text materials from the course. The journal prompts asking "What are the types of assessment" and "How can I use assessment to help my students learn?" garnered the following response:

> Assessment must be authentic and it must evaluate what students are supposed to be learning. The use of technology adds to the students' understanding of what they accomplished – digital pics [*sic*] show the actual work, spreadsheets graphically chart the research results (Teacher G Journal, 2003).

Her only other response addressing the assessment objective was to define "portfolio" as a "Collection of student work that highlights the student's accomplishments and enables the instructor to evaluate content, progress and mastery of subject matter" (Teacher G Journal, 2003).

Leadership of Teacher G

There was a similar lack of description for determining dimensionality of the leadership objective. The researcher noted three instances referencing leadership:

> I hope to be able to assist my IT director in training and development planning by analyzing what training we offered teachers last year, what their responses were, and in what areas they feel they would like to see more training offered to them.
>
> By increasing teachers' knowledge of technology, I can enhance the possibility that they will be more comfortable letting their students utilize technology tools in the curriculum
>
> I feel like I am very much a motivator and a go-getter. I hope that I can encourage my colleagues to integrate technology by supporting them and leading by example (Teacher G Journal, 2003).

Teacher G expressed her understanding in this area in many of her responses, but "leading by example" was the only dimension of leadership she described. Again, there was a lack of description pertaining to her practice that may have caused a misinterpretation during analysis. None of those instances provided a context for her application of the leadership characteristic discussed during the course, but are examples of repetition of the main concepts of the course material.

Technology Implementation of Teacher G

The researcher did not find any discussion of instructional objectives in the responses referring to the student projects, therefore could not interpret any dimensions of technology implementation in Teacher G's journal. This pattern of "lack of description" was evident throughout her journal and hindered the analysis and interpretation.

Summary of Teacher G

Throughout her journal, Teacher G's lack of the use of descriptors left the researcher unable to clarify the dimensions of the three course content categories. The characteristics of action research include recognizing and defining a problem that is occurring in practice. There was not a response that described a specific problem to be addressed; therefore, no dimensions of action research were noted in her journal.

Her responses to the Stages of Adoption of Technology survey suggest that she perceives herself to be creative with the application of technology to new contexts and was able to use it as an instructional tool within the curriculum. The results of her current instructional practice (CIP) implied she was very confident with the implementation of technology. Her Self-Efficacy and Teaching Methodology survey results suggest her comfort level while teaching with technology was very high. Teacher G's reported level of technology implementation at the time of the survey (February, 2005) was a level 5 (expansion). Her self ranking was not supported by her expressed behaviors in the journal responses.

Teacher G's journal entries suggest that she did not demonstrate reflective behaviors during her coursework. Her journal lacked descriptive information about her practice, which hindered the interpretation of her technology implementation. Without a more detailed description of her reflections and her practice, the researcher interpreted this teacher's journal as low level reflection and her practice at a low level technology implementation. This interpretation does not correspond to her survey results. Her perceptions of her knowledge and skills were supported by the responses in her journal, in which she offered textbook definitions for the course concepts. Her LoTi responses

implied that her understanding of technology implementation, but was not supported by actual descriptions of her practice or examples of technology implementation.

Cross-Case Analysis

All five participants self-reported their perceptions pertaining to technology implementation, self-efficacy and their attitudes toward the use of technology. The seven measures used in this study included: 1) Reflective journal analysis; 2) Stages of Adoption of Technology; 3) Self-Efficacy Teaching and Knowledge Instrument; 4) Technology Infusion and Teaching Methodology; and 5) Level of Technology Implementation (LoTi) Questionnaire, which included; 6) Personal Computer Use (PCU) and 7) Current Instructional Practice.

Common Themes from the Reflective Journals

The patterns that emerged during the analysis of the journals illustrated characteristics that separated the cases into two groups: non-reflective and reflective. The non-reflective journals (Teacher C and Teacher G) did not present evidence of technology implementation in practice. The reflective journals (Teacher B, Teacher B_2 and Teacher P) evinced technology implementation efforts both in the classroom and between the three teachers and their colleagues.

The teachers who demonstrated higher levels of reflection provided a rich description of their action research, including specific identification of their concerns and implementation of plans to improve their practice. Their descriptions included the use of teaching strategies identified as best practices by the course materials and exhibited direct applications to specific events in the classroom. All three teachers,

Teacher B, Teacher B_2 and Teacher P, provided examples of changing their assessment strategies to include peer-review activities to help their students build self-assessment skills and improve their learning.

The peer-review strategy was also described as a beneficial characteristic, in relation to successful technology implementation, of their roles as leaders among their colleagues. This leadership role was described in all three cases in conjunction with collaboration with other teachers and students.

The three teachers with higher levels of reflection also expressed frustration over the lack of time for planning and the attitudes of others about the use of technology. Teacher B_2 added the lack of computer access as another barrier to her technology implementation efforts. She described the amount of time required for her students to complete their activities when a computer was needed.

Teacher C demonstrated a high level of confidence in her understanding of the teaching strategies and course content, but did not provide examples of direct applications or specific classroom events for technology implementation. Two of her responses expressed a misconception of the course content. Teacher G demonstrated textbook knowledge of the course content, but did not substantiate her knowledge with supportive examples in her practice. Both teachers demonstrated low levels of reflection in their journals.

Common Themes from the Teachers' Perspectives

Based on the individual cases, the following themes emerged as common across the five teachers:

- Confidence in the implementation of technology for instructional purposes

- Confidence in the personal use of technology
- An understanding of the assessment strategies suggested in the course content
- An understanding of the concept of collaboration for learning (both with teachers and students)
- An expressed belief that the use of technology as a learning tool can improve student achievement

All five participants reported they were at stage 6 (creative application to new contexts) on the stages of adoption of technology scale. The behaviors associated with that stage of adoption include application of learned technology skills and knowledge in the classroom and consistent use of technology as an instructional tool that is integrated into the curriculum. All five teachers also perceived themselves to be high or very high in personal computer use. That self ranking indicates they use e-mail, word processing and desktop publishing applications on a regular basis for home, school and most communication purposes associated with the duties of a teaching professional.

All participants perceived themselves as very confident and comfortable teaching with technology. Below are representative statements to which the participants responded with "strongly agree" on the Self-Efficacy Teaching and Knowledge Instrument for teachers using technology:

- I feel I have the necessary skills to teach with technology
- I feel comfortable improvising during technology-enhanced lessons
- I feel comfortable when using technology instructional strategies that I have not used before

- When teaching with technology, I usually welcome student questions

Below are representative statements to which the participants responded with "Most of the Time" on the Technology Infusion and Teaching Methodology Instrument:

- Technology is used for improving student performance in academic areas
- Technology use is aligned with local and state standards
- I use a wide range of assessments to evaluate student performance (portfolios, rubrics, checklists)
- I share my ideas and lesson plans with my peers

The three teachers with high levels of reflection; Teacher B, Teacher B_2, and Teacher P, all provided rich descriptions of their practice. The descriptions provided a clear picture of their practice and the behaviors and actions that corresponded to the characteristics of high levels of technology implementation. The two teachers who demonstrated a lower level of reflection; Teacher C and Teacher G, did not provide the rich descriptions, but offered superficial responses to the inquiry into their practice (journal prompts).

Four of the cases demonstrated a relationship among their scores on the level of reflection, Loti and CIP measures. The descriptions and examples of technology implementation in their practice supported the results of the three measures. One case, Teacher G, did not demonstrate a relationship of the measures.

The findings in this chapter provided insight into five teachers' experiences as they reflected on efforts to implement technology in their practice and at their schools. The implications of the findings in regard to the research questions will be discussed in chapter five.

CHAPTER 5

DISCUSSION AND CONCLUSIONS

This chapter begins with a brief review of the research and continues with a discussion of what the findings suggest and imply in answer to the research questions:

1. What is the relationship between a teacher's level of reflection about technology implementation, as evidenced in journal entries during a professional development course, and the teacher's level of technology implementation in her or his own classroom?
2. What is the relationship between a teacher's level of reflection about technology implementation, as evidenced in journal entries during a professional development course, and changes in the teacher's attitudes and self-efficacy regarding technology implementation in the classroom?
3. What factors, as perceived by the teachers and evidenced in their journal entries and survey responses, support the implementation of technology?

Review of the Study

This study examined the reflective practices of five teachers during the final semester of a graduate technology applications certification program at the University of North Texas. The teachers were required to keep a journal to record their reflections during an action research project that focused on technology implementation. Journal prompts were provided to guide the teachers in their reflections about the course content and the implications for their practice. The course content objectives consisted of the action research project in which teachers designed and implemented an

elementary level unit of study that incorporated "best practice" strategies for technology implementation with a focus on assessment of student learning. Developing strategies to enable the teachers to become technology leaders in their schools was another objective of the course.

Using the teachers' reflective journals and their responses to survey questions, posed one year after the completion of the program, data were collected about attitudes toward the use of technology and technology implementation practices. The reflective journals were analyzed from two perspectives using: 1) a theoretical framework developed by Lueng and Kember (2003), which is based on the work of Dewey, Schön and Mezirow, to determine the level of reflection demonstrated; and 2) the course objectives as a framework for a narrative analysis.

The results of the Level of Technology Implementation (LoTi) survey provided insight on the teachers' perspective of their technology implementation practices. Each level of technology implementation has been described by Moersch (2001) and the behavioral characteristics were used to compare the descriptions of practice with the characteristics of reflection demonstrated in the teachers' journals. The results of the second survey provided insight on teachers' self-efficacy, teaching methodology, and self-reported measures of their Stages of Adoption of Technology (Christensen, 1997). Cross-case comparisons were also conducted to identify emergent patterns in the data. The patterns provided insight about the dimensions of the levels of reflection and behaviors associated with the characteristics of action research, assessment, and leadership within the context of technology implementation.

Research Question 1

What is the relationship between a teacher's level of reflection about technology implementation, as evidenced in journal entries during a professional development course, and the teacher's level of technology implementation in her or his own classroom?

To answer this question, first, the teachers' journals were evaluated by four college of education faculty (including the researcher) to determine the teachers' level of reflection. Raters used the Lueng and Kember (2003) framework to identify characteristic behaviors described in the journals. Weekly journal responses were analyzed to determine the appropriate level of reflection that the described behaviors demonstrated. The number of instances identified by the faculty was noted and interrater reliability computations were conducted. The alpha values for four of the journals met acceptable standards. A fifth journal from Teacher G had an alpha value below the acceptable standards; however, the researcher included the analysis of the journal in this study to offer insight into the evaluation process.

Once that process was completed, a holistic evaluative approach was used to determine what behaviors, if any, were identified as characteristics of the critical reflection level. Once characteristics were identified, the descriptions of the behaviors were examined to determine the dimensions of the characteristics of the critical reflection process. Kember (2005, private communication) suggests that the evidence for the critical reflection level must provide a clear description of the teacher diagnosing existing conceptual frameworks, a conceptual conflict, and reconstruction of a new conceptual framework.

For this study, the researcher interpreted Kember's definition within the context of action research. This strategy resulted in the expectations that critical reflection should be demonstrated by the teachers' description of a complete action research process, which was characterized by a complete description of:

1. the formation of a problem occurring in practice,
2. the application of the course content to address the problem,
3. implementing a unit of study that applied the solution,
4. and reflection on the process producing suggestions for future changes in their practice.

The researcher used the identified levels of reflection for each participant, suggested by the findings of the evaluators, in further analysis. The four levels of reflection include: habitual action (level 1), understanding (level 2), reflection (level 3), and critical reflection (level 4). The findings of the evaluation are illustrated in Figure 6.

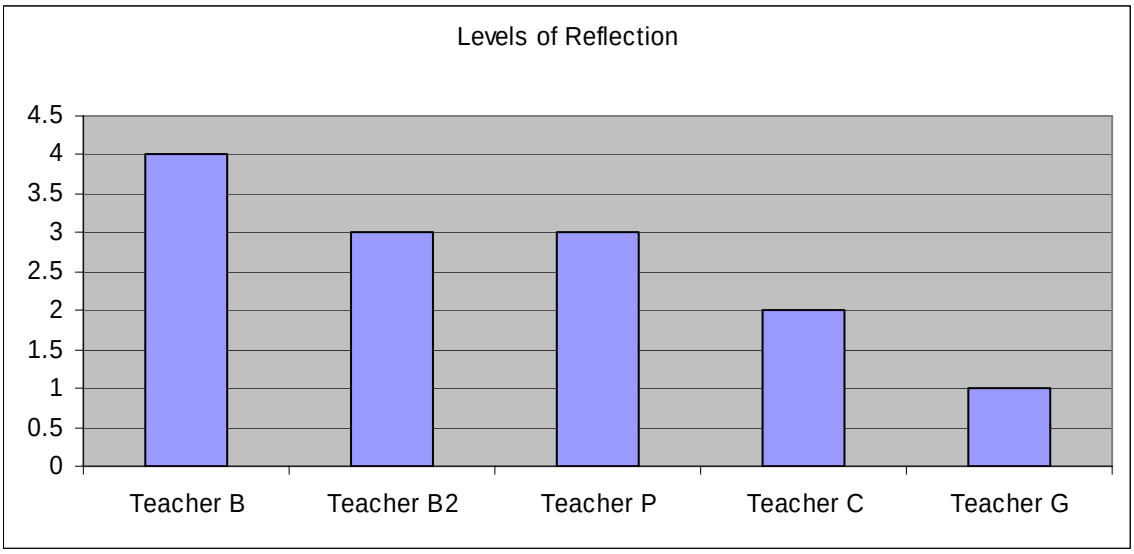

Figure 6. Teachers' level of reflection.

The second step of the analysis consisted in comparing the levels of reflection demonstrated in each participant's journal with the appropriate results obtained from the completed LoTi surveys. To determine whether a relationship existed between the levels of reflection and the levels of technology implementation, the Level of Technology Implementation (LoTi) questionnaire results were analyzed for each participant. The Levels of Technology Implementation, as defined by Moersch (1995) are:

0. Nonuse (e. g., ditto sheets, chalkboard, overhead projector)
1. Awareness (e. g., computer literacy classes, grade book programs)
2. Exploration (e. g., educational games, tutorials)
3. Infusion (desktop publishing applications, spreadsheets/graphs)

4a. Integration-Mechanical (teachers integrate technology with assistance from others)

4b. Integration-Routine (teachers integrate technology without assistance from others)

5. Expansion (technology access is extended beyond the classroom)

6. Refinement (technology is perceived as a process, product, and tool for students to find solutions to "real world" problems

The results were adjusted, for use in the Microsoft Excel © spreadsheet, due to the split in level 4 (4a and 4b), on the LoTi scale. The results are illustrated in Figure 7, in which level 4b is represented by 5, level 5 is represented by 6, and level 6 is represented by 7.

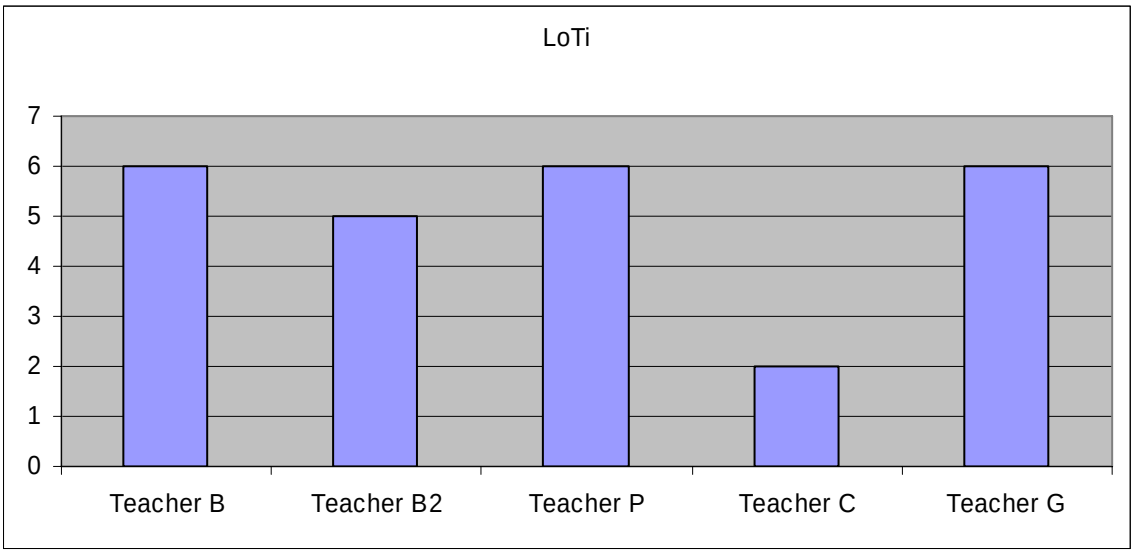

Figure 7. Level of technology implementation results (LoTi).

One section of the LoTi Questionnaire provided results that offered insight into the participants' current instructional practice (CIP), which are relevant to technology implementation. The results are illustrated in Figure 8.

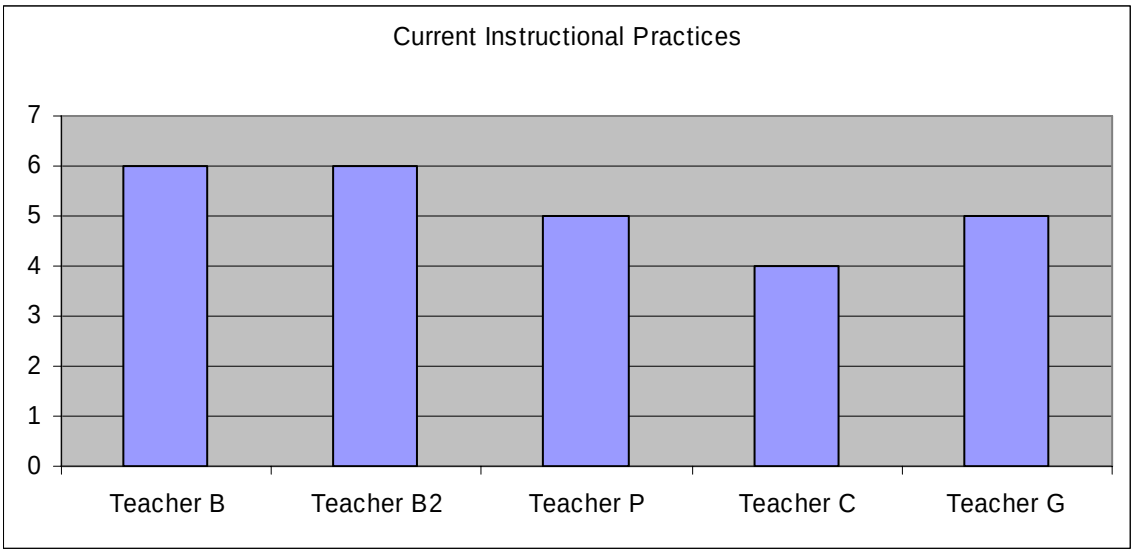

Figure 8. Current instructional practice (CIP) results.

Teacher B demonstrated characteristics associated with critical reflection in her journal responses and she clearly demonstrated a level of technology implementation that corresponded to the LoTi level of 4B integration (routine). Her responses to the LoTi questionnaire indicate she had achieved a higher level of technology implementation, level 5 (expansion) and a level 6 on the CIP measure suggesting a relationship between her level of reflection and her level of technology implementation.

Teacher B_2 demonstrated characteristics associated with reflection (level 3) in her journal responses and she demonstrated a level of technology implementation that corresponded to the LoTi levels of 4A integration (mechanical) and 4b integration (routine). Her responses to the LoTi questionnaire reinforced her demonstrated level of technology implementation, level 4B integration (routine) and a level 6 on the CIP measure suggesting a relationship between her level of reflection and her level of technology implementation.

Teacher P demonstrated characteristics associated with reflection (level 3) in her journal responses and she demonstrated a level of technology implementation that corresponded to the LoTi level of 4B integration (routine). Her responses to the LoTi questionnaire indicated she had achieved a higher level of technology implementation, level 5 (expansion) and a level 6 on the CIP suggesting a relationship between her level of reflection and her level of technology implementation.

Teacher C demonstrated characteristics associated with understanding (level 2) in her journal responses. Due to a lack of detailed descriptions in her reflections on her practice, the researcher interpreted this teacher's journal as non-reflective. Her responses to the LoTi questionnaire indicated she had achieved a low level of technology implementation, level 2 (exploration) and a level 4 on the CIP suggesting a relationship between her level of reflection and her level of technology implementation.

Teacher G's journal entries suggest that she did not demonstrate reflective behaviors during her coursework. Her journal lacked descriptive information about her practice, which hindered the interpretation of her technology implementation. Without a more detailed description of her reflections and her practice, the researcher interpreted this teacher's journal as habitual action (level 1) and her practice at a low level technology implementation. This interpretation was not consistent with her survey results. Her responses to the LoTi questionnaire suggest a high level of technology implementation, Level 5 (expansion) and a level 5 on the CIP suggesting there was not a relationship between her level of reflection and her level of technology implementation.

The descriptions provided in the teachers' reflective journals illustrate the different characteristics for reflection and non-reflection. Those who provided detailed descriptions of the actual changes occurring in their practice demonstrated the reflective behaviors such as questioning beliefs, suggesting solutions based on research and personal experience, and describing the applications of the solutions. The descriptions of instructional practice support their perceptions of technology implementation. Those teachers who did not demonstrate reflective behaviors provided no record of instructional practices to support their perceptions of technology implementation.

The findings suggest that teachers who demonstrated the characteristics of high levels of reflection also demonstrated characteristics of higher levels of technology implementation. Four of the cases demonstrated a relationship among their scores on the level of reflection, Level of Technology Implementation (Loti), and Current Instructional Practice (CIP) measures. The descriptions and examples of technology implementation in their practice provided by teachers in four of the cases supported the results of the three measures concerning reflection, technology implementation, and current instructional practices.

One case, Teacher G, did not demonstrate a relationship among the measures. This finding may suggest that Teachers G's journal was incomplete and might have skewed the results of this study or that she was unable to provide written descriptions of her practice in her reflective journal. During the weekly analysis of the journals, the researcher noted that one faculty member consistently rated Teacher G's journal higher

than the other three journals. This discrepancy was confirmed during the interrater reliability analysis. The Cronbach Alpha value for this journal was 0.39, which was below the suggested 0.50 value for reliability. The absence of description may have contributed to this discrepancy. The low Alpha may also imply that the ability to offer written descriptions could be a characteristic of higher levels of reflection. Thus, a question for further research arose: In order to reflect on one's practice, for action research purposes, must one first be able to describe and identify problems or areas of concern in order to provide a focus for reflection?

The findings of this study suggest that using reflective journals during technology professional development may impact technology implementation. The teachers demonstrating higher levels of reflection provided a rich description of their action research, including specific identification of their concerns with the use of technology and the implementation of their units plans intended to improve their practice. Providing the teachers with an opportunity to reflect on what they are learning during professional development, within the context of action research, may encourage the direct application of the technology implementation strategies that improve practice.

Research Question 2

What is the relationship between a teacher's level of reflection about technology implementation, as evidenced in journal entries during a professional development course, and changes in the teacher's attitudes and self-efficacy regarding technology implementation in the classroom?

The findings indicate there was not a relationship between a teacher's demonstrated level of reflection and her attitudes toward technology. All five teachers, regardless of their level of reflection, demonstrated confidence and comfort in their knowledge and skills for using technology, for both personal use and as an instructional tool. The findings were supported by the teachers' journal responses and on the self-reported measures for Stages of Adoption of Technology, Self-Efficacy Teaching and Knowledge, and Technology Infusion and Teaching Methodology. The Self-Efficacy and Teaching Methodology measures indicated that the five participants perceived themselves as "very comfortable" and confident while teaching with technology. They were open to student questions and tried using new technology instructional strategies that have been shown to improve student learning.

All five teachers' self-assessed behaviors were associated with creative application of technology instruction to new contexts, stage 6 on the Stages of Adoption of Technology measure. They reported high levels of personal computer use and were competent with the technology required to complete an online graduate program. Teacher C expressed confidence in her use of technology, but demonstrated a low level of technology implementation. The researcher posits that the completion of the online graduate program provided the teachers with the experiences needed to feel comfortable with technology use in many contexts. This conclusion concurs with Russell (2003) that "exposure results in higher confidence levels with technology but does not translate into higher levels of use of technology in the classroom" (p. 308).

Research Question 3

What factors, as perceived by the teachers and evidenced in their journal entries and survey responses, support the implementation of technology?

The teachers who demonstrated high levels of reflection suggest that a support structure for technology implementation should provide:

- Collaborative learning environments for teachers and students
- Peer-review, for teachers and students, used for self-assessment as a part of the learning process
- Time for planning including collaborative efforts when designing instructional units integrating core content and technology TEKS
- Access to computers and time for the students to use the technology to create products that demonstrate their understanding of the core content and the technology skills aligned with the TEKS

The reflective journals provided descriptions of the teachers' practice including the use of teaching strategies identified as best practices in the course materials and exhibited direct applications to specific events in the classroom. The description of their action research, including concerns about instructional practices and student learning contribute to a specific body of knowledge that can be beneficial for professional development personnel. Reflection had an immediate impact on Teacher B_2 when she questioned her existing beliefs about her practice: "Before this class, I felt that I was doing a great job in the classroom. I was finding ways to integrate technology, I was modifying and differentiating, and I was using current findings in my lessons, which I

practically had to write myself because we were using 13 year old books. But I did not consider feedback to my students as essential to the learning process". Curriculum planners in her district might be interested in her perceptions of the quality of the textbook materials they are providing.

The three teachers with higher levels of reflection expressed frustration over the lack of time for planning and the attitudes of others about the use of technology. Teacher B_2 added the lack of computer access was a barrier to her technology implementation efforts, describing the amount of time required for her students to complete their learning activities when a computer was needed. The insight into this type of knowledge can be used by district personnel for technology planning.

Using action research, which supports reflection, as a collaborative structure for the course was perceived as beneficial by the participants. Teacher P stated "This course is not what I thought it was going to be. I thought we would develop some units that integrated technology. I was unaware that it was a self-assessment of my teaching abilities. I know areas that need improvement. I never thought about them as an action research project." This is an example of providing the structure to accommodate the communication among teachers about their practice. Teacher B wrote "I believe that in sharing information, we build a united front and can have more impact on the learning environment," which supports the use of collaborative professional development activities. Administrators need this type of information about teachers' perceptions in order to plan professional development activities. Teacher P's suggestion that "I need to

have a set time to reflect on my daily activities with the action research plan" offers insight into daily teacher preparation needs.

Conclusions

The findings of this study have implications that are relevant to the theory and practice of teaching with technology, the practice of professional development, and to stakeholders interested in improving and supporting teaching and learning with school-wide technology implementation. In terms of how teachers perceive teaching with technology, using a framework for reflection can provide them with a better sense of what they are doing in their practice and how their perceptions relate to research. Such a framework also provides a record of their practice to use as a basis of communication and collaboration with others.

Scholars from Dewey to Schön and Mezirow have proposed reflection as a key component in the transformation of a teacher's practice. When reflection occurs during learning, the integration of new knowledge, prior knowledge, and experience provide a foundation for growth. This study suggests the use of reflective journals during technology implementation may provide a basis for sustaining the transformation of teaching practices beyond course work, which is especially important in the face of today's rapidly changing technology. Teachers must constantly change their practice when faced with new technology. To meet the changing demands of an information age society, teachers must ensure students are prepared to live and work in the midst of constant change. Today's teachers need professional development that is based on a collaborative inquiry approach to their practice. With the use of reflective journals to

document the teachers' practice, teacher educators can begin the process of developing a detailed and reliable body of knowledge about teaching and learning with technology.

The study's findings also have implications for all stakeholders interested in identifying effective ways to support teachers in the quest for high levels of learning for all teachers and all students. Teachers remain the expert on their practice and need to be involved in a collaborative effort to create new structures that provide time for teachers to learn and access to technology for all teachers and students. Assistance in integrating technology and content knowledge should be included as part of the collaborative effort. Collaborative action research offers a structural guide for teachers to inquire into their own practice and the practice of other teachers. It can also be used by all faculty and staff on school campuses to address common goals (e. g., improving student writing, improving student test scores) by providing a structure for communication and a collection of instructional practices.

This study adds to the research regarding evaluation of reflection, the use of journals for reflection, and the impact of this strategy on technology implementation. The results of this qualitative study illustrate the process of using the theoretical framework of Lueng and Kember (2003) to evaluate the levels of reflection in written journal responses during professional development programs. The findings suggest that the use of reflective journals, within the context of action research, during technology training, had an impact on technology implementation for practicing teachers. The results support the presumptions of scholars such as Dewey, Schön, and Mezirow that reflection is an important component of a teachers' growth in practice.

Implications and Recommendations

The implication that the use of reflective journals may impact technology implementation suggests a benefit of further research in this area. Instruction about the characteristics of critical reflection should be included in all education courses, especially field experience and practicum courses. In order to develop a systematic way to evaluate reflective journals, college of education faculty need to collect, analyze, and document their findings in regard to reflective journals. By analyzing weekly journal responses, instructors can guide their students to high levels of reflection while evaluating their teaching experiences. Using the holistic approach to evaluate the journals, instructors are provided a description of the student's growth throughout the field experience and can use the descriptions to communicate ways for the students to improve.

The researcher suggests further study to identify journal prompts that will help teach behaviors characteristic of higher level reflection. Time was mentioned as a hindrance in journal keeping, so the use of online journals should also be investigated. This would also provide a more efficient manner of collecting and analyzing data from the journals. A longitudinal investigation, similar to this study, would provide insight to the long-term impact of the use of reflective journals in within many educational contexts.

APPENDIX A

CONSENT FORM

Insight
The SouthCentral RTEC Instrument Library and Data Repository

CONSENT FORM

Training Methods to Improve Technology Implementation

Research prepared for the Doctoral Degree in Computer Education in the Department of Technology and Cognition at the University of North Texas ~ Paige Worrell

Consent to Participate in this Research Study

Title of Study

The Use of Journaling as a Means of Reflection for Greater Technology Implementation among Teachers

Investigator

Paige Worrell
Computer Education
University of North Texas
(personal information redacted)

Faculty Advisor

Dr. Leslie Moller
Computer Education
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Purpose

The purpose of this study is to determine the relationship between the level of reflection and technology implementation to provide the education community with justifiable data about the methods used for training teachers in technology implementation.

Procedures

If you choose to participate you will be asked to complete an online questionnaire that will take approximately 1 hour to complete. This evaluation will ask general questions about technology integration, your technology use and your student technology use. If you took CECS 5800, you will also be asked to send your journal to the investigator listed above.

- I understand that I will complete a questionnaire having to do with technology use and integration.
- I understand that my participation is completely voluntary, and that I am free to withdraw from this study at any time I choose, without penalty.
- I understand that this project is not expected to involve any risks of harm greater than those ordinarily encountered in daily life. I also understand that it is not possible to identify all potential risks in any procedure, but that all reasonable safeguards have been taken to minimize potential risks.
- I understand that the result of this project will be coded in a way that my identity will to be physically attached to the final data that I produce.

- I understand that I may receive a copy of the results [personal information redacted].

Closing Statement

CLICKING ON THE AGREE BOX BELOW INDICATES THAT I HAVE DECIDED TO PARTICIPATE IN THIS RESEARCH STUDY AND THAT I HAVE READ AND UNDERSTAND, AND I AM ABLE TO PRINT A COPY OF THIS CONSENT FORM.

This project has been reviewed and approved by the UNT Committee for the Protection of Human Subjects (940)565-3940.

☑ I have read the consent form and agree to its terms.

APPENDIX B

CODING SCHEME

CODING SCHEME

1. Habitual action: (this is not reflective)
    i. Procedures are followed without significant thought
    ii. Student provides a superficial response to the prompt without an attempt to reach understanding of the concept
    iii. paraphrases or summarizes the readings without a sense of meaning of the underlying constructs

b. Understanding: (this is not reflective)
    i. Concepts are understood as theory without being related to personal experiences or real applications
    ii. No understanding of how the concepts might be applied in practice
    iii. Reliance upon what was in the textbook or lecture notes
    iv. No examples of how theory relates to practice

c. Reflection:
    i. Application of concept to practice and related to personal experience
    ii. Concepts will be interpreted in relation to personal experience
    iii. Specific situations of practice will be discussed in relation to concepts and theories being taught.
    iv. Personal insights will go beyond book theory

d. Critical reflection: (Defined as Mezirow's 'premise reflection')
    i. Implies undergoing a transformation of perspective over time
    ii. Review of presuppositions from conscious and unconscious prior learning and their consequences

iii. Must be evidence of a change in perspective over a fundamental belief

iv. Shows evidence of;

    i. A process for diagnosing existing conceptual frameworks

    ii. A period of disequilibrium and conceptual conflict which makes students dissatisfied with existing conceptions

    iii. Reconstruction in which a new conceptual framework is formed

The weekly journal responses can be coded for levels 1 – 3, but the overall coding to determine if level 4 has been reached must be determined for the journal as a whole. This implies that the reviewer should go through the document twice, the first time looking at the individual prompt/response and the second time to evaluate the journal as a whole.

This course calls for the students to conduct action research while they address an instructional problem by designing 2 technology enhanced instructional units. The textbook for the course is Educative Assessment, so the students focus on assessment during the design phase. The journal is kept to support the reflective requirements of action research.

APPENDIX C

JOURNAL PROMPTS/COURSE TOPICS

Weekly journal prompts

Week	Journal Prompt
1.	State three personal goals for your practice that you believe are achievable during this course.
2.	What are my concerns about using technology to improve student achievement?
	What can I do to improve the areas I am concerned about?
3.	Views on feedback and understanding.
	How does this unit address the action research problem?
	How can you determine if the use of technology will improve student learning?
4.	What type of leadership role you are prepared to take within your school and/or district within the context of instructional technology as it relates to improving learning through action research?
5.	Focus your journal entries on your peer-review experiences and the changes you can make to improve your plan. Keep in mind designing standards for assessments when working on your unit plans.
6.	This week's journal entries should focus on your peer-review activities and the individual performance tasks you are using in your unit.
7.	This week's journal entries should reflect the modifications made for the 4-8 unit and why you chose the exemplars for that unit.

Week	Journal Prompt
8.	Your journal this week should focus on sharing knowledge within a community (e.g. Department/School/district/state). How can providing a workshop for other teachers improve student learning?
9.	What are portfolios and what are their possible uses? What are the three different types of evidence that should be used in an assessment portfolio?
10.	Your journal should focus on your professional development activities and what you have learned through your action research.
11.	Your journal entries for this week should focus on understanding assessment and using it to guide instruction. What are the types of assessment and how can I use assessment to help my students learn?
12.	What do you see as your strengths and weaknesses when looking at accountability for designing your instruction?
13.	Your journal entries this week should focus on the process and product of your work from this course.
14.	Do you display leadership characteristics? How can you share your experiences with colleagues?
15.	Have you met your goals? Have you improved your practice? Can you improve classroom technology use in your school/district?

Course content/topics

Week	Course content /weekly topics
1.	What is the value of action research for improving student learning and teacher leadership?
2.	How can I use action research to improve:
	The use of technology integration in my class/school/district?
	My personal practice?
	My understanding of this?
	The wider educational situation?
3.	What is feedback?
	How do I provide effective and ongoing feedback?
	What are the five facets of understanding?
	How do I obtain evidence of understanding
4.	How can action research support my leadership efforts at my school/district?
	What are the characteristics of leadership?
	What can I do to improve technology use in the classroom?
5.	How can I correlate my action research problem with state/district standards?
	How do I identify criteria and indicators when designing assessments?

Week	Course content /weekly topics
6.	What makes a good assessment?
	What are the design standards for performance tasks?
	How do I adapt activities for assessment?
	How do I plan for self-assessment?
7.	Should scoring rubrics be generic or task specific?
	Does a rubric stifle creativity?
	How do I construct a rubric?
8.	What are areas of concern about using technology to improve learning?
	What can I do to improve technology use in my school/district?
	What makes a good leader?
9.	What is the value of using student portfolios?
10.	How am I ready to teach with technology at all grade levels?
11.	What knowledge emerged from my action research and how can I improve my research for the next cycle?
12.	Why do we need accountability?
	How can I think like an assessor?
	Why is peer review important when designing assessments?
13.	How will my design of the student portfolio to improve student achievement?
	How will my assessment designs improve student achievement?

Week	Course content /weekly topics
14.	Share a summary of a book or article you have read and found extremely helpful for improving your leadership skills. Did it offer any activities you could share with others?
15.	How was my action research valuable to me/my students/my school?

APPENDIX D

LEVELS OF TECHNOLOGY IMPLEMENTATION (LoTi)

(Reproduced with permission from Learning Quest, Inc.)

LoTi © Level Descriptions (Learning Quest, Inc., 2004)

LoTi Level	Description
0 - Nonuse	A perceived lack of access to technology-based tools or a lack of time to pursue electronic technology implementation. Existing technology is predominantly text-based (e.g., ditto sheets, chalkboard, overhead projector).
1 - Awareness	The use of technology-based tools is either (1) one step removed from the classroom teacher (e.g., integrated learning system labs, special computer-based pull-out programs, computer literacy classes, central word processing labs), (2) used almost exclusively by the classroom teacher for classroom and/or curriculum management tasks (e.g., taking attendance, using grade book programs, accessing email, retrieving lesson plans from a curriculum management system or the internet) and/or (3) used to embellish or enhance teacher-directed lessons or lectures (e.g., multimedia presentations).
2 - Exploration	Technology-based tools supplement the existing instructional program (e.g., tutorials, educational games, basic skill applications) or complement selected multimedia and/or Web-based projects (e.g., internet-based research papers, informational multimedia presentations) at the knowledge/comprehension level.

LoTi Level	Description
3 - Infusion	Technology-based tools including databases, spreadsheet and graphing packages, multimedia and desktop publishing applications, and internet use complement selected instructional events (e.g., field investigation using spreadsheets/graphs to analyze results from local water quality samples) or multimedia/Web-based projects at the analysis, synthesis, and evaluation levels.
4a - Integration (Mechanical)	Technology-based tools are integrated in a mechanical manner that provides rich context for students' understanding of the pertinent concepts, themes, and processes. Heavy reliance is placed on prepackaged materials and/or outside resources (e.g., assistance from other colleagues), and/or interventions (e.g., professional development workshops) that aid the teacher in the daily management of their operational curriculum.

LoTi Level	Description
4b - Integration (Routine)	Technology-based tools are integrated in a routine manner that provides rich context for students' understanding of the pertinent concepts, themes, and processes. At this level, teachers can readily design and implement learning experiences (e.g., units of instruction) that empower students to identify and solve authentic problems relating to an overall theme/concept using the available technology (e.g., multimedia applications, internet, databases, spreadsheets, word processing) with little or no outside assistance.
5 - Expansion	Technology access is extended beyond the classroom. Classroom teachers actively elicit technology applications and networking from other schools, business enterprises, governmental agencies (e.g., contacting NASA to establish a link to an orbiting space shuttle via internet), research institutions, and universities to expand student experiences directed at problem-solving, issues resolution, and student activism surrounding a major theme/concept.

LoTi Level	Description
6 - Refinement	Technology is perceived as a process, product (e.g., invention, patent, new software design), and/or tool for students to find solutions related to an identified "real-world" problem or issue of significance to them. At this level, there is no longer a division between instruction and technology use in the classroom. Technology provides a seamless medium for information queries, problem-solving, and/or product development.

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