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Strategies for Sustainable Professional Development Programs to Promote Effective Pedagogical Use of Instructional Technology in Teaching

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Dissertation submitted to the
College of Human Resources and Education
at West Virginia University
in partial fulfillment of the requirements
for the degree of

Doctor of Education
in
Technology Education

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Department of Advanced Educational Studies

Morgantown, West Virginia
2004

Keywords: Professional Development, High-Level Use of Technology, Instructional Technology, Inservice Training

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ABSTRACT

Strategies for Sustainable Professional Development Programs to Promote Effective Pedagogical Use of Instructional Technology in Teaching

Karla R. Assis Cezarino

The purpose of this study was to determine a set of common strategies employed by sustainable instructional technology professional development programs that are found to successfully promote educators' high-level use of technology in their teaching practice. Two questions guided this study: (a) Research Question 1: What do successful instructional technology professional development programs recognize as indicators of high-level use of technology?, and (b) Research Question 2: Which instructional technology professional development strategies successfully promote high-level use of instructional technology in participants' teaching practice?

An online questionnaire consisting of close-ended questions and open-ended questions was used as the means of data collection. The online questionnaire was completed by 70 instructional professional development programs' directors or their designees. The professional development programs participating in this study were awardees of PT3 1999 and 2000 implementation grants.

The data from the close-ended questions of the questionnaire were analyzed using central tendency measures and were used to answer to Research Question 1. For each survey's close-ended questions there was a corresponding open-ended question. The open-ended questions were analyzed using qualitative content analysis and the data coming from this section of the questionnaire were used to answer to Research Question 2.

The results from the analysis of the close-ended section of the questionnaire indicated that the majority of instructional technology professional development programs participating in this study were successful in preparing their participants to address 22 out of the 27 indicators of high-level use of technology presented in this study. The analysis of the open-ended responses indicated that out of the 26 strategies mentioned by participants the most successfully used strategies across indicators were: *Strategy 9: Appropriate Lesson/Learning Activity Development*; *Strategy 6: Presentation/Demo/Hands on; Strategy 1: Identifying/Defining Appropriate Use of IT; Strategy 3: Evaluation/Critique/Assessment; Strategy 14: Problem-Based Learning/ Project-Based Learning;* and *Strategy 26: Lesson Implementation.* Each of the strategies had multiple approaches depending on factors as context and goals of the professional development programs participating in this study. Further study was recommended.

DEDICATION

To the woman I most admire and love, my mom Alzenir, I am but a reflection of her kind soul and her immense strength. To my brothers, Rodrigo and Aleksandro, whose friendship, love and support helped me discover the true meaning of family. To my father, Joao Carlos, who has always encouraged my academic efforts. To my mother-in-law, Dona Elvira, for making me feel as a loved daughter since the first time we met. To the person whose eyes reflect my soul, my true and eternal love, my soul mate, my husband Herval. This dissertation would not be possible without all of the love and support from the people mentioned here.

Para a mulher que mais admiro e amo, minha mãe Alzenir, de quem sou somente um reflexo da sua alma bondosa e sua imensa força. Para meus irmãos, Rodrigo e Aleksandro, que através de seu amor e amizade me ajudaram a descobrir o significado real da palavra família. Para meu pai, João Carlos, que sempre incentivou a minha educação. Para minha sogra, Dona Elvira, por me fazer sentir como uma filha querida desde o primeiro momento que a conheci. Para a pessoa cujos olhos refletem a minha alma, meu verdadeiro e eterno amor, minha alma gêmea, meu esposo Herval. Sem o amor e o apoio de todas estas pessoas aqui mencionadas esta dissertação não seria uma realidade.

In memory of Francisco Freire (vovô), the man who showed me I had wings…
&
Maria Ines Iaquinta (Mara Maravilha) the wild butterfly who showed me how to fly.

Em memória de Francisco Freire (vovô) o homen que me mostrou que eu tinha asas…
&
Maria Inês Iaquinta (Mara Maravilha) a borboleta "doida" que me ensinou a voar.

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CHAPTER I: INTRODUCTION

Educators have been facing what seems to be a never-ending battle to achieve a technological comfort level in their teaching practices. Technology imposes constant revision in the ways of best promoting learning in a content area, demanding educators to be more skilled decision makers (Roblyer & Edwards, 2000; Tomei, 2002).

In the past 10 years, significant increases in the number of computers per student and in the number of schools that have access to the Internet could be seen throughout the United States (Barron, Kember, Harmers, & Kalaydjian, 2003). Schools are spending millions of dollars on computers and software, yet "only 9 percent of their technology budgets go toward teacher preparation…and what limited preparation teachers do receive is still in the form of skills and competencies instead of curriculum application" (Tomei, 2002, p. 206).

The Web-Based Education Commission (2000) suggested that teachers have to feel comfortable with technology; they have to be able to envision the application of technology in their teaching in a natural way. If teachers are not prepared to use technology comfortably as a tool to support students' learning experience, their professional preparation cannot be considered successful for they could not help prepare their students to succeed in the Digital Age (CEO Forum on Education & Technology, 2000).

Nevertheless, in most of the schools, although educators recognize the important role of technology in education, they do not feel well prepared to use it effectively as part of their teaching. Most educators cannot envision the implementation of instructional technology (IT) in a way that supports their teaching approach (North Central Regional Educational Laboratory, 2003; Web-Based Education Commission, 2000).

As a result, there has been an increased focus on the importance of high quality professional development for educators. The US Department of Education (2000) has called attention to the fact that quality professional development programs are essential for educators to be able to keep up with the demands of today's society. According to Mouza, (2002-2003), "it is only through professional development that teachers can acquire the skills necessary to make the most of the digital resources available in their classroom" (p. 275).

Professional development programs for educators face a common problem of a top down design and the disconnection between what is learned during professional development programs and what is implemented in classroom practices (Guskey, 2000). It seems that most of the instructional technology professional development programs forget that top of the line computers and high speed Internet connection do not themselves promote learning, they are just tools that can be used to help facilitate the learning process. As Kleiman and Johnson (1998) state "the power of any tool is not inherent in the tool itself; it is a function of the user's ability to put the tool to good use for specific purpose" (para. 1).

Rationale

Cradler, Freeman, Cradler, and McNabb (2002) reported an increase in educators' interest for technology, and thus an increase in opportunities for learning the how, when and why of implementing technologies into their teaching. On the other hand, one of the findings from a study conducted by Lam (2000) was that the main reason for educators not using computers for teaching was a lack of knowledge about how to integrate computers in their respective subject areas.

Successful Instructional Technology Professional Development Characteristics

Professional development programs for educators must meet educators' different needs and support them through the challenges that technology brings to their teaching, introduce to them the pedagogical issues related to the instructional technology tools; give them hands on experience on using the instructional technology tools, and guide the process of redefining or strengthening their teaching beliefs and practice (Kleiman & Johnson, 1998). "Only ongoing teacher learning through professional development can make current teachers aware of changing expectations and validated, effective, teaching methods" (National Conference of State Legislatures, 2002, para. 1).

The importance of successful teachers' instructional technology training is to promote the implementation of technology in education and to "ensure that teachers are able to integrate technology into the curriculum to improve student achievement" (U. S. Department of Education, No Child Left Behind, 2000, para 2). A report by the North Central Regional Educational Laboratory (2003), suggests that educators need to understand the different ways in which technology can support their own pedagogical practice and belief.

Among the critical components of any faculty development plan suggested by Preparing Tomorrow's Teacher to Use Technology (2002) is the need for emphasis on the pedagogical aspect in the process of technology integration. As Harris (1998) pointed out "the tool in and of itself, no matter how powerful its features, cannot make learning happen. The teacher, no matter how technically competent, enters a related but distinct realm for inquiry when he or she plans for the educational application of any new tool" (p. 6).

High-Level Use of Technology

The term "pedagogical use of technology" in this research implies the high-level use of technology in teaching. It refers to the use of technology as "a classroom tool for research, communication, productivity, and problem-solving" (Barron, et. al., 2003, p. 489). It is the use of technology for promoting critical thinking, "higher order, cognitive processes, alternative assessment schemes, interdisciplinary/integrated instruction, and/or the changing role of the teacher in the classroom" (Moersh, 2002, p. 12). The terms "high-level use of technology" and "pedagogical use of technology" are used interchangeably throughout the study.

Instructional Professional Development Programs' Problems

There is consensus among some noted researchers (Harris, 1998; Mouza, 2002-2003; Roblyer & Edwards, 2000; Tomei, 2002) in mentioning that practice with instructional technologies and an understanding of their pedagogical applications are essential to the success of any professional development program. However, "there has been little carryover into the classroom, and new technologies have remained on the periphery of school life, and been used only sporadically by teachers despite the high expectations of trainers, reformers and the teachers themselves" (Grant, 1996, para. 1). Unfortunately, most of the IT professional developments consider the integration of instructional technology tools into teaching as an obvious process that does not need to be addressed once the tools are mastered (Harris, 1998).

Mckenzie (2001) mentions that most of the IT professional development programs focus on the development and mastery of software rather than on the guidance of the effective integration of the technology being presented in the curriculum as part of the instruction practice. Although numerous studies have pointed out the importance of focusing on pedagogical principles when implementing technology into teaching, Mouza, (2002-2003) suggests, "teachers

often feel uncomfortable using computers and are unaware of the teaching and learning pedagogies that computers and the Internet are able to support" (p. 273).

Almost two decades have passed since computers were first used in education. Today, in the U.S. more than 90 percent of schools have computers that are connected to the Internet (Web-Based Education Commission, 2000). However, educators still do not feel ready to use computers in a confident, creative and competent way, due most of the time to the lack of proper pedagogical training and technical support (Tomei, 2002).

One of the problems faced by professional development programs is the difficulty in determining "best practices" in this area since "what works always depends on where, when and with whom" (Guskey, 2002, p. 51). Although there are a number of studies (Crawford, 2003; Feist, 2003; Grant, 1996; Guskey, 2000) that list the overall characteristics of high quality professional development programs, there have been few systematic research efforts aimed at determining the relationship between these characteristics and educators' outcomes (e.g., classroom applications). Furthermore, not many systematic studies have been conducted focusing on the efficacy of the content and activities presented during a professional development program (Garet, Porter, Desimone, Birman, & Yoon, 2001).

Educators at all levels face the problem of lack of proper preparation and support for efficient integration of technology in the classroom. The access to information on instructional professional developments' best practices could help guide the decisions about the strategies and activities to use when designing future instructional technology (IT) professional development programs (Brush, Glazewski, Rutowski, Berg, Stromfors, Van-Nest, Stock, & Sutton, 2003; Seels, Campbell, & Talsma, 2003).

Although studies (Schrum, 1999; Sparks, 2002; U.S. Department of Education, 2000) have identified the characteristics of successful instructional technology professional development programs, none to this researcher's knowledge have determined strategies that can best guarantee the high-level use of technology in teachers' practice.

Purpose of this Study

The purpose of this study was to determine a set of common strategies employed by sustainable instructional technology professional development programs that are found to successfully promote educators' high-level use of technology in their teaching practice. Moreover, this research offers an initial resource for other instructional technology professional development programs to reflect upon when designing and defining their own strategies.

Research Question

The research questions guiding this study were:

1. What do successful instructional technology professional development programs recognize as indicators of high-level use of technology?
2. Which instructional technology professional development strategies successfully promote high-level use of instructional technology in participants' teaching practice?

Assumptions

The following assumption was made in this study:

1. The professional development programs participating in the study achieved their goal of preparing teachers who can integrate technology successfully as part of their teaching practice.

Limitations

This study was limited in the following ways:

1. This study is restricted to Instructional Technology Professional Development in the USA.
2. The sample size does not allow generalizations.

Definition of Terminology

The following terms were used throughout the study:

Sustainable and Effective Professional Development: "is defined as those processes and activities designed to enhance the professional knowledge, skills, and attitudes of educators so that they might, in turn improve the learning of students…it is a process that is intentional, ongoing and systemic" (Guskey, 2000, p.16).

Instructional Technology: "Instructional technology is another instructional strategy – another tool for teaching elementary, secondary or adult learner" (Tomei, 2002, p. 5). It "combines educational technology with learning strategies, developmental principles, and pedagogical ideals" (Tomei, 2002, p. 7).

Learning: "the process of gaining knowledge and/or expertise" (Knowles, Holton, & Swanson, 1998, p. 17).

Learning Theory: "a set of constructs linking observed changes in performance with what is thought to bring about those changes" (Driscoll, 2000, p. 11).

Integrating Instructional Technology: "refers to the process of determining which electronic tools and which methods for implementing them are appropriate for given classroom situations and problems" (Roblyer & Edwards, 2000, p. 8).

Pedagogy: "the functions and work of teaching" (Shambaugh & Magliaro, 1997, p. 293). "A set of assumptions about learning and strategies for teaching" (Knowles, et. al., 1998, p. 36).

High-level use of technology: term that is used interchangeably with pedagogical use of technology. It refers to the use of technology as "a classroom tool for research, communication, productivity, and problem-solving" (Barron, et. al., 2003, p. 489). It is the use of technology for promoting critical thinking, "higher-order cognitive processes, alternative assessment schemes, interdisciplinary/integrated instruction, and/or the changing role of the teacher in the classroom" (Moersh, 2002, p. 12).

Learning beliefs: "a set of convictions about what learning is, how it occurs, and ways to promote it in humans" (Shambaugh & Magliaro, 1997, p. 292).

Critical Thinking: "involves the dynamic reorganization of knowledge in meaningful and usable ways. It involves three general skills: evaluating, analyzing, and connecting" (Jonassen, 2000, p. 27).

Interactive Professional Development Program: are programs that "encourage reflection, provide control, direct attention, and add dimension to content" (Driscoll, 1998, p. 99).

Education: "is an activity undertaken or initiated by one or more agents that is designed to effect changes in the knowledge, skill, and attitudes of individuals, groups, or communities" (Knowles, et. al., 1998, p. 10).

CHAPTER II: REVIEW OF LITERATURE

Pedagogical Principles and Instructional Technologies

According to Trilling and Hood (1999), in the Industrial Age learning happened through lectures, facts, drills, rules and procedures, in today's Information Age learning happens through projects and problems, inquiry and design, discovery, and invention. In today's educational system various methods and theories of learning are applied in different circumstances to address students' unique needs. Old and new methods are used with a focus on problem-based collaborative activities that reflect students' realities and make their learning experience more relevant (Trilling & Hood, 1999).

Educators are still dealing with the problems of a great number of choices offered by technology and the changing in the roles of teachers and learners imposed by technology use. Thus, often there is not enough time left for the discussion of the pedagogical issues and implications related to the use of a certain instructional technology tool in their classroom (Firdyiwek, 1999). Although technology is seen as a great learning tool, educators must remember that "it's the practice and the results, not the tools that make a difference" (Trilling & Hood, 1999, p. 12).

Educators must perceive the contribution of technology to their teaching practice and the rationale for the use of technology if they are to allocate time and resources on the planning and implementation of instructional technology in their instruction (Roblyer & Edwards, 2000). Among the reasons for educators to use technology are: (a) the motivational aspect of technology, (b) the contribution that technology can make in the creation of a learner-centered environment, (c) the support that technology can give to new instructional practices such as collaborative learning, problem solving, and higher-order skills, (d) the assistance that

technology can provide to increase teachers' productivity, and (e) the need to prepare students' with the skills demanded by today's society (Roblyer & Edwards, 2000).

The education system has been compelled to change in order to reflect the needs of today's society. In this transition, educators have questioned their own instructional practices and teaching beliefs. Although changes in education are seen as a natural process there is a lot of controversy in defining the best way to promote these changes in order to enhance learning (Roblyer & Edwards, 2000).

As a result three distinctive lines of thoughts have arisen: (a) directed instruction: is based primarily on behaviorist and information processing theories and posits that "learning is transmitted knowledge, teacher should be teacher-directed, systematic and structured; and that discovery learning is too unstructured and unsystematic" (Roblyer & Edwards, 2000, p. 50). The directed instruction model "emphasizes individualized environment in which information is presented in a clearly sequenced series of explicit instructions with feedback, reinforcement, and statistically valid and reliable testes" (Firdyiwek, 1999, p. 30); (b) constructivist: is based on cognitive and constructivist theories, and suggests that "leaning is constructed knowledge, teaching should let students participate in activities that are meaningful so they can generate their own knowledge, and that directed instruction is too rigid and teacher-centered" (Roblyer & Edwards, 2000, p. 50). The constructivist model "emphasizes interactivity as a way of developing a general and unified understanding of a domain and favors organizing information to match the developmental stages of the learner. Assessment, involves performance and is relative to the background and developmental stage of the learner" (Firdyiwek, 1999, p. 30); (c) humanist: is based on the belief that "learning is a two-step process involving the acquisition of knowledge followed by individual personalization" (Tomei, 1997, p. 57). The teacher has to

promote a classroom environment free of threats with abundance of materials from which students could choose to build up their own learning.

According to Roblyer and Edwards (2000) "drill and practice and tutorials are associated only with directed instruction; most others (problem solving, multimedia production, Web-based learning) can enhance either directed instruction or constructivist learning, depending on how they are used" (p. 49). Tomei (1997) adds to this thought by mentioning that instructional technologies such as audio and video conferencing can be used in the humanistic level to enhance and encourage interpersonal skills.

Therefore, it is educators' responsibility to choose the instructional technology tool that will best promote students' learning based on their own beliefs and judgment of how learning should take place. A mixed approach merging directed, constructivist and humanist activities is advisable in order to address students' different needs (Roblyer & Edwards, 2000).

Unfortunately, most of the teachers do not know how to integrate technology in a way that would reflect their teaching beliefs. The assumption that the availability of resources would naturally lead to their integration into the teaching and learning environment has been proved wrong (Earle, 2002).

Harris' Activity Structure Genres

Harris (1998) states that as with any other educational tool computer-mediated communication (CMC) instructional technologies tools can only make a difference in the learning and teaching process if they are chosen wisely based on careful thinking by the educator in answering a simple question: Is using instructional technology worth it? Harris (1998) mentions that this question can only be answered after answering the following ones: Is this computer instructional technology tool going to allow my students to do something that they

could not do before? Or is it going to allow my students to do better something that they would do before using other educational tools? If the answer for one of these questions is yes, and if the educator can pedagogically sustain it, then the implementation of instructional technology in the educator's class is likely to be successful and worth the time, effort and expense.

Harris (1998) classifies the computer-mediated communication tools according to the kind of activity that each one can promote. It is important to notice though that a CMC instructional technology tool can have as many uses as the imagination and creativity of an educator. Harris (1998) explores computer-mediated communication tools and places them under three major categories: (a) interpersonal exchange, (b) information collection and analysis, and (c) problem solving. In an overview of these categories, the activities and tools that go under them are presented below:

Table 1

Judi Harris' (1998) Activity Structure

Interpersonal Exchange	
Interpersonal Exchanges are those activities in which individuals communicate electronically with other individuals, with another group, or when groups communicate electronically with other groups.	
Key Pals	Electronic (email, chat, etc.) communication between individual students who attend different schools, or who live in different parts of the state, country, or world.
Global Classrooms	Electronic communication between groups of students, usually two or more classrooms, about topics of common interest

Table 1 (continued)

Judi Harris' (1998) Activity Structure

Electronic Appearances	Inviting authors, teachers, scientists, or other professionals who appear online to answer student questions or participate in discussions relevant to their own professional lives
Telementoring	Subject area specialists act as "online" mentors for students
Question & Answer Activities	Brief communication from students to an "online" expert asking a quick, specific question
Impersonations	"Online" guests play the role of an important character (current or historical) and communicate with students

Information Collection and Analysis

Information Collection and Analysis activities are those that involve students collecting, compiling, and comparing different types of interesting information.

Information Exchanges	Students send or receive information such as local weather conditions, book reviews, favorite quotations, recipes, etc.
Database Creation	Students gather or receive information and put it into an online database where it is available for students in other schools to use

Table 1 (continued)

Judi Harris' (1998) Activity Structure

Electronic Publishing	Students create online publications, such as a newspaper, literary magazines, electronic journals, or ethnic cookbooks
Telefieldtrips	Students electronically "tag along" on fieldtrips with other students in far away places. Students participate by emailing questions to those taking the fieldtrip, who then send back pictures, data and reports about the trip.
Pooled Data Analysis	Students collect information on a specific topic from students and classes around the world, analyze it to find patterns, similarities, or differences, and then report their findings online
Problem Solving	
Problem Solving activities promote critical thinking, collaboration, and problem-based learning.	
Information Searches	Students are presented with a problem and then given clues to help locate important online information they will use to solve it
Peer Feedback Activities	Students share their work (compositions, art, design plans, projects) online with other students or subject area experts who are asked to provide constructive feedback
Parallel Problem Solving	Students in several different locations are electronically presented with a similar problem, which they must solve independently using any and all resources available to them. The different approaches students used to solved the problem are then shared and compared.

Table 1 (continued)

Judi Harris' (1998) Activity Structure

Sequential Problem Solving	Students electronically share in the creation of a new document (story, poem, art piece, etc.) by adding a part to it and then passing it on to others in different locations around the world
Telepresent Problem Solving	Students in different geographical locations around the world work together electronically (asynchronously or real-time) on a common project using many types of multimedia, from remote sensing to chat
Simulations	Students participate in real-time collaborations that simulate actual/fictional events such as a space shuttle launch, Mars mission, United Nations meeting, or interactive mathematical modeling software
Social Action Projects	Students around the world focus on real and immediate global problems and together take action on solutions to these social problems

Note: From "*Virtual Architecture: Designing and Directing Curriculum-based Telecomputing"* by J. Harris, 1998, International Society for Technology in Education (ISTE) as presented on http://www.trek-21.wvu.edu/html/support/IT_exemplar.htm

In sum, when choosing the instructional technology for a certain activity, educators must focus on the content and purpose of the activity, aiming effective instructional practice. "The focus of integration is on pedagogy – effective practices for teaching and learning. Teachers need to be able to make choices about technology integration without becoming technocentric by placing undue emphasis on the technology for its own sake without connections to learning and the curriculum" (Earle, 2002, p. 10).

Indicators of High-level Use of Instructional Technology in Teaching

According to the results from a study conducted by the International Society for Technology in Education (ISTE), commissioned by the Milken Exchange on Education Technology, "the technology infrastructure of education has increased more quickly than the incorporation of IT tools into teaching and learning" (Moursund & Bielefeldt, 1999, p.2).

Although there is a great range of literature that address the problem of the lack of high-level use of technology in teaching (Moursund & Bielefeldt, 1999; Office of Technology Assessment, 1995) there is not a clear guideline of what the indicators of high-level use of technology might be. To address this problem a review of the literature surrounding the indicators of high-level use of technology was conducted. From this review high-level use of technology may be organized in 5 main categories (Boettcher, 2003; Bull, Bull, Cochran, & Bell, 2002; Cradler, 2003; Earle, 2002; Harris, 1998; International Society for Technology Education [ISTE], 2000; Jonassen, 2000; Keefe, 2003; Kimball, Cohen, Dimmick, & Mills, 2003-2004; McGrath, 2004; Mckenzie, 2002; Moursund & Bielefeldt, 1999; Roblyer & Edwards, 2000; Salomon, 2002; Thombs, 2003; Tomei, 1997; Trilling & Hood, 1999; Woodell & Garofoli, 2003).

1. Learner-centered: teachers use technology to promote hands on learning and learners' independence to explore and learn in an active way. Promoting learning through the access, interpretation, organization, and representation of information in a way that reflects students' own understanding of the information available to them.The ITs used by the learners give them the control over their own learning offering endless possibilities for learners to construct their learning experiences. Technology is used to engage learners in activities that lead them to the creation of their own technology-based product,

promoting creativity, self-expression, and feelings of self-efficacy. Different ITs are offered to support different learning styles and needs, which also address students with limited English proficiency, gifted students, and students physically or mentally impaired.

2. Community of learners: teachers use technology as a facilitator of the human and social aspects of learning, creating an atmosphere that favors the interpersonal relation among the learners through collaborative work. Favoring the creation of knowledge based communities, in which learners articulate and negotiate the understanding of a subject and the use of technology to solve authentic problems related to the subject area. Teachers can also use technology to help bridge cultural differences and increase the students' understanding of the issues concerning a multicultural society. Encouraging and supporting the understanding of others beliefs and world perspectives. They can offer different opportunities for students to "craft effective communications in a variety of media for diverse audiences" (Trilling & Hood, 1999, p.8). Instructional technology can be used to encourage conversations and discussions, offering an environment where learners can collaborate, argue and build consensus.
3. High-order thinking skills: teachers choose the instructional technology that would best help students to reorganize "knowledge in meaningful and usable ways. It involves three general skills: evaluating, analyzing, and connecting" (Jonassen, 2000, p. 27). Technology is used to promote authentic learning tasks offering a learning environment that gives "a wide variety of contextualized opportunities for discovery, inquiry, design, practice, instruction, and constructive exploration" (Trilling & Hood, 1999, p. 9). Teachers "must respect and encourage critical thinking and personal knowledge

construction as meaningful goals" using technology to motivate students to engage in thinking and learning activities that reflect students' realities" (Jonassen, 2000, p. 278). ITs are used to guide their students to define their projects and to establish the project's evaluation criteria helping them to refine their problem solving skills and their ability to work collaboratively. Most of the time project-based learning involves cross-curricula activities offering learners the possibility of refining their knowledge and understanding about the content they are studying.

4. Appropriate use of instructional technology: Teachers use technology as a means to establish contact with other teachers and experts in the field in order to exchange ideas and thoughts about teaching, sharing their experiences, thus, broadening their horizons and becoming lifelong learners. They critically evaluate and choose the technology that best addresses their instructional goals answering to the whys and hows of the use of a specific IT as part of a learning activity. Teachers use technology as a tool for supporting the students' learning experiences. ITs that best support the achievement of a certain curriculum goal are chosen as part of content related activities to facilitate students' learning process.
5. Assessment: Teachers use different measures to evaluate students' technology-based products.

Instructional technology professional development programs play a crucial role in shaping the next generations' pedagogical use of technology. The focus of any instructional technology professional development should include the development of awareness of the importance of building activities that incorporate the high-level use of technology in the classroom. As stated by Bober (2002) "A teacher whose technology training has positively

influenced pedagogy knows how to manage instructional time, how to ensure equitable access, how to encourage student initiative. Thinking about professional development as constructivist in nature and competency-based can dramatically alters how we plan for and what we expect from technology training" (p. 96).

National Technology Standards for Teachers

Federal funds have been allocated to equip schools to cope with the changes of a technological society. Most of schools have now access to computers and the Internet. However, few of them know how to use technology as an instructional tool to enhance instruction. The need for parameters in evaluating the use of technology in the classroom and the technology skills that are important for teachers to acquire have been the focus of many grant funders, specially the federal government (Bielefeldt, 2002; Bober, 2002). One way to address the need of high-quality teacher training has been the development of state, local and national standards concerning the integration of technology in the classroom (Moursund & Bielefeldt, 1999).

In 1989 International Society for Technology Education (ISTE) was created having among its goals the establishment of technology standards for teachers (Roblyer, 2003). In 1998, the first National Educational Technology Standards (NETS) for students were established. In 2000, "with funding from the U.S. Department of Education PT3 grant and NETS Partners, NETS for teachers are reviewed and revised" (Roblyer, 2003). Later that year, the ISTE releases NETS for teachers. NETS for administrators were released in 2001.

In 1990, ISTE became a member of the National Council for the Accreditation of Teacher Education (NCATE). The NCATE is responsible for certifying teacher preparation programs in colleges and universities throughout the United States. "NCATE 2000 requires the conceptual framework to address six indicators specified in the NCATE standards. One of these

indicators is “Commitment to Technology.” One way a teacher education program can demonstrate its commitment to technology is by providing evidence that its graduates can meet the NETS for Teachers” (Roblyer, 2003, p. 10). Moreover, international well-known organizations such as UNESCO is adopting NETS for teachers and administrators and translating them into eight languages to be distributed among the 185 nations that are members of UNESCO (Roblyer, 2003).

The National Educational Technology Standards (NETS) for teachers are aligned with a related set of NETS for students (Bielefeldt, 2002; Roblyer, 2003). “At the state level, 48 of the 51 states have adopted, adapted, aligned with, or otherwise referenced at least one set of standards in their state technology plans, certification, licensure, curriculum plans, assessment plans, or other official state documents” (International Society for Technology in Education [ISTE], 2003a, para 1).

The focus of this study is on instructional technology professional development programs and the strategies they use to prepare teachers to integrate technology into the classroom. The NETS for teachers were designed having preservice teachers in mind, but it also suitable for in-service teachers. The goal is to have every teacher candidate meet the national technology educational standards. The standards were designed to be very general allowing customizations in order to fit the different state, university or district realities (ISTE, 2000). An overview of NETS for teachers is provided on Table 2.

Table 2

National Educational Technology Standards for Teachers

I. Technology Operations and Concepts

Teachers demonstrate a sound understanding of technology operations and concepts. Teachers:

A. demonstrate introductory knowledge, skills, and understanding of concepts related to technology (as described in the ISTE *National Educational Technology Standards for Students*).

B. demonstrate continual growth in technology knowledge and skills to stay abreast of current and emerging technologies.

II. Planning and Designing Learning Environments and Experiences

Teachers plan and design effective learning environments and experiences supported by technology. Teachers:

A. design developmentally appropriate learning opportunities that apply technology-enhanced instructional strategies to support the diverse needs of learners.

B. apply current research on teaching and learning with technology when planning learning environments and experiences.

C. identify and locate technology resources and evaluate them for accuracy and suitability.

D. plan for the management of technology resources within the context of learning activities.

E. plan strategies to manage student learning in a technology-enhanced environment.

Table 2 (continued)

National Educational Technology Standards for Teachers

III. Teaching, Learning, and the Curriculum

Teachers implement curriculum plans that include methods and strategies for applying technology to maximize student learning. Teachers:

A. facilitate technology-enhanced experiences that address content standards and student technology standards.

B. use technology to support learner-centered strategies that address the diverse needs of students.

C. apply technology to develop students' higher-order skills and creativity.

D. manage student learning activities in a technology-enhanced environment.

IV. Assessment and Evaluation

Teachers apply technology to facilitate a variety of effective assessment and evaluation strategies. Teachers:

A. apply technology in assessing student learning of subject matter using a variety of assessment techniques.

B. use technology resources to collect and analyze data, interpret results, and communicate findings to improve instructional practice and maximize student learning.

C. apply multiple methods of evaluation to determine students' appropriate use of technology resources for learning, communication, and productivity.

Table 2 (continued)

National Educational Technology Standards for Teachers

V. Productivity and Professional Practice

Teachers use technology to enhance their productivity and professional practice. Teachers:

A. use technology resources to engage in ongoing professional development and lifelong learning.

B. continually evaluate and reflect on professional practice to make informed decisions regarding the use of technology in support of student learning.

C. apply technology to increase productivity.

D. use technology to communicate and collaborate with peers, parents, and the larger community in order to nurture student learning.

VI. Social, Ethical, Legal, and Human Issues

Teachers understand the social, ethical, legal, and human issues surrounding the use of technology in PK–12 schools and apply that understanding in practice. Teachers:

A. model and teach legal and ethical practice related to technology use.

B. apply technology resources to enable and empower learners with diverse backgrounds, characteristics, and abilities.

C. identify and use technology resources that affirm diversity.

D. promote safe and healthy use of technology resources.

E. facilitate equitable access to technology resources for all students.

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According to Bober (2002) "NETS for teachers do not presently include strategies for measuring competence or attainment of standards or advocate training interventions that promote competence or proficiency. The path to excellence, whether pre-service or in-service, is left to individual schools, districts, and states to fashion" (p. 98). Therefore this study will offer suggestions of strategies that could be used in training interventions to promote high-level use o technology in teaching practice and thus addressing in a way standards II to VI of NETS for teachers.

Technology Taxonomy

According to Tomei (2002) the chances of establishing clear and doable objectives are increased when teachers use taxonomy to guide the objectives writing process. Therefore, Tomei (2002) developed the Technology Taxonomy based on Bloom's Cognitive Domain Taxonomy, Krathwohl's Affective Domain Taxonomy, and Kibler, Baker, and Miles' Psychomotor Domain Taxonomy.

The result is a six level technology taxonomy: (a) level one: technology for literacy, (b) level two: technology for collaboration, (c) level three: technology for decision-making, (d) level four: technology for infusion, (e) level five: technology for integration, (f) level six: tech-ology (Tomei, 2003). The levels of the Technology Taxonomy are interrelated. According to Tomei (2002) "the sooner we adopt a taxonomy for instructional technology and begin to rely on a new directory of action verbs to classify our technology-based learning objectives, the sooner we will ensure that technology mature into a successful teaching and learning strategy in its own right" (p.74). Below is the overview of Tomei's (2003) Technology Taxonomy:

Table 3

Tomei's Technology Taxonomy

Taxonomy Classification	Definition of the Level of the Technology Taxonomy
Literacy ***Understanding Technology***	Level 1.0 The minimum degree of competency expected of teachers and students with respect to technology, computers, educational programs, office productivity software, the Internet, and their synergistic effectiveness as a learning strategy.
Collaboration ***Sharing Ideas***	Level 2.0 The ability to employ technology for effective interpersonal interaction.
Decision-Making ***Solving Problems***	Level 3.0 Ability to use technology in new and concrete situations to analyze, assess, and judge.
Infusion ***Learning with Technology***	Level 4.0 Identification, harvesting, and application of existing technology to unique learning situations.
Integration ***Teaching with Technology***	Level 5.0 The creation of new technology-based materials, combining otherwise disparate technologies to teach.
Tech-ology ***The Study of Technology***	Level 6.0 The ability to judge the universal impact, shared values, and social implications of technology use and its influence on teaching and learning.

Note: From *"Taxonomy for the Technology Domain"* by L. D. Tomei, 2003. Retrieved on June, 04, 2004 from http://www.duq.edu/%7Etomei/taxonomy/ Reprinted with permission of the author.

Table 4

The Technology Domain

Taxonomy Classification	Action Verbs That Represent Intellectual Activity On This Level
Literacy **Understanding technology**	Access online course materials, change default system settings, link to web sites, launch software applications, bookmark web sites, participate in a chat session, construct a visual presentation, fill and graph a spreadsheet, populate a database, locate sites using search engines, program function keys on a keyboard, adjust mouse speed and scroll, insert clip art and images, change font and text size, cut/copy/paste, operate a printer.
Collaboration **Sharing ideas**	Send electronic messages, post ideas to a bulletin board, word process a research synopsis, populate and subscribe to an educational listserve, electronically exchange spreadsheet data, capture and incorporate sound bytes, attach an electronic signature, participate in an online chat.

Table 4 (continued)

The Technology Domain

Decision-Making **Solving problems**	Prepare an electronic spreadsheet, prepare a decision paper, find information in a CDROM encyclopedia, search online newspapers, create an inquiry-based science project, prepare a digital resume, create a digital Venn diagram, diagnose a simulated illness using anatomical software, develop a logarithm formula for calculating proper dosages, use brainstorming software to support a plan of action.
Infusion **Learning with Technology**	Take a distance education course, appraise educational software, select appropriate multimedia resources, integrate online learning environments, create web-based lesson home page, create text-based handouts and study guides, create visual-based classroom presentations, download digital maps for exploration, use the digital camera to prepare an electronic insect collection.

Table 4 (continued)

The Technology Domain

Integration **Teaching with Technology**	Create an interactive workbook, fashion an interactive visual lesson, create a web-based virtual tour, build a language arts portfolio, download maps and originate a digital atlas of the US, produce an educational software package.
Tech-ology **The study of technology**	Debate the impact of online chat on language development, debate the use of internet filters in schools, advocate for distance learning in the community at large, develop a personal position concerning the impact of technology on society, argue for the ethical use of technology in medicine, predict technology's probable future roles in society, examine the uses and abuses of technology, copyright and fair use laws for using technology.

Note: From *"Taxonomy for the Technology Domain"* by L. D. Tomei, 2003. Retrieved on June, 04, 2004 from http://www.duq.edu/%7Etomei/taxonomy/ Reprinted with permission of the author.

There is a close relation between Tomei's taxonomy for the technology domain and the NETS for teachers. While the NETS for teachers focus on the goals to be achieved by the teachers, Tomei's taxonomy for the technology domain list the actions that would lead to the

achievement of the NETS for teachers' goals. Together they are powerful tools that can facilitate the implementation of technology in today's education system.

Research Findings about Characteristics of Effective and Successful Professional Development Programs for Educators

Although professional development is considered to be one of the main factors in the improvement of education, educators still face the misfortune of participating in professional developments that lack planning, support, resources or/and an adequate structure offering to educators nothing but a meaningless and wasteful experience (Guskey, 2000). The fact is that "schools can be no better than the teachers and administrators who work in them" (Guskey, 2003, p. 40). Thus, in order to see any significant change in teachers' practice there is a need for high quality professional development efforts as part of any education improvement planning (Guskey, 2003).

There are a number of teachers and school administrators that still have a restricted view of professional development as being short term workshops conducted as special events and without prior involvement of the participants in its planning, resulting in most of the times in a disconnection between what is presented and what is actually considered a need in the classroom daily educational practices. It is important to realize that workshops, lectures, and presentations are as effective as any other approach to professional development when considering the goals for which they are designed and their sustainability throughout times. Teachers need support in the process of attempting to apply the knowledge gained in their daily classroom practice (Guskey, 2000; Holland, 2001).

According to the Office of Technology Assessment (1995), most technology professional developments have succeeded in the aim of helping teachers to master instructional technology

tools such as word processing, database, spreadsheet, and Internet search. Nevertheless a great majority struggles in finding the best approach to promote an effective and pedagogically sound integration of instructional technology into the curriculum.

Guskey (2003) states that "the criteria for determining the effectiveness of professional development vary depending on the intended audience" (p. 46). According to Guskey (2003) "effectiveness, like beauty, is in the eye of the beholder" (p. 46).

The following list addressing the most common characteristics of successful and effective instructional technology professional development programs was resulted from an in-depth literature review on the topic (Bray, 1998; Bybee, 2001; Crawford, 2003; Feist, 2003; Garet, et. al., 2001; Knowles, Holton, & Swanson, 1998; Gonzales, Pickett, Hupert, & Martin, 2002; Guskey, 2000; Mckenzie, 1998; Mckenzie, 2001; National Foundation for the Improvement of Education, 2000; North Central Regional Education Laboratory, 2003; Sparks, 2002; Whitfield & Latimer, 2003). Effective and successful professional development must:

1. Be intentional and focused on broadening teachers knowledge and pedagogical skills to promote students' learning and the integration of technology into the curriculum rather than focusing on building up skills on a specific software - when establishing the goals of any professional development one must understand that they should focus on issues related to learning and learners (Bybee, 2001; Gonzales, et. al, 2002; Guskey, 2000; Mckenzie, 1998; National Foundation for the Improvement of Education, 2000; Sparks, 2002).
    a. Begin with a clear statement of purpose and goals
    b. Ensure that the goals are worthwhile
    c. Determine how the goals can be assessed (Guskey, 2000, p.19)

d. Ensure that the goals are achievable (Sparks, 2002)

2. Be an ongoing process – it goes beyond a 3 or 4 days workshop, and the concept of "one shot" or short duration workshop. It usually involves a significant number of hours and the sessions are related to each other as well as to the classroom practice. It is continuous and can take a formal shape as a workshop or informal one as on site visits or the help desk. It is sustainable over time through ongoing support for participants in order for them to apply what is learned in their instruction and later modify it to better adapt it to his/her educational practice. (Crawford, 2003; Garet, et. al., 2001; Guskey, 2000; Grant, 1996; National Foundation for the Improvement of Education, 2000; Whitfield & Latimer, 2003)
3. Be a systemic process that believes that change happens over an extended period of time and takes into account all levels of the organization. The changes that happen in a large scale are guided by a series of small steps that focus on the learning process and the learner. Thus it is sustained over time through the process of continuous incorporation of the technology into the school culture (Garet, et. al, 2001; Guskey, 2000; National Foundation for the Improvement of Education, 2000; Sparks, 2002; Office of Technology Assessment, 1995)
4. Be flexible and have a multimodal approach, offering different strategies to achieve a goal and support the different learning style of learners participating in the professional development (Crawford, 2003; Feist, 2003; Grant, 1996; Guskey, 2000; National Foundation for the Improvement of Education, 2000).
5. Be designed in line with the andragogical principles, respecting the adult learners and their learning characteristics. Adult learners build new knowledge upon connection to old

ones and are more likely to learn when what is offered is directly linked to their perceived needs, offering them the opportunity to apply immediately the new knowledge to their current practices. (Bray, 1998; Bybee, 2001; Crawford, 2003; Feist, 2003; Garet, et. al., 2001; Knowles, Holton, & Swanson, 1998; Mckenzie, 1998; Mckenzie, 2001; North Central Regional Education Laboratory, 2003; Sparks, 2002; Whitfield & Latimer, 2003)

6. Have the following preconditions:
    a. Adequate time to dedicate to the professional development and flexible scheduling fitting teachers' busy schedule
    b. Structured in a coherent long term plan
    c. Ready access to technology equipment by the participants
    d. Access to on-demand, onsite technical and pedagogical assistance. Participants want help in whatever topic or program they might be having problems.
    e. The choice of certain hardware or software should be based on the school's educational goals. The decisions on the purchase of any software or hardware must be guided by sound educational reasons.
    f. Participants should be trained on the software and hardware they have access in their school and that they are using or planning to use with their students.
    g. The learning resulted from the participation on the professional development should be of immediate application on their teaching
    h. Incentives as release time or money bonus for teachers to learn and apply what is learned in their instruction
    i. Adequate funding for technology as well as human resources

j. An infrastructure and administrators that support collaboration, inquiry and innovation

k. An approach that emphasizes the development of confidence, comfort and competence in the use of technology (Bray, 1998; Feist, 2003; Garet, et. al, 2001; Goodale, Carbonaro, & Snart, 2003; Grant, 1996; Holland, 2001; Mckenzie, 1998; National Foundation for the Improvement of Education, 2000; Office of Technology Assessment [OTA], 1995; Sparks, 2002; Schrum, 1999; U.S. Department of Education, 2000; Whitfield & Latimer, 2003)

7. Be a collaborative process and be based on constructivist theories providing opportunities for teachers to discuss, practice, research, reflect, try things out, analyze the success or failure, revise and try the use of instructional technology in their school context again (Mouza, 2002-2003; North Central Regional Education Laboratory, 2003; OTA, 1995; Sparks, 2002)
8. Provide follow-up support and further mentoring to promote participants' integration of instructional technologies into their teaching. Professional development activities should have built in follow-up procedures (Feist, 2003; Goodale et. al, 2003; Mouza, 2002-2003; OTA, 1995)
9. Provide technical and pedagogical support to assure the efficient use of technology in the classroom by the teachers participating in the professional development. The integration of technology should reflect and directly relate to curriculum goals. First should come the emphasis on the curriculum and then on the use of technology to support it (Feist, 2003; Mouza, 2002-2003; OTA, 1995)

10. Be designed in a way to offer significant support that will lead to the use of technology in a pedagogically sound way. Examples of good practices on the use of technology to empower teachers and students is a must to guarantee the success of professional development (Grant, 1996; Gonzales, et. al, 2002; OTA, 1995)
11. Create a community of learners from the same school subject or grade, thus having a districtwide and site based approach. Allowing educators who are undergoing the experience of technology professional development to share their experiences (Garet, et. al, 2001; Gonzales, et. al, 2002). "A thoughtful combination of large-scale and context-specific approaches can optimize the potential benefits of each and drastically improve both the efficiency and effectiveness of professional development practices" (Guskey, 2000, p. 31).
12. Be designed with the cooperation of the participants, incorporating their needs, and allowing them to shape their own learning. It must take into account participants' knowledge level and perceptions that they have during their different developmental stage. Learners take an active and responsible role in planning, acting and learning within the context of the curriculum they have to teach (Bray, 1998; Bybee, 2001; Grant, 1996; Holland, 2001; Mckenzie, 2001; National Foundation for the Improvement of Education, 2000; Schrum, 1999; U. S. Department of Education, 2000)
13. Be coherent, thus making a connection between technology and the school curriculum as well as to national, state and local educational standards (Feist, 2003; Garet, et. al., 2001; National Foundation for the Improvement of Education, 2000)

14. Require repeated cycles of shared professional development to support teachers to keep up with the new technologies, practices and research on the area of instructional technology (National Foundation for the Improvement of Education, 2000)
15. Have a subject matter focus. It should make a connection between theory and practice bringing to the participants issues relevant to their own instruction deepening their subject area knowledge and offering instructional strategies that could enhance students' learning. Educators learn by solving pertinent problems to the subject and grade level that they teach (Bray, 1998; Garet, et. al, 2001; National Foundation for the Improvement of Education, 2000; Sparks, 2002)
16. Recognize the teacher as a main facilitator of students' learning. It must recognize how important it is for teachers, the community, and the administrator to work together on the accomplishment of the efficient use of technology and how it might better be used to support their educational philosophy (Bybee, 2001; Feist, 2003; OTA, 1995; Sparks, 2002; U.S. Department of Education, 2000).
17. Have a continuous evaluation process. Evaluations should take place before, during and after any professional development. It should gauge the changes and the planning process (Bray, 1998; Bybee, 2001; Guskey, 2000; Mckenzie, 1998; National Foundation for the Improvement of Education, 2000)
18. Involve active learning. Technology not only requires relevant hands-on training but also the development of critical thinking on the application of the tools in which participants are going to be exposed and trained. It requires an interactive approach where learners feel as conducting their own learning experience (Bybee, 2001; Garet, et. al, 2001; Goodale, et. al, 2003; Grant, 1996; Mouza, 2002-3003; OTA, 1995)

19. Be designed based on the latest research evidences available (Guskey, 2003).

In today's educational settings the concept of effective professional development has dramatically changed from the, "one fits all approach" to deliver information to educators, to "systematic effort to bring about change", an opportunity for educators to "discuss, think about, try out, and hone new practices in an environment that values inquiry and experimentation" (Guskey, 2000, p. 7). Furthermore, as stated by Schrum (1999) one of the most difficult challenges of technology professional developments is "to support many different models of technology use to meet the needs of different students, teachers, classroom situations, and learning goals; and to support each teacher in the complex and long term process of refining one's own beliefs and teaching practices" (para. 14). Nevertheless, professional development is essential for the effective integration of instructional technology in teaching practice (Mouza, 2002-2003).

Major models of professional development

Due to the different kinds of professional needs, different approaches are used to professional development. All have at least one common characteristic: the need to be ongoing (Salpeter, 2003). The major approaches are the following:

1. Training (Conferences, Institutes and Workshops): most of the time it consists of one or more presenters that share their ideas and practices about a subject and guide a series of group-oriented activities. It is considered to be one of the most efficient and cost effective approaches of professional development. However it lacks flexibility and opportunities for customized learning. To be truly effective these approach to professional development has to provide follow-up activities and help, giving participants enough support for the

actual implementation of what was learned in their teaching (Grant, 1996; Guskey, 2000; National Foundation for the Improvement of Education, 2000)

2. Observation/Assessment: one can learn a lot by observing and being observed, receiving constructive feedback, and analyzing and reflecting on one's own practice. When the purpose of the observation is set, the kind of feedback that one will receive is more likely to be more relevant to the area or issue in which he/she is trying to improve. However, observation has its constraints it is limited to certain settings and might encounter problems as scheduling time for the observations to take place without overlapping teachers' class hours if one wants to avoid hiring substitutes (Garet, et. al, 2001; Grant, 1996; Guskey, 2000).
3. Involvement in a development/improvement process: a group of educators get together to discuss the improvement of a certain area in the curriculum or their instruction. Most of the time it is a very successful approach since the people involved are interested in the outcomes and have expertise in the area that is being discussed. "School-university partnerships and collaborative relationships, as well as educational cooperatives, are especially useful for these purposes" (Guskey, 2000, p. 25). This kind of partnership can promote an exchange in learning experiences and foster effective practices (Grant, 1996).
4. Study groups: the search for a solution for a determined problem by the school staff. To be successful it should be well structured, the groups should be well supported and well trained (Guskey, 2000; National Foundation for the Improvement of Education, 2000).
5. Inquiry/Action Research: Teachers study what they do in order to improve their own practice (National Foundation for the Improvement of Education, 2000). According to Calhoun (as cited in Guskey, 2000) the inquiry professional development usually

includes five steps that overlap. “Educators are required to a) select a problem question of collective interest; b) collect, organize, and interpret information related to the problem; c) study the relevant professional literature and research ; d) determine possible actions that are likely to achieve commonly valued goals; e) take action and document results”.

6. Individually guided activities: educators drive their own learning by choosing what they will learn and the activities that will best lead to their learning goals. According to Sparks and Loucks-Horsley (as cited in Guskey, 2000) this professional development include the following: (a) identification of a need of interest, (b) development of a plan to meet the need or interest, (c) learning activities, and (d) assessment of whether the learning meets the identified need or interest” (p. 27).
7. Mentoring: Based on the close relationship between human and learning, less experienced educators are paired up with more experienced ones who have the opportunity to observe, share ideas and strategies; and to have an individualized learning experience filled with challenges and support through guided and constructive feedback. However one has to keep in mind that significant time is needed to nurture the relationship between a mentor and the person being mentored. Besides the ideal mentoring matches are not always easy to find (Grant, 1996; Guskey, 2000; National Foundation for the Improvement of Education, 2000).
8. Teacher Network and Online Communities: teachers share their ideas, problems and solutions with other teachers forming a network that can communicate online or face-to-face. These “anytime, anywhere” learning communities help teachers to share experiences, collaborate and determine best practices. The success of an online community can be seen when its members keep communicating with each other even

when the main issue for which the community was created has been solved (National Foundation for the Improvement of Education, 2000; Salpeter, 2003).

9. Train the Teachers: a group of teachers are selected based on their motivation and enthusiasm of learning a certain topic. In terms of technology they are mostly energetic early adopters. They are given training and are requested to provide onsite training in what they have learned to other teachers, inspiring their colleagues in the different uses of technology in teaching. They are given time and administrative support once they return to their buildings to share their knowledge with other teachers. The pitfall of this approach is that trainers have different timing concerning achieving a comfort level with the new information they received in order to feel ready to convey what they have learned to others. Therefore time and support are essential to guarantee the success of this approach (Grant, 1996; OTA, 1995; Salpeter, 2003).

The context where the professional development is going to take place can strongly influence the characteristics that contribute to professional development's effectiveness (Guskey, 2003). Nevertheless, according to Guskey (2000) a combination of the models above is essential to bring effectiveness to any professional development and promote the expected changes.

Professional development programs are considered to be essential for any educational settings where educators' development and success are considered to be one of the institutions' main goals. "At the core of each and every successful educational improvement effort is a thoughtfully conceived, well-designed, and well-supported professional development component" (Guskey, 2000, p. 4). However "seldom is the professional development component thoroughly described or evaluated in sufficient detail to offer practical guidance for those wishing to understand the complexities of the improvement process" (Guskey, 2000, p. 5).

Therefore, this study aims to investigate the strategies employed by successful IT professional development that promote pedagogically appropriate use of ITs as part of teachers' teaching practice.

CHAPTER III: METHOD AND PROCEDURE

The purpose of this study was to determine a set of common strategies employed by sustainable instructional technology professional development programs that are found to successfully promote educators' high-level use of technology in their teaching practice.

Research Questions

The research questions guiding this study were:

1. What do successful instructional technology professional development programs recognize as indicators of high-level use of technology?
2. Which instructional technology professional development strategies successfully promote high-level use of instructional technology in participants' teaching practice?

Research Design

This research used a mixed-method approach. The main source of data collection was a self-administrated, self-reporting, cross-sectional (one fixed point in time) electronic survey. The electronic survey had close-ended questions scored using a 5-point Likert scale. The quantitative data collected from this section were analyzed using central tendency measures. For each survey's close-ended questions there was a corresponding open-ended question. The open-ended questions were analyzed using qualitative content analysis.

An overview of this study's methodology is provided in Table 5:

Table 5

Methodology Overview

Research Questions	Data Source	Data analyses	Expected outcomes
1. What do successful instructional technology professional development programs recognize as indicators of high-level use of technology?	Self-explanatory, self-administrated cross-sectional Pedagogical Use of Instructional Technology in Teaching Questionnaire close-ended questions.	Descriptive analyses	List of the indicators of high-level use of technology most used by the participants
2. Which instructional technology professional development strategies successfully promote high-level use of instructional technology in participants' teaching practice?	Pedagogical Use of Instructional Technology in Teaching Questionnaire open-ended questions.	Content Analysis	Matrix of the most common strategies used to achieve the identified indicator of high-level use of technology.

The participants of this study were purposefully sampled; they were selected as "information-rich cases whose study will illuminate the questions under study" (Patton, 2002, p. 46). The first research question was answered using data from the survey's close-ended responses and the second research question was answered using data generated from the survey's open-ended responses. This study determined the indicators of high-level use of technology as identified by the participants, and the most common strategies used to achieve them. The following steps were taken in order to conduct this study: (a) identification of participants, (b) questionnaire development, (c) administration of questionnaire, and (d) data collection and analyses.

Identification of Participants

As recognized by many researchers (Garet et al., 2001; Guskey, 2000; National Foundation for the Improvement of Education, 2000; Office of Technology Assessment, 1995; Sparks, 2002) professional development for teachers is essential in improving the quality of education. Following this perspective, the current study focused on the professional development for teachers.

The pool of potential participants was purposefully selected, and was comprised of 179 directors or their designees of the PT3 1999 and 2000 implementation grant awardees from across the United States and its territories. PT3 awarded three different kinds of grants: "capacity-building grants to lay the initial groundwork for a teacher preparation reform strategy, implementation grants to encourage systemic reform of teacher preparation programs, and catalyst grants to stimulate large-scale, innovative improvements for preparing technology-proficient teachers" (U.S. Department of Education, 2000, para. 3). These grants were awarded through a careful screening of participants who offered a well-detailed and high-quality proposal explaining how they would prepare prospective faculty to effectively integrate technology into their future teaching practice.

The implementation grants awarded in 1999 and 2000 were required to provide strong evidence that they would accomplish the following: (a) establish clear and feasible teaching and learning goals, (b) develop a well structured plan to help k-12 and higher education faculty to incorporate technology into their teaching and thus improve prospective teachers' learning experience, (c) prepare a careful and detailed plan concerning the budget necessary to support the learning experiences, (d) design an ongoing evaluation plan, (e) participate in regional meetings and a national conference, and (f) promote the formation of a community of learners (Preparing Tomorrow's Teacher to Use Technology [PT3], 1998). The criteria described above reflect the characteristics of successful professional programs found through the conducting a careful and in-depth literature review on this topic by the researcher.

This study focused specifically on implementation grants awarded in 1999 and 2000 because (a) they have already been identified by PT3 as successful programs, (b) their evaluation process is over, and (c) they had time to reflect upon their program and perfecting it.

Questionnaire Development

A questionnaire was developed to answer this study's research questions. The questionnaire was comprised of both close-ended and open-ended questions. Data from the close-ended questions were used to answer Research Question 1 and the data from the open-ended questions were used to answer Research Question 2. The close-ended and open-ended questions were interrelated. The questionnaire was administered online. Measures, described further on this study, were taken to guarantee the confidentiality and anonymity of the responses. In order to develop the instrument used for data collection the researcher took the following steps:

1. Identification of the high-level use of technology indicators presented in the literature.

2. Establishment of the connection between NETS for teachers and the high-level use of technology indicators identified in the literature.
3. Identification of reliable and valid surveys related to the assessment of high-level use of instructional technology in teaching practice.
4. Identification of the questions in the surveys that dealt with high-level use of instructional technology.
5. Cross-referencing of the selected questions with the high-level use of technology indicators found in the literature.
6. Elimination of overlapping questions.
7. Testing for content validity.
8. Posting the questionnaire on password protected university server.
9. Tested questionnaire design and assured the efficiency of the method of delivery.
10. Revision and modification of the survey.
11. Contact of participants.
12. Completion of survey by participants.

High-Level Use of Technology and NETS for Teachers

An in-depth literature review was conducted to identify the indicators of high-level use of instructional technology in teaching practice. The rationale for using instruments related to NETS for teachers (International Society for Technology Educational [ISTE], 2000) for development of this study's data collection instrument is: (a) the accreditation of International Society for Technology Educational (ISTE) by the National Council for the Accreditation of Teacher Education (NCATE) and the recognition of the importance of NETS for teacher by NCATE (ISTE, 2003b); (b) "at the state level, 48 of the 51 states have adopted, adapted, aligned with, or otherwise referenced at least

one set of standards in their state technology plans, certification, licensure, curriculum plans, assessment plans, or other official state documents" (ISTE, 2003a, para. 1); (c) that well-known international organizations such as the United Nations Educational, Scientific and Cultural Organization (UNESCO) are adopting NETS for teachers and administrators and translating them into eight languages to be distributed among the 185 nations that are members of UNESCO (Roblyer, 2003), and (d) the partnership between the Department of Education PT3 Programs and ISTE.

Identification of Existing Surveys

In order to have a fair sample of the domain an in-depth review of literature was conducted to identify surveys that addressed high-level use of technology. From this review, the researcher evaluated a set of surveys and identified possible questions that were adapted for the purpose of this study. Among the surveys that were evaluated, the ones that most closely addressed NETS for teachers and had questions that dealt with the high-level use of technology were the following:

1. The National Educational Standards for Teachers Profiles created by ISTE for assessing the level of compliance of teachers with the NETS standards (International Society for Technology in Education [ISTE], 2003).
2. The Professional Competency Continuum (PCC) Assessment Tool survey commissioned by the Milken Exchange on Education Technology. This survey was designed to allow educators to assess their "professional competency in the use of education technology" and indicate the areas in which educators need support for effective integration of technology in learning (Coughlin & Lemke, 1999, p. 10). The statements that were used in the construction of this study's instrument dealt with

higher use of technology and can be found under the transformation category of the PCC tool.

3. The Levels of Technology Implementation Questionnaire (LoTi) was designed by Moersch (1996-1997) with the objective of providing "a fair approximation of teacher behaviors related to technology implementation" (p. 41). Thus, assisting "school districts in restructuring their staff's curricula to include concept/ process-based instruction, authentic, uses of technology, and qualitative assessment" (p. 41).

None of the surveys above dealt solely with the issue of high-level use of technology. Therefore it was necessary to carefully select the questions and to adapt them in order to address this study's needs.

Questionnaire Design

The design of the questionnaire utilized both close-ended and open-ended questions. The questionnaire's close-ended questions were adapted from (a) the National Educational Standards for Teachers Profiles created by ISTE, (b) Level of Technology Implementation Questionnaire (LoTi) Preservice Teacher, Higher-Education Teacher, and Inservice Teacher, version 4.0, created by Moersh, and (c) the Professional Competency Continuum (PCC) Assessment Tool survey commissioned by the Milken Exchange on Education Technology. The PCC Assessment tool assesses different areas of technology integration. For the purpose of this survey, the questions adapted from the PCC Assessment tools were the ones that dealt with the assessment of technology integration in relation to curriculum, learning and assessment, and professional practice.

The survey questions identified for inclusion were those that best matched the high-level use of technology indicators described in this study's literature review (see pp. 26-28). The list of indicators was used to evaluate each of the selected instruments' questions. Selected questions from

the different instruments were compared among themselves for similarities. Overlapping questions, those that were stated differently but meant the same, were eliminated (see Appendix A).

The questions identified for inclusion were classified under five categories created based on the review of literature on high-level use of technology indicators (see pp. 26-28 of this document). The classification process was done as follows: (a) a panel of three experts reviewed the categories for appropriateness of used terminology, (b) each of the three experts placed the questionnaire's question under the category he/she found to be most appropriate, (c) the researcher and the panel of experts met to reach a consensus regarding the questionnaire's questions and the categories in which they belong, (d) a consensus was achieved when three of the four people meeting agreed regarding the category in which the questionnaire's question belonged. Following the consensus meeting the 13 categories that were first conceptualized by the researcher, were collapsed to 5 categories (see Table 6; Table 7).

Table 6

High-Level Use of Technology Categories and Questionnaire's Items (Before Consensus Meeting)

Categories of High-Level Use of Technology	Questionnaire's Items
1. Learner-centered – Learning to learn instruction	6
2. Creation of community of learners	13, 17, 21, 26
3. Creation of community of practice	10
4. Learner autonomy	14
5. Appropriate use of Instructional Technology	1, 22, 23, 24, 27
6. Development of critical thinking	2
7. Development of cross-cultural understanding	15
8. Enhancement of communication skills	12, 16
9. Enhancement of problem solving skills	3, 18, 25
10. Implementation of project-based learning	19, 20
11. Multiple learning approach	8, 11
12. The use of ITs aligned to curriculum goals, and national and state standards	4, 5, 7
13. Multiple measures for evaluating students	9

Table 7

High-Level Use of Technology Categories and Questionnaire's Items (After Consensus Meeting)

Categories of High-Level Use of Technology	Questionnaire's Items
1. **Learner-centered**: (merged: **1** Learner-centered**, 4** Learner autonomy**, 11** Multiple learning approach**)**	6, 8, 11, 14,
2. **Community of learners:** (merged: **2** Creation of community of learners**, 8** Enhancement of communication skills**, 7** Development of cross-cultural understanding**)**	12, 13, 15, 16, 17, 21, 26
3. **High-order thinking skills**: (merged: **6** Development of critical thinking**, 9** Enhancement of problem solving skills**, 10** Implementation of project-based learning**)**	2, 3, 18, 19, 20, 25
4. Appropriate use of Instructional Technology: (merged: **3** Creation of community of practice**, 5** Appropriate use of Instructional Technology**, 12** The use of ITs aligned to curriculum goals, and national and state standards**)**	1, 4, 5, 7, 10, 22, 23, 24, 27
5. Assessment: (**13** Multiple measures for evaluating students**)**	9

Note: Detailed explanation of the above categories is given on pp. 26-28 of this document. Refer to Appendix A for individual questionnaire items.

The following criteria were used when determining the panel of experts: (a) deep understanding and exposure to the area of research, (b) use of instructional technology in their own practice for communications, decision-making, instruction, integration and acculturation as described by Tomei (2002), (c) influence others, such as, pre-service teachers, in the high-level use of technology in the classroom.

As stated earlier the questionnaire had two interrelated sections. For each close-ended question there was an open-ended that requested a description of the strategies used to address the close-ended questions. Responses to the close-ended questions took the form of a continuous ordinal rating scale. Following Fowler's (1995) advice, the questionnaire had open-ended questions because "the list of possible answers is not known or is very long" (p. 59).

Instrument Content Validity

According to Hittleman and Simon (2002) in order to establish the content validity of the questionnaire the instrument creator has to "demonstrate that the specific items or questions represent an accurate sampling of specific bodies of knowledge. Creators of instruments establish content validity by submitting the instruments' items to a group of authorities in the content areas. It is their expert opinions that determine whether the instruments have content validity" (p. 112).

Therefore, the researcher asked a panel of three "specialists in the area to review the instrument and agree that 'yes, these are the appropriate items to get what is desired'"(Cox, 1996, p. 35). The same experts that guided categorizing the questionnaire's questions participated in establishing the content validity of the questionnaire. The following criteria were used when determining the panel of experts: (a) deep understanding and exposure to the area of research, (b) use of instructional technology in their own practice for communications, decision-making, instruction, integration and acculturation as described by Tomei (2002), and (c) in a position to influence others, such as, pre-service teachers, in the high-level use of technology in the classroom.

The researcher met with the three experts and explained the purpose and objective of the study, and reviewed the content validity process to be carried out. A folder including the following content was given to each of the experts: (a) a copy of the original instruments used to construct the questionnaire, (b) comparison table of questionnaire's items and instruments used to create them (see

Appendix A), (c) assessment of questionnaire's content validity tool (see Table 8), and (d) explanation of categories (see pp. 20-23).

The experts were asked to categorize the questions and to evaluate each question according to the criteria suggested by Yaghmaie (2003). Each item was judged for its content domain with the criteria of relevance (R), clarity (C), simplicity (S), and ambiguity (A). Experts rated the questions using a 4-point scale where the value of 1 was attributed to *Strongly Disagree*, 2 to *Disagree*, 3 to *Agree*, and 5 to *Strongly Agree* (see Table 8). For the criteria of ambiguity a reversed scale was used where 4 was attributed to *Strongly Disagree*, 3 to *Disagree*, 2 to *Agree*, and 1 to *Strongly Agree.*

The following definitions were used by the experts when assessing the questionnaire items: (a) relevance: relation to the matter at hand, (b) clarity: free of confusion, the comprehensibility of clear expression, (c) simplicity: directness of expression, uncomplicated, readily understood (d) ambiguity: capable of being understood in two or more possible senses or ways (Merriam-Webster, 1995).

The experts were given one week to analyze the questions, rate them, and comment on the categorization process. Analysis of the results of the content validity process was done using the Content Validity Index (CVI), developed by Waltz and Bausell (1983), which is the "proportion of items given a rating of 3 or 4 by the raters involved" (p. 71). As suggested by Yaghmaie (2003) only those items receiving CVI 0.75 or higher were considered suitable for the study without questioning (see Table 8).

$$CVI = \frac{\text{number of items given a rating of 3 or 4 by raters}}{\text{Total number of items for which the question is being evaluated}}$$

A second meeting was arranged to present the results and discuss the questionnaire until an agreement was met concerning each item that would be included and those that would be excluded from the questionnaire. A consensus was reached when two of the three experts agreed.

Of the 29 items 12 (questions 5, 10, 12, 14, 16, 17, 18, 19, 23, 25, 27, and 29) had a CVI below 0.75. However, only two (questions 12 and 23) of the twelve were eliminated. The other 10 were considered by the experts worth keeping with modifications, or clarifications. Even when the CVI was above 0.75 the experts still went over the questions together to check for appropriate language and a broader consensus, as a result slight modifications were made on the questions under the supervision and agreement of the panel of experts (see Table 8).

Table 8

Results of Assessment of Questionnaire's Content Validity

Questionnaire Items **Our professional development prepared participants to:**	**Expert 1**				**Expert 2**				**Expert 3**				**Content Validity Index (n. of 3 and 4 divided by 12)**
	R*	**C***	**S***	**A***	**R***	**C***	**S***	**A***	**R***	**C***	**S***	**A***	
1. differentiate between appropriate and inappropriate uses of technology for students' grade level and content area.	4	4	4	4	4	3	3	4	4	3	4	4	12/12 = **1**
2. design and implement learning activities that integrate technology to support and expand students' critical thinking	4	4	4	4	4	4	4	4	4	4	4	4	12/12 = **1**
3. design and implement learning activities that integrate technology to support and expand students' ~~authentic~~ problem solving skills	4	3	3	4	3	3	3	3	4	4	4	4	12/12 = **1**
4. design and implement learner-centered lessons that are based on the current best practices for integrating the learning of subject matter and student technology standards	4	4	4	4	3	3	2	2	4	4	3	4	10/12 = **0.83**
5. assess learner-centered lessons that are based on the current best practices for integrating ~~the learning of~~ subject matter and student technology standards	4	4	4	4	2	2	2	2	4	4	4	4	8/12 = **0.66**
6. design and implement student-centered, instructional materials that take advantage of computers to engage students in their own learning	4	4	4	4	4	4	4	4	4	3	3	3	12/12 = **1**
7. design and teach technology-enriched learning activities that connect content, state and national standards with student technology standards	4	4	4	4	4	4	4	4	4	4	4	4	12/12 = **1**

* **R:** relevance; **C:** clarity**; S:** simplicity; A**:** ambiguity

Shaded Area: Item eliminated

Table 8 (continued)

Results of Assessment of Questionnaire's Content Validity

Questionnaire Items **Our professional development prepared participants to:**	**Expert 1**				**Expert 2**				**Expert 3**				**Content Validity Index (n. of 3 and 4 divided by 12)**
	R*	**C***	**S***	**A***	**R***	**C***	**S***	**A***	**R***	**C***	**S***	**A***	
8. design and teach technology-enriched learning activities that meet the individual ~~diverse~~ needs of students	4	4	4	4	3	3	3	2	4	4	4	4	11/12 = **0.92**
9. design an evaluation plan that applies multiple measures for evaluating technology-based students' products	4	4	4	4	4	4	4	4	4	4	4	4	12/12 = **1**
10. participate in online professional collaborations with peers and experts (kept without modification- consensus of experts)	4	4	4	4	?	?	?	?	4	4	4	4	8/12 = **0.66**
11. design and facilitate learning experiences that use assistive technologies to meet the special physical needs of students	4	4	4	4	4	3	?	2	4	4	4	4	10/12 = **0.83**
12. design, manage, and facilitate learning experiences that affirm diversity (redundant 12 and 16 – 12 was eliminated)	4	4	4	3	?	?	?	?	4	4	4	4	8/12 = **0.66**
13. guide collaborative learning activities in which students use technology resources to solve authentic problems in the subject area (s)	4	4	4	3	3	?	?	?	4	4	4	4	9/12 = **0.75**
14. arrange equitable access to appropriate technology resources that enable students to engage successfully in learning activities across subject/content areas and grade levels (kept without modification- consensus of experts)	4	4	4	4	?	?	?	?	4	3	3	4	8/12 = **0.66**

* **R:** relevance; **C:** clarity**; S:** simplicity; A**:** ambiguity

Shaded Area: Item eliminated.

Table 8 (continued)

Results of Assessment of Questionnaire's Content Validity

Questionnaire Items **Our professional development prepared participants to:**	Expert 1				Expert 2				Expert 3				Content Validity Index (n. of 3 and 4 divided by 12)
	R*	**C***	**S***	**A***	**R***	**C***	**S***	**A***	**R***	**C***	**S***	**A***	
15. plan and implement technology-based learning activities that promote student engagement in analysis, synthesis, interpretation, and creation of original products	4	4	4	4	4	4	4	4	4	4	4	4	12/12 = **1**
16. facilitate students' use of technology that addresses their social needs and cultural identity (kept without modification- consensus of experts)	4	4	4	4	?	?	?	?	4	4	4	4	8/12 = **0.66**
17. facilitate students' use of technology that promotes their interaction with the global community (kept without modification- consensus of experts)	4	4	4	4	?	?	?	?	4	4	4	4	8/12 = **0.66**
18. structure a learning environment where student collaboration is the common practice ~~norm~~ when using technology	4	4	4	4	2	?	?	?	4	4	4	4	8/12 = **0.66**
19. use students' interests, experiences ~~and desire to solve authentic and relevant problems~~ when planning a variety of computer-related activities ~~in their classroom~~	4	4	3	4	2	1	1	1	4	4	4	4	8/12 = **0.66**
20. implement project-based learning ~~in a classroom situation~~ that emphasizes critical content and higher-order thinking skills (e.g., analysis, synthesis, evaluation) using the available computers	4	4	4	4	3	4	3	4	4	4	4	4	12/12 = **1**
21. design and implement web-based projects that emphasize complex thinking skill strategies such as problem-solving, scientific inquiry, or decision-making	4	4	4	4	3	4	3	3	4	4	4	4	12/12 = **1**
22. Guide students' use of the Internet for collaboration with others	4	4	4	4	4	4	4	4	4	4	4	4	12/12 = **1**
23. design projects in which students use the ~~classroom~~ computer(s) for research purpose that require them to investigate an issue/problem, think creatively, take a position, make decisions, and/or seek out a solution(redundant 23 and 20 – 23 was eliminated)	4	4	4	4	?	?	?	?	4	3	3	3	8/12 = **0.66**

* **R:** relevance; **C:** clarity**; S:** simplicity; A**:** ambiguity

Shaded Area: Item eliminated

Table 8 (continued)

Results of Assessment of Questionnaire's Content Validity

Questionnaire Items **Our professional development prepared participants to:**	**Expert 1**				**Expert 2**				**Expert 3**				**Content Validity Index (n. of 3 and 4 divided by 12)**
	R*	**C***	**S***	**A***	**R***	**C***	**S***	**A***	**R***	**C***	**S***	**A***	
24. use content-specific tools (e.g., software, simulation, web tools) to support learning.	4	4	4	4	4	4	4	4	4	4	4	4	12/12 = **1**
25. use technology resources to facilitate knowledge construction. (kept without modification- consensus of experts)	4	4	4	4	?	1	1	1	4	4	4	4	8/12 = **0.66**
26. apply technology tools and resources to collect, analyze, and interpret data and report results ~~to parents and students~~	4	4	4	3	3	3	3	4	4	4	4	4	12/12 = **1**
27. ~~take into consideration the process of transferring~~ transfer what students' have learned in the classroom to real world situation ~~(e.g., student-generated recycling program, student-generated business)~~ when planning the use of technology in the classroom (e.g., student-generated recycling program, student-generated business)	4	4	4	4	1	1	1	1	4	4	4	4	8/12 = **0.66**
28. design online collaborative projects with other entities (e.g., schools, businesses, organizations) to find solutions, make decisions, or seek a resolution to an issue of importance to the students.	4	4	4	4	4	4	4	4	4	4	4	4	12/12 = **1**
29. use technology in instruction to provide students with increased levels of interactivity ~~that are much higher than those that previously existed in the classroom~~.	4	4	4	3	?	1	?	1	4	3	3	3	8/12 = **0.66**

* **R:** relevance; **C:** clarity**; S:** simplicity; **A:** ambiguity

Shaded Area: Item eliminated

Note: Adapted from *"Content validity and its estimation"* by F. Yaghmaie. Retrieved on March, 09, 2004 from http://www.sbmu.ac.ir/Journal/MedEdu/jme7no1/Content%20validity%20and%20its%20estimation.htm

Posting on Password Protected University Server and Questionnaire Revisions

After the establishment of the questionnaire's content validity, the questionnaire was posted to a secure password protected university server. Electronic survey was chosen as the means of data collection for the following reasons: (a) participants have access to the required technology, (b) participants feel comfortable using the technology, (c) rapid response time, and (d) it is less expensive than mail surveys (Shannon & Bradshaw, 2002).

The online survey had close-ended questions in the form of radio buttons from which the participants chose their response. It also had open-ended questions in the form of text box where participants typed their answers. The questions were shown all at once and for each close-ended question there was a corresponding open-ended question. Participants could complete the survey at their own pace; so long as they did not exit the program. They would not be timed out, but if they exited the questionnaire's screen they would lose the data. After completing the questionnaire, participants had to click on the submit button in order to submit their final answers. An automatic e-mail message was sent to the researcher every time a participant completed the questionnaire and hit the submit button.

To test the questionnaire design and assure the efficiency of the method of delivery a trial session was conducted. The trial session consisted of having three Technology Education doctoral students fill out the online questionnaire and e-mail the researcher their suggestions concerning the ease of completing the questionnaire, and layout. Revisions were made to the online questionnaire based on the doctoral students' suggestions and on the results of the trial session.

Data Collection

According to Fink and Koseccoff (1985) a survey is used to "help set policy and formulate rules, provide data on the merits of services and programs, or offer new insights into thoughts and behavior" (p. 20). Surveys are "systems for collecting information to describe, compare and predict attitudes, opinion, values, knowledge and behavior" (Fink, 1995c, p. 21). Therefore, due to the focus of this study this researcher decided to use survey as the major method of collecting data.

The instrument used in this study was a self-administrated cross-sectional (one point in time) online questionnaire (see Appendix B) that was available for completion to all 179 potential participants (Fink & Kosecoff, 1985). The questionnaire was available online for 2 weeks during the 2004-summer semester to 179 directors or their designees of 1999 and 2000 PT3 implementation grants. The researcher posted the survey online using a password protected university server as the main means of survey distribution and data collection. The cross-sectional (one point in time) design was chosen as the best way to portray one's opinion at a particular time (Fink, 1995c).

The instrument, as well as an explanation of the research, was submitted to the Institutional Review Board for its approval. To assure participants' privacy and confidentiality the following was done: (a) an e-mail was sent to all 179 potential participants requesting their participation on the study with "a fair explanation of the procedures to be followed and their purposes, (b) a description of any risk and benefits, (c) an offer to answer any inquiries, (d) and instruction that the person is free to withdraw the consent and to discontinue participation without prejudice" (p. 51). Refer to Appendix C to see the e-mail sent to participants, and Appendix D for the Institutional Review Board approval to conduct this research.

The e-mail was sent to each participant individually, and it also contained instructions regarding how to access the online questionnaire including each participant's username and password. They were asked to indicate a proxy who could answer in their name and complete the survey in case they were willing to participate but could not, for some reason, complete the survey. Participants were encouraged to complete the survey within the period of a week (see Appendix C). Data collection was over in a two-week period. After the second week, the data collection was considered completed.

A thank-you card and a request to answer the survey were mailed on the first week of data collection together with a thank-you magnet, as a follow-up and an incentive for participating in the study (see Appendix E). At the end of the first week of data collection, an e-mail was sent for those who had not completed the survey, asking for their participation and giving them one more week to complete the survey (Appendix F). A final reminder e-mail was sent three days before the day assigned as the final day of data collection, encouraging participants to complete the questionnaire (see Appendix G). A Thank-you e-mail was sent to each of the participants who completed the survey (See Appendix H). This procedure was used to attempt to increase response rate (Cox, 1996; Patten, 2001).

Data Analysis

This study used a parallel mixed analyses method in which the open-ended and close-ended responses were analyzed separately and then "the findings are integrated after both sets of analyses have been undertaken" (Onwuegbuzie & Teddlie, 2003, p. 366). The close-ended questions were analyzed using a 5-point Likert scale where the value of 1 was attributed to *Strongly Disagree*, 2 to *Disagree*, 3 to *Not Applied in my Professional Development*, 4 to *Agree*, and 5 to *Strongly Agree*. As suggested by Patten (2001), it was stated in the directions on the

instrument that the participants might choose the option that closest corresponds to their opinion. The percentage of the responses was calculated as well as the median (Patten, 2001). The median score was used because "Since the median always falls in the middle, it is used when you want to describe 'typical' performance" (Fink & Kosecoff, 1985, p. 79).

A list of the high-level use of technology indicators identified by the participants was generated from the questionnaire items that had a median of 3.5 or higher, which represents more than 50% of the respondents answering *Agree* or *Strongly Agree* to a question. The other items in the questionnaire that did not score a median of 3.5 or higher were disregarded. In order to capture all possible strategies all open-ended responses were analyzed.

Content analysis was the approach used to analyze the open-ended questions. The open-ended data were coded and categorized. According to Miles and Huberman (1994), "codes are tags or labels for assigning units of meaning to the descriptive or inferential information compiled during a study" (p. 56). Categories were created interactively, at different phases of the mixed methods research process, a priori and a posteriori of the data collection (Onwuegbuzie & Teddlie, 2003). In this study the data were placed under the five pre-established categories that were created based on the related literature review on the topic, and reviewed by a panel of experts who agreed on them (see pp. 20-23 of this document).

Codes were generated by reading the first seven survey responses (10% of the total responses) and completing the intrarespondent matrix template for each question (see Appendix I). The coding was discussed with the researcher's adviser. After establishing the sub-categories (strategies types), an expert in the area of research was asked to code the answers from the seven analyzed surveys to establish consensus regarding the code system to be used for analysis of the

remaining surveys. A meeting was held to establish consensus regarding the coding system. Consensus was reached when both the researcher and the expert agreed on coding the same data.

After consensus on the coding scheme was reached and the remaining data were collected, the researcher and the expert used the developed coding scheme to analyze one more response. Another meeting between the researcher and the expert was held to compare the results and resolve differences in coding.

The percent agreement was calculated as a measure of interrater reliability. This measure is the ratio of the number of items on which the raters agreed divided by the total number of items: ((Total number of agreements) / (Total number of observations)) X 100. An overall percentage agreement equal to or higher than 80% was desired. In this study an agreement of 85% was achieved.

A descriptive report was generated from the collected data containing text and tables (Cox, 1996; Fink, 1995a; Fink & Kosecoff, 1985). As a result of data analysis a matrix of the most common strategies to address the high-level use of technology identified by the participants was generated.

CHAPTER IV: RESULTS

This study was guided by two research questions. The first research question dealt with the identification of the indicators of high-level use of technology by professional development programs participating in this study. Data from the quantitative portion of the questionnaire were analyzed, and the median was calculated in order to answer this question. The second question of this study addressed the identification of the strategies used by professional development programs to promote high-level use of instructional technology in participants' teaching practice. To answer this question, a qualitative analysis of the questionnaire's open-ended responses was conducted. The following is an in-depth description of the findings.

Questionnaire Return Rate

The potential participants of this study were 179 directors or their designees, awardees of the PT3 1999 and 2000 implementation grants, from all over the United States and its territories. From 179 potential participants, 64 were 1999 implementation grants whereas 115 were implementation grants awarded in 2000.

Data collection was conducted in the summer of 2004, and it lasted two weeks. At the end of the first week, a total of 25 (13.96%) participants had responded to the questionnaire. Following a thank-you note to all potential participants (see Appendix E) and an e-mail reminder to non-respondents (see Appendix F), the number increased to 21 (11.73%) more participants. After the final e-mail reminder (see Appendix G), 24 (13.41%) more participants responded. A total of 70 (39.11%) people responded to the questionnaire. From the 70 people who responded to the questionnaire, 19 (27.14%) were those who received grants in 1999 whereas 46 (65.71%) were those who received them in 2000, and 5 (7.14%) could not be identified. A thank-you e-mail was sent to each participant who completed the survey (see Appendix H).

From 179 potential participants, 8 (4.47%) forwarded the e-mail or indicated another person who could complete the questionnaire. Unfortunately, nine (5.02%) participants refused to participate for the following reasons: (a) too busy, (b) on a field trip, (c) on vacation, (d) felt that their PT3 did not fit the research, (e) not part of the project any longer, or (f) program was not a success. There were 20 (11.17%) of the 179 participants who could not be contacted. The e-mails sent came back as undelivered e-mails. Although further efforts were made to contact other people responsible for the project, the e-mail addresses listed on PT3 web site gave the same error. One participant, when trying to submit the questionnaire electronically, experienced technical problems and decided to print out the questionnaire to send it by mail. For a summary of the return rate see Table 9:

Table 9

Return Rate

Contact Attempts	**Number of Surveys Received**	**Response Rate**
Introduction e-mail	25	13.97%
Thank-you card/ incentive/ e-mail reminder	21	11.73%
Final e-mail reminder	24	13.41%
Total	70	39.11%

Findings Based on Research Questions

The following is the description of the findings from the two questions that guided this study. A brief statement of the analysis procedures involved in each of the questions is presented along with the research findings.

Research Question 1: Analyses and Findings

Research Question 1: *What do successful instructional technology professional development programs recognize as indicators of high-level use of technology?* was answered by analyzing the data from the close-ended questions from the Pedagogical Use of Instructional Technology in Teaching Questionnaire (see Appendix B). The close-ended questions of the questionnaire were analyzed using a 5-point Likert scale in which the value of 1 was attributed to *Strongly Disagree*, 2 to *Disagree*, 3 to *Not Applied in my Professional Development*, 4 to *Agree*, and 5 to *Strongly Agree*. The percentage of the responses was calculated (see Appendix J) as well as the median (see Table 10).

Table 10

Recognized Indicators of High-level Use of Technology

	Questionnaire Items Our professional development prepared participants to:	***n* Valid**	***n* Missing**	**Median**
1.	**differentiate between appropriate and inappropriate uses of technology for students' grade level and content area.**	**70**	**0**	**4**
2.	**design and implement learning activities that integrate technology to support and expand students' critical thinking.**	**70**	**0**	**4**
3.	**design and implement learning activities that integrate technology to support and expand students' problem solving skills.**	**70**	**0**	**4**
4.	**design and implement learner-centered lessons that are based on the current best practices for integrating the learning of subject matter and student technology standards.**	**67**	**3**	**4**

* Items with a median lower than 3.5 were excluded from the list of high-level use of technology indicators.

Table 10 (continued)

Recognized Indicators of High-level Use of Technology (Table 10 - continued)

	Questionnaire Items Our professional development prepared participants to:	*n* Valid	*n* Missing	Median
5.	**assess learner-centered lessons that are based on the current best practices for integrating subject matter and student technology standards.**	**69**	**1**	**4**
6.	**design and implement student-centered, instructional materials that take advantage of computers to engage students in their own learning.**	**69**	**1**	**4**
7.	**design and teach technology-enriched learning activities that connect content, state and national standards with student technology standards.**	**65**	**5**	**5**
8.	**design and teach technology-enriched learning activities that meet the individual needs of students.**	**69**	**1**	**4**
9.	**design an evaluation plan that applies multiple measures for evaluating technology-based students' products.**	**69**	**1**	**4**
10.	**participate in online professional collaborations with peers and experts.**	**70**	**0**	**4**
11.	**design and facilitate learning experiences that use assistive technologies to meet the special physical needs of students.**	**69**	**1**	**3***
12.	**guide collaborative learning activities in which students use technology resources to solve authentic problems in the subject area (s).**	**70**	**0**	**4**
13.	**arrange equitable access to appropriate technology resources that enable students to engage successfully in learning activities across subject/content areas and grade levels.**	**70**	**0**	**4**

* Items with a median lower than 3.5 were excluded from the list of high-level use of technology indicators.

Table 10 (continued)

Recognized Indicators of High-level Use of Technology

Questionnaire Items Our professional development prepared participants to:	*n* Valid	*n* Missing	Median
14. **plan and implement technology-based learning activities that promote student engagement in analysis, synthesis, interpretation, and creation of original products.**	**69**	**1**	**4**
15. **facilitate students' use of technology that addresses their social needs and cultural identity.**	**67**	**3**	**3***
16. **facilitate students' use of technology that promotes their interaction with the global community.**	**70**	**0**	**3***
17. **structure a learning environment where student collaboration is the common practice when using technology.**	**68**	**2**	**4**
18. **use students' interests, experiences when planning a variety of computer-related activities.**	**68**	**2**	**4**
19. **implement project-based learning that emphasizes critical content and higher-order thinking skills (e.g., analysis, synthesis, evaluation) using the available computers.**	**68**	**2**	**4**
20. **design and implement web-based projects that emphasize complex thinking skill strategies such as problem-solving, scientific inquiry, or decision-making.**	**65**	**5**	**4**
21. **guide students' use of the Internet for collaboration with others.**	**67**	**3**	**4**
22. **use content-specific tools (e.g., software, simulation, web tools) to support learning.**	**69**	**1**	**4**
23. **use technology resources to facilitate knowledge construction.**	**66**	**4**	**4**

* Items with a median lower than 3.5 were excluded from the list of high-level use of technology indicators.

Table 10 (continued)

Recognized Indicators of High-level Use of Technology

Questionnaire Items Our professional development prepared participants to:	*n* Valid	*n* Missing	Median
24. **apply technology tools and resources to collect, analyze, and interpret data and report results.**	**67**	**3**	**4**
25. **transfer what students' have learned in the classroom to real world situation when planning the use of technology in the classroom(e.g., student-generated recycling program, student-generated business).**	**66**	**4**	**3***
26. **design online collaborative projects with other entities (e.g., schools, businesses, organizations) to find solutions, make decisions, or seek a resolution to an issue of importance to the students.**	**68**	**2**	**3***
27. **use technology in instruction to provide students with increased levels of interactivity.**	**69**	**1**	**4**

***** Items with a median lower than 3.5 were excluded from the list of high-level use of technology indicators.

The items in the questionnaire that had a median above 3.5 were those indicators of high-level use of technology recognized as part of participating professional development programs. Research Question 1 inquired about what indicators of high-level use of technology instructional technology professional development programs recognized as part of their programs. Analysis of the quantitative data presented in Table 10, indicated that from the 27 indicators of high-level use of technology a total of 22 were recognized as part of the professional development programs participating in this study.

Research Question 2: Analyses and Findings

Following the methods described in Chapter 3, the open-ended questions from the Pedagogical Use of Instructional Technology in Teaching Questionnaire (see Appendix B) were

analyzed to answer Research Question 2: *Which instructional technology professional development strategies successfully promote high-level use of instructional technology in participants' teaching practice?* The analyses were divided into the following steps: (a) establishment of a coding scheme, (b) analysis of participants' responses per indicator, and (c) analysis of strategies across indicators. Following is an in-depth description of these steps.

Establishment of Coding Scheme

The establishment of the coding scheme was divided into the following steps:

1. Content analysis of the first seven responses, which corresponded to 10% of the total responses, was conducted and a coding scheme was generated. The use of the intrarespondent matrix (see Appendix I) helped to organize the data, facilitating the analysis process.
2. The same set of questions was analyzed and coded by an expert in the area of research, and a meeting conducted in to compare the coding schemes generated from the analyses of the questions.
3. After discussing the differences in coding, a consensus was achieved resulting in the final coding scheme that was used to analyze the remainder of the responses.
4. This final coding scheme was tested by having the researcher and the expert code one additional question independently.
5. A final follow-up meeting was conducted to assess the reliability of the coding scheme. The resulting interrater reliability was 85%.

A total of 28 codes were generated. During the process of analysis some codes were collapsed resulting in the 26 codes that are presented in Table 11.

Table 11

Code Scheme - Strategies

Code	Strategies	Description
1.	Identifying/Defining appropriate use of IT	Reasoning behind choosing a technology, and/or learning theory involving the use of technology.
2.	Exemplars/Models/Experts	Best examples of IT integration, including examples given by experts and models developed by credible institutes.
3.	Evaluation/Critique/Assessment	Assessment of technology use or the evaluation of any process involving the choice of IT implementation.
4.	Observation	Observation of IT use by others.
5.	Modeling	Providing example of IT use through their teaching.
6.	Presentation/Demo/Hands on	Presenting the software/hardware, demonstrating its use and allowing time for hands on activities with the software/hardware that was introduced.
7.	Examples	Example of work done (not necessarily excellent work in the area).
8.	Mentoring/Consultation	Providing individual assistance and support.
9.	Appropriate (Lesson/Learning Activity) Development	Development of lessons in which technology is used to contribute to the overall learning experience, with ITs that are chosen to support students' learning goal.
10.	Referencing Standards	Standards were referenced but not taught directly.
11.	Team Work/Group Discussion/Peer Discussion	Any kind of organized discussion that enhanced the learning experience, and/or any work done collaboratively.
12.	Grouping	Facilitating the learning experience by directing activities to certain group that fits under certain criteria.
13.	Appropriate lesson development and assessment	Development of lesson assessment was part of lesson development plan.

Table 11

Code Scheme - Strategies (Table 11 - continued)

Code	Strategies	Description
14.	Problem- Based Learning/Project-Based Learning	Learning Activities that promote problem-solving and/or project based learning. i.e: WebQuest.
15.	Standards Specific Training	Formal training on standards and how to better address them.
16.	Present/Develop/Use Rubrics	Any kind of activity that involves rubrics.
17.	Special Funding/Special Incentives	Financial funding or special incentives awarded to those participating in the professional development program.
18.	Collaborative Learning	Any activity that promotes collaborate learning, except the ones involving telecollaboration.
19.	Telecollaboration	Relates to the telecollaborative activities classified by Judi Harris (see Table 1).
20.	Made Technology Available	Any effort towards providing software and hardware.
21.	Technology Support Teams	Offering technical support during and after training.
22.	Specific Assessment Tool	Development/use of a specific assessment tool.
23.	Faculty Research (Presentations/Conferences)	Require participants to present their work and/or participate in conferences.
24.	Course/Curriculum Modification	Adapted a course/curriculum to address the use of instructional technology.
25.	Resources Development	Development of instructional technology activities that could later be used by others in the field.
26.	Lesson Implementation	Lessons that were developed and then implemented into participants' teaching.

Analysis of Participants' Responses per Indicator

In order to better answer Research Question 2, the responses for all 27 indicators were analyzed, including the five indicators that did not make the final list of high-level use of

technology indicators. The analysis of all 27 indicators was done to ensure that all successful strategies described by professional development programs were captured.

Table 12 shows the number of participants who answered *Agree* or *Strongly Agree* to an indicator and the number of participants who provided responses to the open-ended questions. For all questions, participants were asked to respond to those open-ended questions if they *Agree* or *Strongly Agree*, however, not all of them did. Therefore, the number of participants marking *Agree* or *Strongly Agree* and the number of open-ended responses differ for each indicator. For instance, as shown in Table 12, from the 70 participants of this study 53 answered *Agree* or *Strongly Agree* to indicator 1. Although it was expected that all 53 would provide the strategies that they used to address indicator one, only 51 did.

Thus, because there are discrepancies in the number of participants who marked *Agree* or *Strongly Agree* and the number of open-ended responses, any calculation involving number of responses used the values from the *number of responses to the open-ended reponses* column in Table 12.

Table 12

Number of Responses per Indicator

	Indicators	Number and Percentages of Agreed/Strongly Agreed Reponses	Number and Percentage of Open-Ended Responses
1.	**differentiate between appropriate and inappropriate uses of technology for students' grade level and content area.**	53 (75.71%)	51 (72.86%)
2.	**design and implement learning activities that integrate technology to support and expand students' critical thinking.**	63 (90.00%)	60 (85.71%)
3.	**design and implement learning activities that integrate technology to support and expand students' problem solving skills.**	63 (90.00%)	56 (80.00%)
4.	**design and implement learner-centered lessons that are based on the current best practices for integrating the learning of subject matter and student technology standards.**	57 (81.43%)	51 (72.86%)

Table 12 (continued)

Number of Responses per Indicator

	Indicators	Number and Percentages of Agree/Strongly Agree Reponses	Number and Percentages of Open-Ended Responses
5.	**assess learner-centered lessons that are based on the current best practices for integrating subject matter and student technology standards.**	44 (62.86%)	41 (58.57%)
6.	**design and implement student-centered, instructional materials that take advantage of computers to engage students in their own learning.**	57 (81.43%)	49 (70.00%)
7.	**design and teach technology-enriched learning activities that connect content, state and national standards with student technology standards.**	56 (80.00%)	53 (75.71%)
8.	**design and teach technology-enriched learning activities that meet the individual needs of students.**	54 (77.14%)	40 (57.14%)
9.	**design an evaluation plan that applies multiple measures for evaluating technology-based students' products.**	35 (50.00%)	28 (40.00%)
10.	**participate in online professional collaborations with peers and experts.**	41 (58.57%)	33 (47.14%)
11.	**design and facilitate learning experiences that use assistive technologies to meet the special physical needs of students.**	34 (48.57%)	25 (35.72%)
12.	**guide collaborative learning activities in which students use technology resources to solve authentic problems in the subject area (s).**	52 (74.29%)	42 (60.00%)
13.	**arrange equitable access to appropriate technology resources that enable students to engage successfully in learning activities across subject/content areas and grade levels.**	40 (57.14%)	27 (38.57%)
14.	**plan and implement technology-based learning activities that promote student engagement in analysis, synthesis, interpretation, and creation of original products.**	54 (77.14%)	41 (58.57%)
15.	**facilitate students' use of technology that addresses their social needs and cultural identity.**	28 (40.00%)	15 (21.43%)
16.	**facilitate students' use of technology that promotes their interaction with the global community.**	33 (47.14%)	21 (30.00%)

Table 12 (continued)

Number of Responses per Indicator

Indicators	Number and Percentages of Agree/Strongly Agree Reponses	Number and Percentages of Open-Ended Responses
17. **structure a learning environment where student collaboration is the common practice when using technology.**	54 (77.14%)	37 (52.86%)
18. **use students' interests, experiences when planning a variety of computer-related activities.**	45 (64.29%)	33 (47.14%)
19. **implement project-based learning that emphasizes critical content and higher-order thinking skills (e.g., analysis, synthesis, evaluation) using the available computers.**	48 (68.57%)	29 (41.43%)
20. **design and implement web-based projects that emphasize complex thinking skill strategies such as problem-solving, scientific inquiry, or decision-making.**	41 (58.57%)	29 (41.43%)
21. **guide students' use of the Internet for collaboration with others.**	40 (57.14%)	26 (37.14%)
22. **use content-specific tools (e.g., software, simulation, web tools) to support learning.**	61 (87.14%)	46 (65.71%)
23. **use technology resources to facilitate knowledge construction.**	50 (71.43%)	30 (42.86%)
24. **apply technology tools and resources to collect, analyze, and interpret data and report results.**	47 (67.14%)	32 (45.71%)
25. **transfer what students' have learned in the classroom to real world situation when planning the use of technology in the classroom(e.g., student-generated recycling program, student-generated business).**	25 (35.71%)	16 (22.86%)
26. **design online collaborative projects with other entities (e.g., schools, businesses, organizations) to find solutions, make decisions, or seek a resolution to an issue of importance to the students.**	24 (34.29%)	13 (18.57%)
27. **use technology in instruction to provide students with increased levels of interactivity.**	46 (65.71%)	30 (42.86%)

Intrarespondent and interrespondent matrixes - Analyses of participants' choice of strategies per indicator. As a means for an efficient analysis of qualitative data, Onwuegbuzie and Teddlie (2003) suggested the use of intrarespondent matrices for coding purposes and the

use of interrespondent matrices for the purpose of analysis. Therefore, for each indicator, an intrarespondent matrix was used to organize the open-ended responses for coding (see Appendix I). During the process of coding, participants were assigned codes in order to assure their anonymity.

Following the coding process an interrespondent matrix was generated for each of the 27 indicators with the purpose of better visualizing and understanding the results of coding. "The interrespondent matrix indicates which individuals contribute to each emerging theme" (Onwuegbuzie & Teddlie, 2003, p. 356). From the analysis of participants' responses the researcher could determine when a strategy was mentioned by a participant (see Appendix K). A value of one was attributed to a strategy if it was present in the participant's response; otherwise a value of zero was attributed to the strategy. Participants could choose more than one strategy to address a particular indicator. Table 13 shows the interrespondent matrix template used in this study and Table 14 gives an example on how the template was used.

Table 13

Interrespondent Matrix Template

Indicator #: Indicator statement.

Strategies Addressed in Indicator #

Participants (code of participants who responded to the question)	Strategy 1	Strategy 2	Strategy 3	Strategy 4
Percentage (sum of 1s related to the strategy/ number of responses) X 100				

Table 14

Example of Interrespondent Matrix Analysis

Indicator 1: Our professional development program prepared participants to **differentiate between appropriate and inappropriate uses of technology for students' grade level and content area.** If you Agreed or Strongly Agreed with this statement please list the strategy(ies) that you used to accomplish it.

Strategies Addressed in Indicator 1

Participants' Code	Exemplars/ Models	Observation	Modeling	Team Work
Participant 1	0	1	1	0
Participant 4	1	1	1	1
Percentage of participants selecting a strategy	1/2 x 100 = 50 %	2/2 X 100 = 100%	2/2 X 100 = 100%	1/2 x 100 =50 %

The example in Table 14 leads to the following conclusion: Participant 1 chose *Observation* and *Modeling* to address Indicator 1, whereas Participant 4 chose *Exemplars/Models, Observation, Modeling, and Team Work* as the strategies to address Indicator 1. In the example provided in Table 14, there were only two responses for indicator one.

For each strategy the percentage was calculated by summing the number of participants who selected a particular strategy, dividing the result by the total number of responses to that indicator, which in this case was 2, and multiplying it by 100. This procedure was followed to analyze the indicators separately. A sample analysis of raw data for indicators 1, 2, and 3 is found in Appendix K.

Summarizing interrespondent results. Table 15, summarizes the analysis of all raw data and shows the percentage of strategy use per indicator. Table 15 provides a better visualization and assessment of the levels of use of a strategy per indicator. To distinguish among levels of use, there was a need to determine a suitable range. The procedures used to determine this range are as follows:

1. Natural data cut-offs were determined. By analyzing the data in Table 15, the researcher found that the maximum percentage of use of a strategy for an indicator was 82%, and the minimum was 0%. Since the study focused on those strategies used, the value of 0% was not considered when determining the range. Thus, the range of percentage usage was set as 1% to 82%.
2. The mid-point in the range was determined to be 41%, and data were organized into two columns: percentages above and below 41%. When divided into these two columns, the data revealed that only 16 out of the 702 percentages presented in Table 15 were above 41% , with the remaining 686 below 41%.
3. The final range used to analyze the data on Table 15 was: 1-10, 11-20, 21-30, 31-40, and >41.
4. The range intervals were classified in the following manner: >40 Very Often Used, 40-31 Often Used, 30-21 Occasionally Used, 20-11 Rarely Used, 10-1 Very Rarely Used.

This classification allowed the data from Table 15 to be read in the following manner: Looking at Indicator 2 (I-2) in the second row of Table 15, 42% of the total number of participants who responded to the open-ended question for Indicator 2 used Strategy 9 to address this particular indicator. According to the established ranges of percentage, 42% is classified as *Very Often Used*. Therefore, the results suggest that Strategy 9 was used very often to address Indicator 2. On the other hand, Strategy 4 was only used by 2% of the participants who provided open-ended responses to this particular indicator, classifying it as a *Rarely Used* strategy for Indicator 2.

Table 15

Percentage of Strategies Used per Indicator

INDICATORS	Strategy 1	Strategy 2	Strategy 3	Strategy 4	Strategy 5	Strategy 6	Strategy 7	Strategy 8	Strategy 9	Strategy 10	Strategy 11	Strategy 12	Strategy 13	Strategy 14	Strategy 15	Strategy 16	Strategy 17	Strategy 18	Strategy 19	Strategy 20	Strategy 21	Strategy 22	Strategy 23	Strategy 24	Strategy 25	Strategy 26
I-1	45	4	39	4	4	22	4	8	27	22	8	10	2	6	0	2	4	0	0	4	2	8	2	0	0	10
I-2	42	7	30	2	8	22	5	10	42	3	8	3	2	17	0	0	5	2	0	3	5	2	2	0	0	15
I-3	13	4	23	2	14	20	4	11	46	2	11	4	4	18	0	2	4	2	2	0	9	5	2	2	0	11
I-4	18	16	20	2	14	18	12	6	45	24	6	0	4	8	4	0	0	4	0	0	2	0	2	2	4	14
I-5	5	20	34	2	2	10	5	5	17	39	2	0	20	2	5	20	0	2	0	0	2	12	0	0	2	12
I-6	12	8	16	4	14	18	8	6	47	6	10	0	0	18	0	4	4	4	0	2	6	0	2	4	10	10
I-7	6	6	21	0	4	13	8	4	36	77	8	2	19	2	6	4	2	2	2	0	2	0	0	6	4	19
I-8	18	8	30	0	5	20	15	8	53	13	3	3	0	5	0	8	3	3	3	5	3	5	0	3	0	13
I-9	7	4	39	0	4	11	4	0	0	4	0	0	25	0	4	46	0	0	0	0	0	11	0	0	0	4
I-10	3	0	0	0	3	12	0	3	9	0	0	0	0	0	0	0	9	6	82	9	3	0	0	0	3	0
I-11	20	8	4	0	4	20	12	16	20	0	0	8	0	0	0	0	8	8	8	16	0	0	0	0	0	0
I-12	14	17	12	0	19	17	12	10	21	2	5	2	0	33	0	0	2	7	5	0	0	0	0	5	5	10

Percentage Range: >40 Very Often Used, 40-31 Often Used, 30-21 Occasionally Used, 20-11 Rarely Used, 10-1 Very Rarely Used

Table 15 (continued)

Percentage of Strategies Used per Indicator

INDICATORS	Strategy 1	Strategy 2	Strategy 3	Strategy 4	Strategy 5	Strategy 6	Strategy 7	Strategy 8	Strategy 9	Strategy 10	Strategy 11	Strategy 12	Strategy 13	Strategy 14	Strategy 15	Strategy 16	Strategy 17	Strategy 18	Strategy 19	Strategy 20	Strategy 21	Strategy 22	Strategy 23	Strategy 24	Strategy 25	Strategy 26
I-13	26	7	11	0	4	19	7	7	0	4	11	0	0	7	0	0	4	4	4	41	0	0	0	0	0	4
I-14	22	20	15	2	10	20	12	7	46	7	7	0	2	22	0	7	7	5	5	2	5	0	0	0	0	17
I-15	27	7	7	0	7	33	7	27	27	0	13	0	0	7	0	0	7	7	7	0	7	0	0	0	7	20
I-16	24	14	14	0	0	19	0	10	5	0	0	0	0	10	0	0	0	10	43	0	5	0	5	0	0	5
I-17	22	8	8	0	16	16	5	11	14	3	16	0	0	16	0	0	5	14	11	8	8	0	0	0	0	5
I-18	12	9	15	0	15	15	6	15	36	3	9	0	0	12	0	0	3	3	3	0	3	0	0	3	0	12
I-19	14	14	24	0	28	31	17	3	28	7	3	0	0	24	0	3	0	3	0	0	0	0	0	0	0	7
I-20	10	7	7	0	3	17	14	3	52	3	7	0	0	55	0	0	0	0	10	0	3	0	0	3	0	17
I-21	27	4	15	0	4	15	8	4	8	0	12	0	0	12	0	0	0	19	46	0	4	4	0	0	0	12
I-22	28	7	13	0	7	39	7	11	24	0	7	0	0	11	0	0	2	0	0	7	4	0	0	4	4	20
I-23	23	7	13	0	17	23	10	7	27	0	10	0	0	13	0	0	0	0	3	0	3	0	0	7	0	20
I-24	9	6	34	0	6	25	9	9	16	3	6	3	0	3	0	3	0	0	0	0	0	19	9	0	0	13
I-25	13	13	19	0	25	25	19	31	25	6	6	6	0	13	0	0	0	0	0	6	6	6	0	0	0	25
I-26	8	0	8	0	23	23	23	8	8	0	0	0	0	0	0	0	0	8	38	8	8	8	0	0	0	15
I-27	20	7	7	0	17	7	17	7	20	0	10	3	0	13	0	0	0	3	17	0	0	0	0	3	0	13

Percentage Range: >40 Very Often Used, 40-31 Often Used, 30-21 Occasionally Used, 20-11 Rarely Used, 10-1 Very Rarely Used

By analyzing the data from Table 15 the top strategies used to address each indicator could be identified. As an example, for Indicator 20 (I-20), Strategy 9 was used by 52% of the participants who provided open-ended responses to Indicator 20, and Strategy 14 was used by 55% of those participants who provided open-ended responses to this indicator, classifying these strategies as those *Very Often Used* for this particular indicator. On the other hand, Strategies 6, 7, and 26 were used by 17%, 14%, and 17% respectively of the participants who provided open-ended responses to Indicator 20, classifying these strategies as those *Rarely Used* for this particular indicator. Strategies used for each of the indicators were ranked based on their level of use as determined by the established range intervals (see Appendix L). The analysis of Table 15 showed that Indicators 11 (I-11) and 27 (I-27) were the only two indicators in which all the strategies used fell within the ranges of *Rarely Used* and *Very Rarely Used.*

In order to have an understanding of the number of strategies used per indicator and the number of strategies in a given range interval, the data from Table 15, were redisplayed in Table 16. Table 16 can be read in the following manner: For Indicator 4 (I-4) out of the 26 strategies, a total of 20 were used to address that particular indicator: one strategy was Very Often Used (>40%), one strategy was Occasionally Used (30%-21%), seven were Rarely Used (20%-11%), and 11 were Very Rarely Used (10%-1%) by the participants who answered to this specific indicator.

Table 16

Summary of Frequency of Strategies Used per Ranges

Indicators	> 40 Very Often Used	40-31 Often Used	30-21 Occasionally Used	20-11 Rarely Used	10-1 Very Rarely Used
I-1	1	1	3	0	16
I-2	2	0	2	2	15
I-3	1	0	1	7	14
I-4	1	0	1	7	11
I-5	0	2	0	6	12
I-6	1	0	0	5	15
I-7	1	1	1	3	16
I-8	1	0	1	5	14
I-9	1	1	1	2	7
I-10	1	0	0	1	9
I-11	0	0	0	6	7
I-12	0	1	1	6	10
I-13	1	0	1	3	10
I-14	1	0	3	4	12
I-15	0	1	3	2	10
I-16	1	1	0	3	7
I-17	0	0	0	8	8
I-18	0	0	0	7	9
I-19	0	1	4	3	6
I-20	2	0	0	3	10
I-21	1	0	1	6	7
I-22	0	1	2	4	9
I-23	0	0	3	4	7
I-24	0	1	1	3	11
I-25	0	1	4	5	6
I-26	0	1	3	1	8
I-27	0	0	0	7	8

The data presented in the first three columns of Table 16 suggest that there were only selected few strategies used by a large number of professional development programs to address

certain indicators. Contrasting with the large number of strategies that fell within the last two columns of Table 16, suggesting that the majority of strategies for an indicator were used by a low number of professional developments to address their specific context needs.

Analyses of Strategies Across Indicators

Research Question 2 inquires about the strategies used to promote successful integration of technology in teaching. Although the data from the analysis of the strategies use per indicator offers us important information it does not show the strategies most used to address a different number of indicators. To identify the most often used strategies overall, data needed to be analyzed across indicators. The differences in the intensity of use of a strategy across indicators led to the necessity of assigning weighted values to the percentages in Table 15. Table 17 shows the weighted values assigned to the range intervals.

Table 17

Weighted Values Assigned to the Range Intervals

Weighted Values	Range Intervals	Total Number of Percentages per Range Intervals
5	41% - 82% (Very Often Used)	16
4	31% - 40% (Often Used)	13
3	21% - 30% (Occasionally Used)	37
2	11% - 20% (Rarely Used)	115
1	1% - 10% (Very Rarely Used)	272

The assignment of the weighted values to the percentages in Table 15 is represented in Table 18. Table 18 can be read in the following manner: For Indicator 2 (I-2) more than 40% of the total number of participants who provided open-ended responses to Indicator 2 used Strategy

9; therefore, weight of 5 was assigned to that strategy. At the other extreme, for the same indicator Strategy 4 received a 1 because it was used by less than 10% of the total number of participants who provided open-ended responses to Indicator 2.

After assigning weighted values to the percentages, sums were calculated for each strategy across all indicators. The results of the sum of weights are represented in the last line of Table 18. To determine the overall strength of each strategy a range based on the sum of weights was established. The following steps were taken to establish the range:

1. Natural data cut-offs were determined. By analyzing the sum of weights in the last line of Table 18 the researcher found that the highest value resulting from the sum of weights of a strategy was 78, and the lowest was 4. Thus, the range was determined to be 4 to 78;
2. The range was then divided into quartiles which allowed the distinction of a strategy's level of use across indicators: 78-60 *Very Often Used*, 59-41 *Often Used*, 40-22 *Occasionally Used*, and 21-4 *Rarely Used*.

Table 18

Weight Assigned to the Percentage of Strategies Used per Indicator

INDICATORS	Strategy 1	Strategy 2	Strategy 3	Strategy 4	Strategy 5	Strategy 6	Strategy 7	Strategy 8	Strategy 9	Strategy 10	Strategy 11	Strategy 12	Strategy 13	Strategy 14	Strategy 15	Strategy 16	Strategy 17	Strategy 18	Strategy 19	Strategy 20	Strategy 21	Strategy 22	Strategy 23	Strategy 24	Strategy 25	Strategy 26
I-1	5	1	4	1	1	3	1	1	3	3	1	1	1	1	0	1	1	0	0	1	1	1	1	0	0	1
I-2	5	1	3	1	1	3	1	1	5	1	1	1	1	2	0	0	1	1	0	1	1	1	1	0	0	2
I-3	2	1	3	1	2	2	1	2	5	1	2	1	1	2	0	1	1	1	1	0	1	1	1	1	0	2
I-4	2	2	2	1	2	2	2	1	5	3	1	0	1	1	1	0	0	1	0	0	1	0	1	1	1	2
I-5	1	2	4	1	1	1	1	1	2	4	1	0	2	1	1	2	0	1	0	0	1	2	0	0	1	2
I-6	2	1	2	1	2	2	1	1	5	1	1	0	0	2	0	1	1	1	0	1	1	0	1	1	1	1
I-7	1	1	3	0	1	2	1	1	4	5	1	1	2	1	1	1	1	1	1	0	1	0	0	1	1	2
I-8	2	1	3	0	1	2	2	1	5	2	1	1	0	1	0	1	1	1	1	1	1	1	0	1	0	2
I-9	1	1	4	0	1	2	1	0	0	1	0	0	3	0	1	5	0	0	0	0	0	2	0	0	0	1
I-10	1	0	0	0	1	2	0	1	1	0	0	0	0	0	0	0	1	1	5	1	1	0	0	0	1	0
I-11	2	1	1	0	1	2	2	2	2	0	0	1	0	0	0	0	1	1	1	2	0	0	0	0	0	0
I-12	2	2	2	0	2	2	2	1	3	1	1	1	0	4	0	0	1	1	1	0	0	0	0	1	1	1
I-13	3	1	2	0	1	2	1	1	0	1	2	0	0	1	0	0	1	1	1	5	0	0	0	0	0	1

[e] Level of Use: 5 Very Often Used, 4 Often Used, 3 Occasionally Used, 2 Rarely Used, 1 Very Rarely Used, and 0 Never Used

Table 18 (continued)

Weight Assigned to the Percentage of Strategies Used per Indicator

INDICATORS	Strategy 1	Strategy 2	Strategy 3	Strategy 4	Strategy 5	Strategy 6	Strategy 7	Strategy 8	Strategy 9	Strategy 10	Strategy 11	Strategy 12	Strategy 13	Strategy 14	Strategy 15	Strategy 16	Strategy 17	Strategy 18	Strategy 19	Strategy 20	Strategy 21	Strategy 22	Strategy 23	Strategy 24	Strategy 25	Strategy 26
I-14	3	2	2	1	1	2	2	1	5	1	1	0	1	3	0	1	1	1	1	1	1	0	0	0	0	2
I-15	3	1	1	0	1	4	1	3	3	0	2	0	0	1	0	0	1	1	1	0	1	0	0	0	1	2
I-16	3	2	2	0	0	2	0	1	1	0	0	0	0	1	0	0	0	1	5	0	1	0	1	0	0	1
I-17	3	1	1	0	2	2	1	2	2	1	2	0	0	2	0	0	1	2	2	1	1	0	0	0	0	1
I-18	2	1	2	0	2	2	1	2	4	1	1	0	0	2	0	0	1	1	1	0	1	0	0	1	0	2
I-19	2	2	3	0	3	4	2	1	3	1	1	0	0	3	0	1	0	1	0	0	0	0	0	0	0	1
I-20	1	1	1	0	1	2	2	1	5	1	1	0	0	5	0	0	0	0	1	0	1	0	0	1	0	2
I-21	3	1	2	0	1	2	1	1	1	0	2	0	0	2	0	0	0	2	5	0	1	1	0	0	0	2
I-22	3	1	2	0	1	4	1	2	3	0	1	0	0	2	0	0	1	0	0	1	1	0	0	1	1	2
I-23	3	1	2	0	2	3	1	1	3	0	1	0	0	2	0	0	0	0	1	0	1	0	0	1	0	2
I-24	1	1	4	0	1	3	1	1	2	1	1	1	0	1	0	1	0	0	0	0	0	2	1	0	0	2
I-25	2	2	2	0	3	3	2	4	3	1	1	1	0	2	0	0	0	0	0	1	1	1	0	0	0	3
I-26	1	0	1	0	3	3	3	1	1	0	0	0	0	0	0	0	0	1	4	1	1	1	0	0	0	2
I-27	2	1	1	0	2	1	2	1	2	0	1	1	0	2	0	0	0	1	2	0	0	0	0	1	0	2
∑	**61**	**32**	**59**	**7**	**40**	**64**	**36**	**36**	**78**	**30**	**27**	**10**	**12**	**44**	**4**	**15**	**15**	**22**	**34**	**17**	**20**	**13**	**7**	**11**	**8**	**43**

Level of Use: 5 Very Often Used, 4 Often Used, 3 Occasionally Used, 2 Rarely Used, 1 Very Rarely Used, and 0 Never Used

Quartiles: 78-60 Very Often Used, 59-41 Often Used, 40-22 Occasionally Used, and 21-4 Rarely Used.

The analysis of the sum of the weights, as found in the final row of Table 18, according to the level of use attributed to the quartiles enabled the ranking of the strategies used across indicators. Using the ranges determined by the sum of the weights, strategies were grouped by their overall strength of use. Table 19 shows the rank of the strategies across the indicators and within the quartiles.

Table 19

Rank of Strategies Use Across Indicators and Within the Quartiles

Quartiles	Strategies	Sum of Weights Totals
78-60 – Very Often Used	Strategy 9: Appropriate Lesson/Learning Activity Development	78
	Strategy 6: Presentation/Demo/Hands on	64
	Strategy 1: Identifying/Defining appropriate use of IT	61
59-41 – Often Used	Strategy 3: Evaluation/Critique/Assessment	59
	Strategy 14: Problem- Based Learning/Project-Based Learning	44
	Strategy 26: Lesson Implementation	43
40-22 – Occasionally Used	Strategy 5: Modeling	40
	Strategy 7: Examples	36
	Strategy 8: Mentoring/Consultation	36
	Strategy 19: Telecollaboration	34
	Strategy 2: Exemplars/Models/Experts	32
	Strategy 10: Referencing Standards	30
	Strategy 11: Team Work/Group Discussion/Peer Discussion	27
	Strategy 18: Collaborative Learning	22
21-4 – Rarely Used	Strategy 21: Technology Support Teams	20
	Strategy 20: Made Technology Available	17
	Strategy 16: Present/Develop/Use Rubrics	15
	Strategy 17: Special Funding/Special Incentives	15
	Strategy 22: Specific Assessment Tool	13
	Strategy 13: Appropriate Lesson Development and Assessment	12
	Strategy 24: Course/Curriculum Modification	11
	Strategy 12: Grouping	10
	Strategy 25: Resources Development	8
	Strategy 4: Observation	7
	Strategy 23: Faculty Research (Presentations/Conferences)	7
	Strategy 15: Standards Specific Training	4

What is not shown in Table 19 are the specific indicators addressed by each of the strategies. Those can be found in Appendix M. The progression of analysis presented in Tables 11-19 led to the identification of those strategies, in rank order, that were successful in

promoting high-level use of instructional technology in participants' teaching practice. The mid-point of the sum of weights was 41, therefore any strategy whose sum of weight was equal to or above 41 was considered a top strategy used across indicators. Table 20 shows the top six strategies used by the majority of the participants to address different indicators.

Table 20

Rank of the Top Six Used Strategies Across Indicators

Rank	Strategy Code	Description
1st	Strategy 9	Appropriate (Lesson/Learning Activity) Development
2nd	Strategy 6	Presentation/Demo/Hands on
3rd	Strategy 1	Identifying/Defining Appropriate Use of IT
4th	Strategy 3	Evaluation/Critique/Assessment
5th	Strategy 14	Problem-Based Learning/ Project-Based Learning
6th	Strategy 26	Lesson Implementation

The way the strategies were addressed in each indicator varies. This variation is more than can be presented in text. However, Appendix N provides the description of the use of the top six strategies for the indicators in which they were *Very Often Used*, *Often Used* and *Occasionally Used*. Appendix O shows the same level of details for those strategies whose the sum of weights fell within 40-22 (*Occasionally Used*). Appendix N and O were included in this study for professional development programs interested in the way the strategies were applied in the listed indicators.

In summary data analyzed to answer Research Question 2 indicated that Strategies 9, 6, 1, 3, 14 and 26 were the top six strategies used across indicators. Strategies 5, 8, 7, 19, 2, 10, 11, and 18 were occasionally used across indicators but might be a possible consideration when planning a professional development program.

Of the 26 strategies used by participants to address the different indicators, 6 were used by a considerably high number of participants across indicators, 8 were occasionally used, and 12 were used sporadically and by a low number of participants to address some specific indicators. Therefore, these last 12 indicators are excluded from the list of strategies to consider when designing instructional technology professional development programs.

CHAPTER V: SUMMARY, DISCUSSION, AND RECOMMENDATIONS

This chapter is divided in the following sections: (a) summary of research design, (b) discussion, (c) implications, and (d) recommendations for future research.

Summary of Research Design

The purpose of this study was to determine a set of common strategies employed by sustainable instructional technology professional development programs that are found to successfully promote educators' high-level use of technology in their teaching practice. Two questions guided this study: (a) Research Question 1: What do successful instructional technology professional development programs recognize as indicators of high-level use of technology?, and (b) Research Question 2: Which instructional technology professional development strategies successfully promote high-level use of instructional technology in participants' teaching practice?

The potential participants of this study were 179 directors or their designees, awardees of the PT3 1999 and 2000 implementation grants, from all over the United States and its territories. Out of these 179 potential participants, 70 (39.11%) chose to participate in this study. An online questionnaire consisting of close-ended questions and open-ended questions were completed by the 70 participants during the summer of 2004.

The data from the close-ended questions of the questionnaire were analyzed using central tendency measures and were used to answer Research Question 1. For each close-ended question there was a corresponding open-ended question. The open-ended questions were analyzed using qualitative content analysis and the data coming from this section of the questionnaire were used to answer Research Question 2.

Discussion

Research Question 1

Research Question 1 inquired about what indicators of high-level use of technology are recognized as part of instructional technology professional development programs. The overall results indicated that of the 27 indicators of high-level use of technology, 22 were recognized as part of the professional development programs participating in this study (see Table 10, p. 69).

The results from the analysis of the close-ended section of the Pedagogical Use of Instructional Technology in Teaching Questionnaire suggest that the majority of instructional technology programs participating in this study were successful in preparing their participants to address 22 of the 27 indicators of high-level use of technology. Table 21 presents the 22 indicators recognized by the professional development programs and their alignment with the NETS for teachers.

Table 21

Indicators Recognized by Professional Development Programs Aligned with NETS for Teachers

Indicators **Professional Development Programs Prepared Participants to:**	**NETS for Teachers**
I-1. differentiate between appropriate and inappropriate uses of technology for students' grade level and content area.	I, II,V,VI
I-2. design and implement learning activities that integrate technology to support and expand students' critical thinking.	I, III
I-3. design and implement learning activities that integrate technology to support and expand students' problem solving skills.	I, III
I-4. design and implement learner-centered lessons that are based on the current best practices for integrating the learning of subject matter and student technology standards.	II, III,V

Table 21 (continued)

Indicators Recognized by Professional Development Programs Aligned with NETS for Teachers

Indicators **Professional Development Programs Prepared Participants to:**	NETS for Teachers
I-5. assess learner-centered lessons that are based on the current best practices for integrating subject matter and student technology standards.	IV, V
I-6. design and implement student-centered, instructional materials that take advantage of computers to engage students in their own learning.	II, III
I-7. design and teach technology-enriched learning activities that connect content, state and national standards with student technology standards.	II, III
I-8. design and teach technology-enriched learning activities that meet the individual needs of students.	II, III
I-9. design an evaluation plan that applies multiple measures for evaluating technology-based students' products.	IV
I-10. participate in online professional collaborations with peers and experts.	V
I-12. guide collaborative learning activities in which students use technology resources to solve authentic problems in the subject area (s).	III
I-13. arrange equitable access to appropriate technology resources that enable students to engage successfully in learning activities across subject/content areas and grade levels.	II, III, IV
I-14. plan and implement technology-based learning activities that promote student engagement in analysis, synthesis, interpretation, and creation of original products.	II, III
I-17. structure a learning environment where student collaboration is the common practice when using technology.	I,VI
I-18. use students' interests, experiences when planning a variety of computer-related activities.	I, II, III
I-19. implement project-based learning that emphasizes critical content and higher-order thinking skills (e.g., analysis, synthesis, evaluation) using the available computers.	III

Table 21 (continued)

Indicators Recognized by Professional Development Programs Aligned with NETS for Teachers

Indicators Professional Development Programs Prepared Participants to:	NETS for Teachers
I-20. design and implement web-based projects that emphasize complex thinking skill strategies such as problem-solving, scientific inquiry, or decision-making.	III
I-21. guide students' use of the Internet for collaboration with others.	II
I-22. use content-specific tools (e.g., software, simulation, web tools) to support learning.	I, III
I-23. use technology resources to facilitate knowledge construction.	I, III
I-24. apply technology tools and resources to collect, analyze, and interpret data and report results.	IV
I-27. use technology in instruction to provide students with increased levels of interactivity.	II, III

These 22 indicators addressed, to some extent, all the categories of high-level use of technology described in the literature review in this study. The majority of professional development programs reported to be successful in addressing Indicators 6, 8, and 14. These results suggest that professional development programs are using technology to promote learner-centered instruction as called for in the literature (Moursund & Bielefeldt, 1999; Roblyer & Edwards, 2000; Salomon, 2002,Woodell & Garofoli, 2003). The literature on high-level use of technology also indicates that professional development programs should prepare participants to use technology to create an atmosphere that favors the interpersonal relation among the learners through collaborative work (ISTE, 2000; Jonassen, 2000; McGrath, 2004; Roblyer & Edwards, 2000; Salomon, 2002). This was accomplished by the majority of the participants reporting their success in addressing indicators 12, 13, 17 and 21 that dealt with this issue. Furthermore, in addressing Indicators 2, 3, 18, 19, and 20 the professional development programs participating in this study covered the issues concerning high-order thinking skills as called for in this study's

literature review (Jonassen, 2000, Trilling & Hood, 1999). Finally, literature on high-level use of technology also advocates the need for preparing participants of professional development programs to use instructional technology as a means to establish contact with other teachers and experts in the field in order to exchange ideas and thoughts about teaching, and sharing their experiences (Earle, 2002; Harris, 1998; Keefe, 2003; Mckenzie, 2002; Tomei, 1997). The majority of the professional development programs participating in this study indicated success in dealing with this issue by addressing Indicators 1, 4, 5, 7, 10, 22, 23, and 9 as components of their programs.

In conclusion, the results of this study show that 22 of the 27 indicators were recognized as major components of the majority of participating programs. The most critical issues found in the literature about high-level use of technology were well addressed by the participating programs. However, there were standards and indicators not addressed well by the programs participating in this study and therefore warrant explanation. Standards not addressed are shown in Table 22. The five indicators not addressed by the participants are shown in Table 23.

Table 22

NETS for Teachers not Covered by Professional Development Programs

VI. Social, Ethical, Legal, and Human Issues

Teachers understand the social, ethical, legal, and human issues surrounding the use of technology in PK–12 schools and apply that understanding in practice. Teachers:

B. apply technology resources to enable and empower learners with diverse backgrounds, characteristics, and abilities.

C. identify and use technology resources that affirm diversity.

E. facilitate equitable access to technology resources for all students.

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Table 23

Indicators of High-level Use of Technology not Addressed by Professional Development Programs

Indicator Code	Indicator Statement Our professional development program prepared participants to:
I-11	design and facilitate learning experiences that use assistive technologies to meet the special physical needs of students.
I-15	facilitate students' use of technology that addresses their social needs and cultural identity.
I-16	facilitate students' use of technology that promotes their interaction with the global community.
I-25	transfer what students' have learned in the classroom to real world situation when planning the use of technology in the classroom(e.g., student-generated recycling program, student-generated business).
I-26	design online collaborative projects with other entities (e.g., schools, businesses, organizations) to find solutions, make decisions, or seek a resolution to an issue of importance to the students.

The literature on high-level use of technology indicates the need to prepare teachers to support different learning styles and needs, which also addresses students with limited English

proficiency, gifted students, and students physically or mentally impaired (Boettcher, 2003; Kimball, Cohen, Dimmick, & Mills, 2003-2004; Thombs, 2003; Trilling & Hood, 1999). However, results indicate that the majority of instructional technology professional development programs did not prepare participants to address Indicator 11 (see Table 23).

Although professional development programs prepared participants to support learner-centered instruction and to use instructional technology to support different learning styles and needs, they did not prepare participants to use technology to support students who are physically or mentally impaired. The lack of success by professional development programs to support participants to prepare learning activities for special needs students might be due to the lack of training of teachers in general to address this population in a classroom context, even when technology is not involved. As indicated by some professional development programs, this was not a goal of their project, although they recognize its importance. As stated by one participant "we barely 'touched' on this objective; however we are now working more in this area." Participants in this study suggested that this was addressed only when having special education teachers as part of their professional development programs, as mentioned by a participant "the special education participants worked on developing lessons for special needs students."

The literature on high-level use of technology also suggests that teachers should use technology to help bridge cultural differences and increase the students' understanding of the issues concerning a multicultural society, encouraging and supporting the understanding of others beliefs and world perspectives (Jonassen, 2000; Trilling & Hood, 1999). However, the majority of professional development programs participating in this study did not prepare their participants to address Indicator 15 and Indicator 16 (see Table 23).

Although the professional development programs in this study reported to be successful in preparing their participants to use technology to facilitate the creation of a community of learners, they did not report success in preparing their participants to use technology to deal with cultural and multicultural issues. This result might be a reflection of the the feeling that this is an issue that comes naturally with instruction as mentioned by a participant that there is "no need to promote this, it comes naturally". Participants also reported that they had difficulties in addressing Indicator 16 due to technical difficulties imposed by online communication, "we attempted this but our server and pipeline abruptly became a huge issue."

It was also mentioned in the literature on high-level use of technology that teachers "must respect and encourage critical thinking and personal knowledge construction as meaningful goals using technology to motivate students to engage in thinking and learning activities that reflect students' realities" (Jonassen, 2000, p. 278). Professional development programs reported to be successful in preparing participants to encourage critical thinking and personal knowledge construction by supporting participants in preparing activities that reflect students' realities. However, the majority of professional development programs surveyed did not prepare their participants to address Indicator 25 (see Table 23).

Although professional development programs prepared participants to design activities that reflect their students' realities, they did not prepare participants to design activities that would support student transfer of what they have learned to their real lives. This is an issue that goes beyond the use of technology in education. Although educators advocate the connection between what students' learn and their realities, it is still an issue to lead students to transfer their content knowledge to their daily life knowledge.

The literature review on high-level use of technology also mentioned the need for teachers to use technology as a facilitator of the human and social aspects of learning, creating an atmosphere that favors the interpersonal relation among the learners through collaborative work (Boettcher, 2003; Bull, Bull, Cochran, & Bell, 2002; Cradler, 2003; Earle, 2002; Harris, 1998). However, the majority of the professional development programs did not address Indicator 26 (see Table 23).

Although professional development programs were successful in preparing participants to design project-based learning activities, they did not prepare participants to design online collaborative projects. As mentioned by some participants of this study, one of the reasons might be the lack of trust in technology to integrate an online project with another educational institute as a major part of a unit plan. Technology accessibility might also be an issue, for although one can guarantee one's own access to technology the online partner may have limitations to access technology. Also, that might not be one of the professional development's goals as stated by one of the participants: "not really of focus of our whole program, yet."

In conclusion, instructional professional development programs participating in this study reported preparing participants to address the majority of high-level use of technology indicators presented in this study. However, the professional development programs appeared to be weak on preparing participants to use technology to support social learning activities, learning activities that support diversity population, learning activities that support the learning of students with physical of mental needs, or learning activities that involve the global community. Furthermore, though professional development programs report success in preparing participants to design and implement project-based instruction, they fail to report the same success in helping participants transfer what they have learned in class to real world situation.

Research Question 2

Research Question 2 inquired about the strategies that successfully promote high-level use of instructional technology in participants' teaching practice. The overall results indicated that the top six strategies used across indicators were:

- *Strategy 9: Appropriate (Lesson/Learning Activity) Development*
- *Strategy 6: Presentation/Demo/Hands on*
- *Strategy 1: Identifying/Defining Appropriate Use of IT*
- *Strategy 3: Evaluation/Critique/Assessment*
- *Strategy 14: Problem- Based Learning/ Project-Based Learning*
- *Strategy 26: Lesson Implementation*

The strategies that were occasionally used across indicators should be taken into consideration by professional development programs when preparing for their own programs for the following reasons: (a) the strategies that were occasionally used overall were the top strategies used to address particular indicators, and (b) they might have not made it to the top strategies for the way that the rater interpret and coding the participants responses:

- *Strategy 5: Modeling*
- *Strategy 8: Mentoring/Consultation*
- *Strategy 7: Examples*
- *Strategy 19: Telecollaboration*
- *Strategy 2: Exemplars/Models/Experts*
- *Strategy 10: Referencing Standards*
- *Strategy 11: Team Work/Group Discussion/Peer Discussion*
- *Strategy 18: Collaborative Learning.*

All the most used strategies per indicator fell under the top six strategies and the occasionally used strategies used across indicators, with the exception of Strategies 16 and 20 that fell among the rarely used strategies across indicators but were the most often used strategies to address Indicator 9 and Indicator 13, respectively. Therefore, they might be considered when planning to address these specific indicators.

Of the 26 strategies used by participants to address the different indicators, 6 were used by a considerably high number of participants across indicators, 8 were occasionally used, and 12 were used sporadically and by a low number of participants to address some specific indicators, excluding them from the list of strategies to consider when designing instructional technology professional development programs.

Study results suggested that the top strategies used by professional development programs to promote high-level use of technology focused on the preparation of participants to explore, understand and support the use of technology in the classroom. All six top strategies were connected with preparing participants to develop appropriate lesson plans, units, or learning activities that integrate technology to support high-level thinking skills. Preparing participants to focus on the purpose of an activity and the reason for selecting certain instructional technology tools to enhance students' learning experience have been a priority for the majority of the professional development programs participating in this study. These findings substantiate the literature that advocates that it is the educators' responsibility to choose the instructional technology tool that will best promote students' learning based on their own beliefs and judgment of how learning should take place. The practice with instructional technologies and an understanding of their pedagogical applications are essential to the success of any professional

development program (Harris, 1998; Mouza, 2002-2003; Roblyer & Edwards, 2000; Tomei, 2002).

Findings from this study also suggest that professional development programs choose a number of different strategies to address the same goal. This is reflected in the results of the percentages of strategies used per indicator. None of the strategies were used 100%, meaning that no one strategy was used by all the participants to address any given indicator. This result confirms Guskey's (2003) statement that the context where the professional development takes place strongly influences the characteristics that contribute to professional development's effectiveness. Therefore, to find diversity in the strategies used to address one common goal is to be expected since the professional development programs participating in this study differ in their context and the populations they addressed.

Implications

The findings from this study imply that instructional technology professional development programs should take the following into consideration when planning for professional development programs that focus in the high-level use of technology in participants' teaching:

First, professional development programs must make sure that the 22 indicators of high-level use of technology recognized by the professional development programs in this study are addressed, since they cover to some extent all NETS for teachers and what the literature review on this study report about high-level use of technology. Nevertheless, in order to cover all the items in NETS for teachers and to address everything found in the literature about high-level use of technology the 27 indicators presented in this study should be addressed and be part of the professional development programs goals, not only the 22 recognized as part of the professional

development programs in this study. Therefore, professional development programs should pay extra attention to assure that their professional development programs have activities that ensure the preparation of participants to use technology to support social learning activities, leaning activities that support diversity population, learning activities that support the learning of students with physical or mental needs, learning activities that involve the global community, and learning activities that support the transferring of what their students have learned in class to real world situation. A starting point is to see what kind of strategies the professional development programs that reported success in this area used to address the five indicators that were not part of the final list of high-level of use of technology recognized by the majority of professional development programs participating in this study.

Second, professional development programs should focus on the top six strategies listed in this study, when preparing participants to appropriately develop lesson plans, units, or learning activities that integrate technology to support high-level thinking skills. The top six strategies listed in this study support the preparation of participants to focus on the purpose of an activity and the reason for selecting certain instructional technology tools to enhance students' learning experience.

Finally, professional development programs should also consider those strategies that were "occasionally used" by the participants in this study as options to better address the context in which professional development programs take place. Furthermore, professional development programs looking to use the results of this study in future planning of their programs should look at individual indicators for those strategies most often used. For example, according to the results of this study *Strategy 19: Telecollaboration* was not among the top six strategies, however, for Indicator 10 this strategy had the highest percentage of use, indicating that the majority of the

participants addressing Indicator 10 chose Strategy 19. Therefore, in addition to look at the top six strategies across indicators, professional development programs should look at the top strategies used per indicator to address the unique needs of the program.

In answering the research question, what are not addressed are the varieties of ways these strategies were implemented. Professional development programs reading these results should consider reviewing all the ways in which these strategies were used by referring to Appendix N and O. In summary, professional development programs should do the following when planning for their programs: (a) determine the goals of the professional development program, (b) match their goals with the high-level use of technology indicators presented in this study, (c) include the top six strategies – find the top strategies that are addressed by the indicators targeted by the program, and (d) find the best way to implement the strategies (see Appendix N and Appendix O). Following these steps should very well assure the success of professional development programs targeting high-level use of technology.

Recommendations for Further Research

The instructional professional development programs participating in this study had different specific goals, and focused on the needs of different populations. Some of them had interns as participants, others had faculty members, and still others had k-12 in-service teachers as their participants, while some had a mix of participants. The context in which they took place was unique for each of them. These factors might have influenced the results of this study. Therefore, further research should replicate this study focusing on instructional professional development programs that address a common target population.

This study focused on strategies used across indicators. While the results gave important insights into the kind of strategies being used to address high-level use of technology, further

research focusing on the strategies per indicator would contribute to the overall understanding of ways to better promote the use of high-level use of technology in teaching.

Another area that warrants exploration is the indicators that the majority of participants reported as not being addressed by their professional development programs. Determining the reasons for failure to address these indicators can better help future professional development programs to include them as part of their programs.

The use of a questionnaire as the main means of data collection restricted the access to information. The inclusion of interviews as part of the research design could contribute significantly to the richness of the data collected.

There was much more to discuss from the open-ended data collected in this study. Some of the responses were very rich in detail, but taking all of it into consideration was beyond the scope of this study. Moreover, further validation of the instrument used is necessary. It is important to mention that this study's findings cannot be generalized due to the many constraints on this research design and the small population it addressed. It would be interesting if further study were conducted on the identification of indicators of high-level use of instructional technology in teaching, for which this research could serve as a source of comparison.

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APPENDICES

APPENDIX A

QUESTIONNAIRE'S ITEMS AND INSTRUMENS USED TO CREATE THEM

Questionnaire's Items and Instruments Used to Create Them

	NETS for Teachers Profiles				LoTi			PCC		
QUESTIONNAIRE ITEMS	General	Professional	Student Teaching/ internship	First-Year Teaching	Inservice	Preservice	Higher Education	Currr, Learn & Assess	Professional Practice	NETS for Teachers
1. **differentiate between appropriate and inappropriate uses of technology for students' grade level and content area**	12	2			15		15	3		I, II,V,VI
2. **design and implement learning activities that integrate technology to support and expand students' critical thinking.**	5					46				I, III
3. **design and implement learning activities that integrate technology to support and expand students' problem solving skills.**	5		17			46				I, III
4. **design and implement learner-centered lessons that are based on the current best practices for integrating the learning of subject matter and student technology standards**		8	7	4						II, III,V
5. **assess learner-centered lessons that are based on the current best practices for integrating subject matter and student technology standards.**			7							IV, V
6. **design and implement student-centered, instructional materials that take advantage of computers to engage students in their own learning.**						34				II, III
7. **design and teach technology-enriched learning activities that connect content, state and national standards with student technology standards.**		7	6					2		II, III
8. **design and teach technology-enriched learning activities that meet the individual needs of students.**		6,7								II, III
9. **design an evaluation plan that applies multiple measures for evaluating technology-based students' products.**		12	9					15		IV
10. **participate in online professional collaborations with peers and experts.**	13	18	15	17					3	V

Questionnaire's Items and Instruments Used to Create Them (continued)

	NETS for Teachers Profiles				LoTi			PCC		
QUESTIONNAIRE ITEMS	General	Professional	Student Teaching/ internship	First-Year Teaching	Inservice	Preservice	Higher Education	Currr, Learn & Assess	Professional Practice	**NETS for Teachers**
11. **design and facilitate learning experiences that use assistive technologies to meet the special physical needs of students.**		24	5							II, III,VI
12. **guide collaborative learning activities in which students use technology resources to solve authentic problems in the subject area (s).**			8							III
13. **arrange equitable access to appropriate technology resources that enable students to engage successfully in learning activities across subject/content areas and grade levels.**				3						II, III, IV
14. **plan and implement technology-based learning activities that promote student engagement in analysis, synthesis, interpretation, and creation of original products.**				5						II, III
15. **facilitate students' use of technology that addresses their social needs and cultural identity.**	14			12						III,VI
16. **facilitate students' use of technology that promotes their interaction with the global community.**				12						III,VI
17. **structure a learning environment where student collaboration is the common practice when using technology.**	15							4		I,VI
18. **use students' interests, experiences when planning a variety of computer-related activities.**	9				33	35	34			I, II, III
19. **implement project-based learning that emphasizes critical content and higher-order thinking skills (e.g., analysis, synthesis, evaluation) using the available computers.**		1			8	8			10	III
20. **design and implement web-based projects that emphasize complex thinking skill strategies such as problem-solving, scientific inquiry, or decision-making.**					5	5				III

Questionnaire's Items and Instruments Used to Create Them (continued)

	NETS for Teachers Profiles				LoTi			PCC		
QUESTIONNAIRE ITEMS	General	Professional	Student Teaching/ internship	First-Year Teaching	Inservice	Preservice	Higher Education	Curr, Learn & Assess	Professional Practice	**NETS for Teachers**
21. **guide students' use of the Internet for collaboration with others.**					21		22	11		II
22. **use content-specific tools (e.g., software, simulation, web tools) to support learning.**	4									I, III
23. **use technology resources to facilitate knowledge construction.**	5							7		I, III
24. **apply technology tools and resources to collect, analyze, and interpret data and report results.**			12						5	IV
25. **transfer what students' have learned in the classroom to real world situation when planning the use of technology in the classroom(e.g., student-generated recycling program, student-generated business).**					36		33	5		II, III
26. **design online collaborative projects with other entities (e.g., schools, businesses, organizations) to find solutions, make decisions, or seek a resolution to an issue of importance to the students.**						22	21			II, III
27. **use technology in instruction to provide students with increased levels of interactivity.**								6		II, III

APPENDIX B

PEDAGOGICAL USE OF INSTRUCTIONAL TECHNOLOGY IN TEACHING QUESTIONNAIRE

Pedagogical Use of Instructional Technology in Teaching Questionnaire

DIRECTIONS:

This questionnaire takes about 30 minutes to complete. It focuses exclusively on the instructional uses of the computer-based technology. It presents you with 27 statements reflecting ways in which a PT3 professional development program may have prepared participants to use ITs as part of their practice.

For each statement you are being asked to indicate the degree to which the statement reflects your way of preparing participants to use IT. Choose **Strongly Agree** or **Agree** if your program prepared the participants to accomplish what is indicated in the statement. Choose **Disagree** or **Strongly Disagree** if your program did not prepare the participants to accomplish what is indicated in the statement. Choose **Not Applied in my Professional Development** if the statement was not part of the program's goals and/or objectives.

For those statements you answer **Strongly Agree** or **Agree**, use the text box beside the question to briefly describe the strategy(ies) your program used to achieve the statement. Otherwise, write **N/A** in the textbox, or **leave it blank** skipping to the next question. After completing all the survey **click** on the **Submit** button at the bottom of the page. Below is an example of a **Strongly Agree** response.

EXAMPLE:

Our professional development program prepared participants to: **0. differentiate between appropriate and inappropriate uses of technology for students' grade level and content area.** ◉ **Strongly Agree *(Provide Strategies)*** ○ **Agree *(Provide Strategies)*** ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**0.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.** a) Participants from the same subject area and grade level were asked to develop a collaborative lesson using technology tools b) Examples of lessons that successfully used instructional technology to promote learning in their content area were provided to them c) Their lessons were evaluated for effectiveness and suggestions were made by experts in their area

CLICK TO BEGIN QUESTIONNAIRE

Pedagogical Use of Instructional Technology in Teaching Questionnaire

Take the time you need to complete the questionnaire. You will not be timed out. However, you must complete it once you start it. You cannot close it and then come back.

Enter your e-mail:

Our professional development program prepared participants to: **1. differentiate between appropriate and inappropriate uses of technology for students' grade level and content area.** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**1.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**
Our professional development program prepared participants to: **2. design and implement learning activities that integrate technology to support and expand students' critical thinking.** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**2.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**
Our professional development program prepared participants to: **3. design and implement learning activities that integrate technology to support and expand students' problem solving skills.** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**3.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**
Our professional development program prepared participants to: **4. design and implement learner-centered lessons that are based on the current best practices for integrating the learning of subject matter and student technology standards** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**4.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**

Our professional development program prepared participants to: **5. assess learner-centered lessons that are based on the current best practices for integrating subject matter and student technology standards.** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**5.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**
Our professional development program prepared participants to: **6. design and implement student-centered, instructional materials that take advantage of computers to engage students in their own learning.** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**6.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**
Our professional development program prepared participants to: **7. design and teach technology-enriched learning activities that connect content, state and national standards with student technology standards.** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**7.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**
Our professional development program prepared participants to: **8. design and teach technology-enriched learning activities that meet the individual needs of students.** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**8.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**

Our professional development program prepared participants to: **9. design an evaluation plan that applies multiple measures for evaluating technology-based students' products.** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**9.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**
Our professional development program prepared participants to: **10. participate in online professional collaborations with peers and experts.** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**10.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**
Our professional development program prepared participants to: **11. design and facilitate learning experiences that use assistive technologies to meet the special physical needs of students.** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**11.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**
Our professional development program prepared participants to: **12. guide collaborative learning activities in which students use technology resources to solve authentic problems in the subject area (s).** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**12.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**

Our professional development program prepared participants to: **13. arrange equitable access to appropriate technology resources that enable students to engage successfully in learning activities across subject/content areas and grade levels.** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**13.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**
Our professional development program prepared participants to: **14. plan and implement technology-based learning activities that promote student engagement in analysis, synthesis, interpretation, and creation of original products.** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**14.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**
Our professional development program prepared participants to: **15. facilitate students' use of technology that addresses their social needs and cultural identity.** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**15.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**
Our professional development program prepared participants to: **16. facilitate students' use of technology that promotes their interaction with the global community.** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**16.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**

Our professional development program prepared participants to: **17. structure a learning environment where student collaboration is the common practice when using technology.** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**17.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**
Our professional development program prepared participants to: **18. use students' interests, experiences when planning a variety of computer-related activities.** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**18.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**
Our professional development program prepared participants to: **19. implement project-based learning that emphasizes critical content and higher-order thinking skills (e.g., analysis, synthesis, evaluation) using the available computers.** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**19.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**
Our professional development program prepared participants to: **20. design and implement web-based projects that emphasize complex thinking skill strategies such as problem-solving, scientific inquiry, or decision-making.** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**20.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**

Our professional development program prepared participants to: **21. guide students' use of the Internet for collaboration with others.** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**21.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**
Our professional development program prepared participants to: **22. use content-specific tools (e.g., software, simulation, web tools) to support learning.** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**22.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**
Our professional development program prepared participants to: **23. use technology resources to facilitate knowledge construction.** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**23.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**
Our professional development program prepared participants to: **24. apply technology tools and resources to collect, analyze, and interpret data and report results.** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**24.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**

Our professional development program prepared participants to: **25. transfer what students' have learned in the classroom to real world situation when planning the use of technology in the classroom(e.g., student-generated recycling program, student-generated business).** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**25.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**
Our professional development program prepared participants to: **26. design online collaborative projects with other entities (e.g., schools, businesses, organizations) to find solutions, make decisions, or seek a resolution to an issue of importance to the students.** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**26.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**
Our professional development program prepared participants to: **27. use technology in instruction to provide students with increased levels of interactivity.** ○ **Strongly Agree** *(Provide Strategies)* ○ **Agree** *(Provide Strategies)* ○ **Disagree** ○ **Strongly Disagree** ○ **Not Applied in my Professional Development**	**27.a. If you Agreed or Strongly Agreed with this statement please list the strategy(ies) you used to accomplish it.**
28. Is there anything that you would like to add?	

APPENDIX C

INTRODUCTION E-MAIL TO PARTICIPANTS

Subject: PT3 Research Request

Dear <participant's name>,

I am a doctoral student in the Technology Education program at West Virginia University conducting a study on successful PT3 professional development projects. As a project who exemplifies successful IT integration, you are being asked to participate.

My study aims to identify those strategies you employed in your sustainable instructional technology professional development program that are found to successfully promote educators' high-level use of technology in their teaching practice. Your participation will contribute to the development of a taxonomy of strategies to guide future professional developments. The resulting taxonomy will be made available for your use.

Participation in this study is relatively easy and involves completing one short online questionnaire. I estimate it will take approximately 20-30 minutes to complete it. Your participation is critical. However, if for some reason you are not able to participate, I ask that you identify the next best person who could complete the questionnaire on behalf of your program. Indicating this person to me is very much appreciated and it will allow the success of this study. I am encouraging participants to complete this survey within one week of receiving this e-mail. Should you choose to participate please follow the steps outlined below:

1. **Go** to questionnaire's online address
2. Please **read** the information and then **click** on the **"Click to Begin the Questionnaire"** link at the bottom of the page.
3. **Login** with your Username: **<participant's username>** and Password: **<participant's username>.**
4. After completing the survey please **click** on the **Submit** button at the end of the page.

Note: Take the time you need to complete the questionnaire. You will not be timed out. However, you must complete it once you started it. You cannot close it and then come back

Your participation is voluntary, and you may refrain from answering any or all questions without explanation. Please note that your responses are appreciated and will add to the validity of the study. Confidentiality and anonymity of your responses will be protected throughout the study.

If you have any questions or comments concerning this study, please feel free to contact me at (304-599-4196) or kassis@mix.wvu.edu or contact my faculty advisor, Dr. John Wells at (304- 293 3803 ext. 1703) or jgwells@mail.wvnet.edu . This survey was approved by the Institutional Review Board for the Protection of Human Subjects at West Virginia University.

Your participation in this study means a great deal to me personally but will also contribute to my profession, thank you for your time and effort in participating in this research.

Sincerely,

Karla Assis
Doctoral Student – Technology Education
West Virginia University
<Address>
Morgantown - WV 26505 - <Telephone>

APPENDIX D

INSTITUTIONAL REVIEW BOARD APPROVAL

West Virginia University
College of Human Resources and Education

May 10, 2004

MEMORANDUM

TO: Karla Assis

FROM: Lynn Cartwright
Interim Associate Dean

RE: Human Resources & Education H.S. #2004-034

Title: "Strategies for Sustainable Professional Development Programs to Promote Effective Pedagogical Use of Instructional Technology in Teaching"

Your Application for Exemption for the above-captioned research project has been reviewed under the Human Subjects Policies and has been approved.

This exemption will remain in effect on the condition that the research is carried out exactly as described in the application.

Best wishes for the success of your research.

cc: Deans Office
Student Advising and Records
John Wells, Advisor

Office of the Dean

802 Allen Hall
PO Box 6122
Morgantown, WV 26506-6122

Phone: 304-293-5703
Fax: 304-293-7565

Equal Opportunity/Affirmative Action Institution

APPENDIX E

THANK-YOU CARD AND THANK YOU MAGNET

Dear <participant's name>,

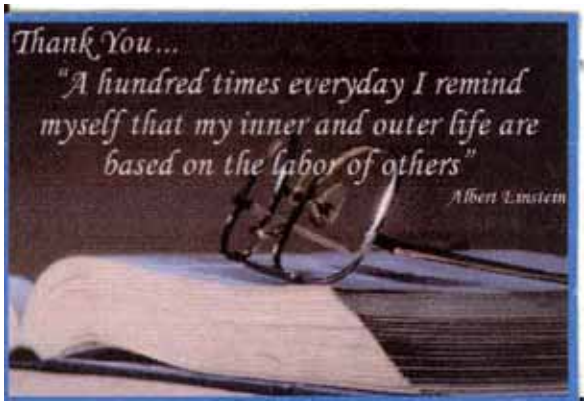
"We can do no great things; only small things with great love"

Mother Teresa

I would like to express my deepest appreciation for having made possible the progress of my research. If you did not have the chance yet to complete the questionnaire, there is still time. Your participation will have a profound impact on the results of this study. I understand how busy you are and I am very grateful for you taking the time to help me through this learning journey.

Best regards,

Karla Assis
Doctoral Student – Technology Education
West Virginia University
<Address>
Morgantown - WV 26505 - <Telephone>



APPENDIX F

FIRST E-MAIL REMINDER

Subject: PT3 Research – Reminder

Dear [Participant's Name],

This is a follow up to the previous e-mail I sent asking you to participate in my study. I am aware of your busy schedule, but if you could spare approximately 20 to 30 minutes of your time and complete the online questionnaire (questionnaire's web address) it would mean a lot for my research. The questionnaire will be available for completion for one more week. The data collection will end at midnight on May 29, 2004. If you want to participate in this study but you do not have the time to complete the survey please indicate the next best person who could complete the questionnaire in behalf of your program.

To participate in this study please click on the questionnaire's link above, read the information and click on the link **Click to Begin Questionnaire** at the bottom of the page. You will be prompted to enter the **user name**: < > and the **password**: < >. After completing the questionnaire **click on** the **Submit** button on the bottom of the page.

Thank you for your time and for considering completing the questionnaire!

If you have any question, feel free to contact me at (304-599-4196) or kassis@mix.wvu.edu or contact my faculty advisor, Dr. John Wells at (304- 293 3803 ext. 1703) or jgwells@mail.wvnet.edu . This questionnaire was approved by the Institutional Review Board for the Protection of Human Subjects at West Virginia University

Sincerely,

Karla Assis
Doctoral Student – Technology Education
West Virginia University
Address - Telephone

APPENDIX G

FINAL E-MAIL REMINDER

Subject: PT3 Research – Reminder

Dear [Participant's Name],

Time to participate is running out. The data collection for this study will end on May 29, 2004. Your participation is crucial for this study. I would really appreciate if you could take approximately 20 to 30 minutes of your busy schedule to complete this online questionnaire (questionnaire's web address). I therefore thank you in advance for considering taking your time to complete this questionnaire.

To participate in this study please click on the questionnaire's link, read the information and click on the link **Click to Begin Questionnaire** at the bottom of the page. You will be prompted to enter the **user name**: < > and the **password**: < >. After completing the questionnaire **click on** the **Submit** button on the bottom of the page.

Thank you very much for your time.

If you have any question, feel free to contact me at (304-599-4196) or kassis@mix.wvu.edu or contact my faculty advisor, Dr. John Wells at (304- 293 3803 ext. 1703) or jgwells@mail.wvnet.edu . This questionnaire was approved by the Institutional Review Board for the Protection of Human Subjects at West Virginia University.

Sincerely,

Karla Assis
Doctoral Student – Technology Education
West Virginia University
Address - Telephone

APPENDIX H

THANK-YOU E-MAIL

Subject: PT3 Research - Thank you
Dear (participant's name)

I would like to thank you for taking the time to complete the questionnaire. Your participation meant a lot to my study. When the study is completed I will make available the results to you. I am grateful for your support and your efforts to contribute to the success of this study.

Have a wonderful summer!
Best regards,

Karla Assis
Doctoral Student – Technology Education
West Virginia University
<Address>
Morgantown - WV 26505 - <Telephone>

APPENDIX I

INTRARESPONDENT MATRIX TEMPLATE

GENERATING CODING FROM PARTICIPANTS' RESPONSES

Intrarespondent Matrix Template – Generating Coding from Participants' Responses

Indicator #: Question statement.

Category in which the indicator belongs

Par	Participants Responses	Researcher Coding	Suggestions by Expert
1.			
2.			
3.			
4.			
5.			
6.			
7.			

Example:

Indicator 1: Our professional development program prepared participants to **differentiate between appropriate and inappropriate uses of technology for students' grade level and content area.** If you Agreed or Strongly Agreed with this statement please list the strategy (ies) that you used to accomplish it.

Category 4: Appropriate Use of Instructional Technology

Par	Participants Responses	Researcher Coding	Suggestions by Expert
1.			
2.			
3.			
4.			
5.			
6.			
7.			

APPENDIX J

HIGH-LEVEL USE OF TECHNOLOGY: PERCENT/FREQUENCY

High-Level Use of Technology: Percent/Frequency

QUEST1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	1.4	1.4	1.4
	2	9	12.9	12.9	14.3
	3	7	10.0	10.0	24.3
	4	30	42.9	42.9	67.1
	5	23	32.9	32.9	100.0
	Total	70	100.0	100.0	

QUEST2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	4	5.7	5.7	5.7
	3	3	4.3	4.3	10.0
	4	35	50.0	50.0	60.0
	5	28	40.0	40.0	100.0
	Total	70	100.0	100.0	

QUEST3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	3	4.3	4.3	4.3
	3	4	5.7	5.7	10.0
	4	36	51.4	51.4	61.4
	5	27	38.6	38.6	100.0
	Total	70	100.0	100.0	

High-Level Use of Technology: Percent/Frequency (continued)

QUEST4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	4	5.7	6.0	6.0
	3	6	8.6	9.0	14.9
	4	24	34.3	35.8	50.7
	5	33	47.1	49.3	100.0
	Total	67	95.7	100.0	
Missing	System	3	4.3		
Total		70	100.0		

QUEST5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	10	14.3	14.5	14.5
	3	15	21.4	21.7	36.2
	4	20	28.6	29.0	65.2
	5	24	34.3	34.8	100.0
	Total	69	98.6	100.0	
Missing	System	1	1.4		
Total		70	100.0		

High-Level Use of Technology: Percent/Frequency (continued)

QUEST6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	5	7.1	7.2	7.2
	3	7	10.0	10.1	17.4
	4	29	41.4	42.0	59.4
	5	28	40.0	40.6	100.0
	Total	69	98.6	100.0	
Missing	System	1	1.4		
Total		70	100.0		

QUEST7

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	4	5.7	6.2	6.2
	3	5	7.1	7.7	13.8
	4	20	28.6	30.8	44.6
	5	36	51.4	55.4	100.0
	Total	65	92.9	100.0	
Missing	System	5	7.1		
Total		70	100.0		

High-Level Use of Technology: Percent/Frequency (continued)

QUEST8

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	6	8.6	8.7	8.7
	3	9	12.9	13.0	21.7
	4	31	44.3	44.9	66.7
	5	23	32.9	33.3	100.0
	Total	69	98.6	100.0	
Missing	System	1	1.4		
Total		70	100.0		

QUEST9

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	1.4	1.4	1.4
	2	19	27.1	27.5	29.0
	3	14	20.0	20.3	49.3
	4	21	30.0	30.4	79.7
	5	14	20.0	20.3	100.0
	Total	69	98.6	100.0	
Missing	System	1	1.4		
Total		70	100.0		

High-Level Use of Technology: Percent/Frequency (continued)

QUEST10

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	1.4	1.4	1.4
	2	14	20.0	20.0	21.4
	3	14	20.0	20.0	41.4
	4	25	35.7	35.7	77.1
	5	16	22.9	22.9	100.0
	Total	70	100.0	100.0	

QUEST11

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	15	21.4	21.7	21.7
	3	20	28.6	29.0	50.7
	4	27	38.6	39.1	89.9
	5	7	10.0	10.1	100.0
	Total	69	98.6	100.0	
Missing	System	1	1.4		
Total		70	100.0		

QUEST12

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	4	5.7	5.7	5.7
	3	14	20.0	20.0	25.7
	4	29	41.4	41.4	67.1
	5	23	32.9	32.9	100.0
	Total	70	100.0	100.0	

High-Level Use of Technology: Percent/Frequency (continued)

QUEST13

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	1.4	1.4	1.4
	2	14	20.0	20.0	21.4
	3	15	21.4	21.4	42.9
	4	23	32.9	32.9	75.7
	5	17	24.3	24.3	100.0
	Total	70	100.0	100.0	

QUEST14

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	4	5.7	5.8	5.8
	3	11	15.7	15.9	21.7
	4	30	42.9	43.5	65.2
	5	24	34.3	34.8	100.0
	Total	69	98.6	100.0	
Missing	System	1	1.4		
Total		70	100.0		

High-Level Use of Technology: Percent/Frequency (continued)

QUEST15

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	18	25.7	26.9	26.9
	3	21	30.0	31.3	58.2
	4	22	31.4	32.8	91.0
	5	6	8.6	9.0	100.0
	Total	67	95.7	100.0	
Missing	System	3	4.3		
Total		70	100.0		

QUEST16

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	18	25.7	25.7	25.7
	3	19	27.1	27.1	52.9
	4	23	32.9	32.9	85.7
	5	10	14.3	14.3	100.0
	Total	70	100.0	100.0	

QUEST17

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	6	8.6	8.8	8.8
	3	8	11.4	11.8	20.6
	4	32	45.7	47.1	67.6
	5	22	31.4	32.4	100.0
	Total	68	97.1	100.0	
Missing	System	2	2.9		
Total		70	100.0		

High-Level Use of Technology: Percent/Frequency (continued)

QUEST18

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	8	11.4	11.8	11.8
	3	15	21.4	22.1	33.8
	4	27	38.6	39.7	73.5
	5	18	25.7	26.5	100.0
	Total	68	97.1	100.0	
Missing	System	2	2.9		
Total		70	100.0		

QUEST19

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	9	12.9	13.2	13.2
	3	11	15.7	16.2	29.4
	4	23	32.9	33.8	63.2
	5	25	35.7	36.8	100.0
	Total	68	97.1	100.0	
Missing	System	2	2.9		
Total		70	100.0		

High-Level Use of Technology: Percent/Frequency (continued)

QUEST20

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	1.4	1.5	1.5
	2	11	15.7	16.9	18.5
	3	12	17.1	18.5	36.9
	4	18	25.7	27.7	64.6
	5	23	32.9	35.4	100.0
	Total	65	92.9	100.0	
Missing	System	5	7.1		
Total		70	100.0		

QUEST21

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	11	15.7	16.4	16.4
	3	16	22.9	23.9	40.3
	4	21	30.0	31.3	71.6
	5	19	27.1	28.4	100.0
	Total	67	95.7	100.0	
Missing	System	3	4.3		
Total		70	100.0		

High-Level Use of Technology: Percent/Frequency (continued)

QUEST22

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	5	7.1	7.2	7.2
	3	3	4.3	4.3	11.6
	4	37	52.9	53.6	65.2
	5	24	34.3	34.8	100.0
	Total	69	98.6	100.0	
Missing	System	1	1.4		
Total		70	100.0		

QUEST23

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	3	4.3	4.5	4.5
	3	13	18.6	19.7	24.2
	4	26	37.1	39.4	63.6
	5	24	34.3	36.4	100.0
	Total	66	94.3	100.0	
Missing	System	4	5.7		
Total		70	100.0		

High-Level Use of Technology: Percent/Frequency (continued)

QUEST24

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	10	14.3	14.9	14.9
	3	10	14.3	14.9	29.9
	4	30	42.9	44.8	74.6
	5	17	24.3	25.4	100.0
	Total	67	95.7	100.0	
Missing	System	3	4.3		
Total		70	100.0		

QUEST25

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	1.4	1.5	1.5
	2	18	25.7	27.3	28.8
	3	22	31.4	33.3	62.1
	4	12	17.1	18.2	80.3
	5	13	18.6	19.7	100.0
	Total	66	94.3	100.0	
Missing	System	4	5.7		
Total		70	100.0		

High-Level Use of Technology: Percent/Frequency (continued)

QUEST26

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	1.4	1.5	1.5
	2	16	22.9	23.5	25.0
	3	27	38.6	39.7	64.7
	4	16	22.9	23.5	88.2
	5	8	11.4	11.8	100.0
	Total	68	97.1	100.0	
Missing	System	2	2.9		
Total		70	100.0		

QUEST27

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	9	12.9	13.0	13.0
	3	14	20.0	20.3	33.3
	4	19	27.1	27.5	60.9
	5	27	38.6	39.1	100.0
	Total	69	98.6	100.0	
Missing	System	1	1.4		
Total		70	100.0		

APPENDIX K

INTERRESPONDENT MATRIX

SAMPLE RESULTS FROM THE ANALYSES OF PARTICIPANT CHOICE OF STRATEGIES PER INDICATOR

Sample Results from the Interrespondent Matrix – Analyses of Participants' Choice of Strategies per Indicator

Strategies Present in Indicator 1: 51 Responses of 53 Possible Open-Ended Responses

Participants	Strategy 1	Strategy 2	Strategy 3	Strategy 4	Strategy 5	Strategy 6	Strategy 7	Strategy 8	Strategy 9	Strategy 10	Strategy 11	Strategy 12	Strategy 13	Strategy 14	Strategy 15	Strategy 16	Strategy 17	Strategy 18	Strategy 19	Strategy 20	Strategy 21	Strategy 22	Strategy 23	Strategy 24	Strategy 25	Strategy 26
1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
3	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
7	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
9	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
10	0	0	1	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
20	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	1	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
28	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
29	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
31	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
33	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	1	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Sample Results from the Interrespondent Matrix – Analyses of Participants' Choice of Strategies per Indicator (continued)

Strategies Present in Indicator 1: 51 Responses of 53 Possible Open-Ended Responses (continued)

Participants	Strategy 1	Strategy 2	Strategy 3	Strategy 4	Strategy 5	Strategy 6	Strategy 7	Strategy 8	Strategy 9	Strategy 10	Strategy 11	Strategy 12	Strategy 13	Strategy 14	Strategy 15	Strategy 16	Strategy 17	Strategy 18	Strategy 19	Strategy 20	Strategy 21	Strategy 22	Strategy 23	Strategy 24	Strategy 25	Strategy 26
36	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	1	0	0	1	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
40	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	1	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
51	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
53	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
54	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
55	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
%	**45**	**4**	**39**	**4**	**4**	**22**	**4**	**8**	**27**	**22**	**8**	**10**	**2**	**6**	**0**	**2**	**4**	**0**	**0**	**4**	**2**	**8**	**2**	**0**	**0**	**10**

Sample Results from the Interrespondent Matrix – Analyses of Participants' Choice of Strategies per Indicator (continued)

Strategies Present in Indicator 2: 60 Responses of 63 Possible Open-Ended Responses

Participants	Strategy 1	Strategy 2	Strategy 3	Strategy 4	Strategy 5	Strategy 6	Strategy 7	Strategy 8	Strategy 9	Strategy 10	Strategy 11	Strategy 12	Strategy 13	Strategy 14	Strategy 15	Strategy 16	Strategy 17	Strategy 18	Strategy 19	Strategy 20	Strategy 21	Strategy 22	Strategy 23	Strategy 24	Strategy 25	Strategy 26
1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2	1	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
6	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
10	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
11	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	1	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
17	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
20	0	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	1	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	1
23	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
28	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
29	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Sample Results from the Interrespondent Matrix – Analyses of Participants' Choice of Strategies per Indicator (continued)

Strategies Present in Indicator 2: 60 Responses of 63 Possible Open-Ended Responses

Participants	Strategy 1	Strategy 2	Strategy 3	Strategy 4	Strategy 5	Strategy 6	Strategy 7	Strategy 8	Strategy 9	Strategy 10	Strategy 11	Strategy 12	Strategy 13	Strategy 14	Strategy 15	Strategy 16	Strategy 17	Strategy 18	Strategy 19	Strategy 20	Strategy 21	Strategy 22	Strategy 23	Strategy 24	Strategy 25	Strategy 26
31	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
33	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
34	1	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
45	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
50	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
52	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
54	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
56	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
60	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Sample Results from the Interrespondent Matrix – Analyses of Participants' Choice of Strategies per Indicator (continued)

Strategies Present in Indicator 2: 60 Responses of 63 Possible Open-Ended Responses (continued)

Participants	Strategy 1	Strategy 2	Strategy 3	Strategy 4	Strategy 5	Strategy 6	Strategy 7	Strategy 8	Strategy 9	Strategy 10	Strategy 11	Strategy 12	Strategy 13	Strategy 14	Strategy 15	Strategy 16	Strategy 17	Strategy 18	Strategy 19	Strategy 20	Strategy 21	Strategy 22	Strategy 23	Strategy 24	Strategy 25	Strategy 26
62	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
64	1	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	1	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
%	**42**	**7**	**30**	**2**	**8**	**22**	**5**	**10**	**42**	**3**	**8**	**3**	**2**	**17**	**0**	**0**	**5**	**2**	**0**	**3**	**5**	**2**	**2**	**0**	**0**	**15**

Sample Results from the Interrespondent Matrix – Analyses of Participants' Choice of Strategies per Indicator (continued)

Strategies Present in Indicator 3: 56 Responses of 63 Possible Open-Ended Responses

Participants	Strategy 1	Strategy 2	Strategy 3	Strategy 4	Strategy 5	Strategy 6	Strategy 7	Strategy 8	Strategy 9	Strategy 10	Strategy 11	Strategy 12	Strategy 13	Strategy 14	Strategy 15	Strategy 16	Strategy 17	Strategy 18	Strategy 19	Strategy 20	Strategy 21	Strategy 22	Strategy 23	Strategy 24	Strategy 25	Strategy 26
1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
8	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
9	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
11	0	1	0	0	1	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	1	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
20	0	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
22	1	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
28	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
29	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Sample Results from the Interrespondent Matrix – Analyses of Participants' Choice of Strategies per Indicator (continued)

Strategies Present in Indicator 3: 56 Responses of 63 Possible Open-Ended Responses (continued)

Participants	Strategy 1	Strategy 2	Strategy 3	Strategy 4	Strategy 5	Strategy 6	Strategy 7	Strategy 8	Strategy 9	Strategy 10	Strategy 11	Strategy 12	Strategy 13	Strategy 14	Strategy 15	Strategy 16	Strategy 17	Strategy 18	Strategy 19	Strategy 20	Strategy 21	Strategy 22	Strategy 23	Strategy 24	Strategy 25	Strategy 26
33	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
36	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
46	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
50	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
54	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
59	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
63	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
64	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Sample Results from the Interrespondent Matrix – Analyses of Participants' Choice of Strategies per Indicator (continued)

Strategies Present in Indicator 3: 56 Responses of 63 Possible Open-Ended Responses (continued)

Participants	Strategy 1	Strategy 2	Strategy 3	Strategy 4	Strategy 5	Strategy 6	Strategy 7	Strategy 8	Strategy 9	Strategy 10	Strategy 11	Strategy 12	Strategy 13	Strategy 14	Strategy 15	Strategy 16	Strategy 17	Strategy 18	Strategy 19	Strategy 20	Strategy 21	Strategy 22	Strategy 23	Strategy 24	Strategy 25	Strategy 26
67	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
%	**13**	**4**	**23**	**2**	**14**	**20**	**4**	**11**	**46**	**2**	**11**	**4**	**4**	**18**	**0**	**2**	**4**	**2**	**2**	**0**	**9**	**5**	**2**	**2**	**0**	**11**

APPENDIX L

RANK OF STRATEGIES USED PER INDICATOR

Rank of Strategies Used per Indicator

Indicator 1: differentiate between appropriate and inappropriate uses of technology for students' grade level and content area.

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
• Strategy 1: Identifying/Defining appropriate use of IT	• Strategy 3: Evaluation/Critique/ Assessment	• Strategy 9: Appropriate (Lesson/Learning Activity) Development • Strategy 6: Presentation/Demo/ Hands on • Strategy 10: Referencing Standards	None	• Strategy 12: Grouping • Strategy 26: Lesson Implementation • Strategy 11: Team Work/Group Discussion/Peer Discussion • Strategy 8: Mentoring/Consultation • Strategy 22: Specific Assessment Tool • Strategy 14: Problem- Based Learning/Project-Based Learning • Strategy 4: Observation • Strategy 5: Modeling • Strategy 7: Examples • Strategy 2: Exemplars/Models/Experts • Strategy 17: Special Funding/Special Incentives • Strategy 20: Made Technology Available • Strategy 16: Present/Develop/Use Rubrics • Strategy 21: Technology Support Teams • Strategy 13: Appropriate Lesson Development and Assessment • Strategy 23: Faculty Research (Presentations/Conferences)

Rank of Strategies Used per Indicator (continued)

Indicator 2: design and implement learning activities that integrate technology to support and expand students' critical thinking.

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
• Strategy 1: Identifying/Defining appropriate use of IT • Strategy 9: Appropriate (Lesson/Learning Activity) Development	None	• Strategy 3: Evaluation/Critique/ Assessment • Strategy 6: Presentation/Demo/ Hands on	• Strategy 14: Problem-Based Learning/Project-Based Learning • Strategy 26: Lesson Implementation	• Strategy 8: Mentoring/Consultation • Strategy 11: Team Work/Group Discussion/Peer Discussion • Strategy 5: Modeling • Strategy 2: Exemplars/Models/Experts • Strategy 17: Special Funding/Special Incentives • Strategy 7: Examples • Strategy 21: Technology Support Teams • Strategy 10: Referencing Standards • Strategy 12: Grouping • Strategy 20: Made Technology Available • Strategy 4: Observation • Strategy 13: Appropriate Lesson Development and Assessment • Strategy 18: Collaborative Learning • Strategy 22: Specific Assessment Tool • Strategy 23: Faculty Research (Presentations/Conferences)

Rank of Strategies Used per Indicator (continued)

Indicator 3: design and implement learning activities that integrate technology to support and expand students' problem solving skills.

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
• Strategy 9: Appropriate (Lesson/Learning Activity) Development	None	• Strategy 3: Evaluation/Critique/ Assessment	• Strategy 6: Presentation/Demo/ Hands on • Strategy 14: Problem-Based Learning/Project-Based Learning • Strategy 5: Modeling • Strategy 1: Identifying/Defining appropriate use of IT • Strategy 8: Mentoring/Consultation • Strategy 11: Team Work/Group Discussion/Peer Discussion • Strategy 26: Lesson Implementation	• Strategy 21: Technology Support Teams • Strategy 22: Specific Assessment Tool • Strategy 7: Examples • Strategy 12: Grouping • Strategy 13: Appropriate Lesson Development and Assessment • Strategy 17: Special Funding/Special Incentives • Strategy 2: Exemplars/Models/Experts • Strategy 4: Observation • Strategy 10: Referencing Standards • Strategy 16: Present/Develop/Use Rubrics • Strategy 18: Collaborative Learning • Strategy 19: Telecollaboration • Strategy 23: Faculty Research (Presentations/Conferences) • Strategy 24: Course/Curriculum Modification

Rank of Strategies Used per Indicator (continued)

Indicator 4: design and implement learner-centered lessons that are based on the current best practices for integrating the learning of subject matter and student technology standards.

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
• Strategy 9: Appropriate (Lesson/Learning Activity) Development	None	• Strategy 10: Referencing Standards	• Strategy 3: Evaluation/Critique/ Assessment • Strategy 6: Presentation/Demo/ Hands on • Strategy 1: Identifying/Defining appropriate use of IT • Strategy 2: Exemplars/Models/Experts • Strategy 5: Modeling • Strategy 26: Lesson Implementation • Strategy 7: Examples	• Strategy 14: Problem- Based Learning/Project-Based Learning • Strategy 8: Mentoring/Consultation • Strategy 11: Team Work/Group Discussion/Peer Discussion • Strategy 13: Appropriate Lesson Development and Assessment • Strategy 15: Standards Specific Training • Strategy 18: Collaborative Learning • Strategy 25: Resources Development • Strategy 4: Observation • Strategy 21: Technology Support Teams • Strategy 23: Faculty Research (Presentations/Conferences) • Strategy 24: Course/Curriculum Modification

Rank of Strategies Used per Indicator (continued)

Indicator 5: assess learner-centered lessons that are based on the current best practices for integrating subject matter and student technology standards.

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
None	• Strategy 10: Referencing Standards • Strategy 3: Evaluation/Critique/ Assessment	None	• Strategy 2: Exemplars/Models/ Experts • Strategy 13: Appropriate Lesson Development and Assessment • Strategy 16: Present/Develop/Use Rubrics • Strategy 9: Appropriate (Lesson/Learning Activity) Development • Strategy 22: Specific Assessment Tool • Strategy 26: Lesson Implementation	• Strategy 6: Presentation/Demo/ Hands on • Strategy 1: Identifying/Defining appropriate use of IT • Strategy 7: Examples • Strategy 8: Mentoring/Consultation • Strategy 15: Standards Specific Training • Strategy 4: Observation • Strategy 5: Modeling • Strategy 11: Team Work/Group Discussion/Peer Discussion • Strategy 14: Problem- Based Learning/Project-Based Learning • Strategy 18: Collaborative Learning • Strategy 21: Technology Support Teams • Strategy 25: Resources Development

Rank of Strategies Used per Indicator (continued)

Indicator 6: design and implement student-centered, instructional materials that take advantage of computers to engage students in their own learning.

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
• Strategy 9: Appropriate (Lesson/Learning Activity) Development	None	None	• Strategy 6: Presentation/Demo/ Hands on • Strategy 14: Problem-Based Learning/Project-Based Learning • Strategy 3: Evaluation/Critique/ Assessment • Strategy 5: Modeling • Strategy 1: Identifying/Defining appropriate use of IT	• Strategy 11: Team Work/Group Discussion/Peer Discussion • Strategy 25: Resources Development • Strategy 26: Lesson Implementation • Strategy 2: Exemplars/Models/ Experts • Strategy 7: Examples • Strategy 8: Mentoring/Consultation • Strategy 10: Referencing Standards • Strategy 21: Technology Support Teams • Strategy 4: Observation • Strategy 16: Present/Develop/Use Rubrics • Strategy 17: Special Funding/Special Incentives • Strategy 18: Collaborative Learning • Strategy 24: Course/Curriculum Modification • Strategy 20: Made Technology Available • Strategy 23: Faculty Research (Presentations/Conferences)

Rank of Strategies Used per Indicator (continued)

Indicator 7: design and teach technology-enriched learning activities that connect content, state and national standards with student technology standards.

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
• Strategy 10: Referencing Standards	• Strategy 9: Appropriate (Lesson/Learning Activity) Development	• Strategy 3: Evaluation/Critique/ Assessment	• Strategy 13: Appropriate Lesson Development and Assessment • Strategy 26: Lesson Implementation • Strategy 6: Presentation/Demo/ Hands on	• Strategy 7: Examples • Strategy 11: Team Work/Group Discussion/Peer Discussion • Strategy 1: Identifying/Defining appropriate use of IT • Strategy 2: Exemplars/Models/ Experts • Strategy 15: Standards Specific Training • Strategy 24: Course/Curriculum Modification • Strategy 5: Modeling • Strategy 8: Mentoring/Consultation • Strategy 16: Present/Develop/Use Rubrics • Strategy 25: Resources Development • Strategy 12: Grouping • Strategy 14: Problem- Based Learning/Project-Based Learning • Strategy 17: Special Funding/Special Incentives • Strategy 18: Collaborative Learning • Strategy 19: Telecollaboration • Strategy 21: Technology Support Teams

Rank of Strategies Used per Indicator (continued)

Indicator 8: design and teach technology-enriched learning activities that meet the individual needs of students.

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
• Strategy 9: Appropriate (Lesson/Learning Activity) Development	None	• Strategy 3: Evaluation/Critique/ Assessment	• Strategy 6: Presentation/Demo/ Hands on • Strategy 1: Identifying/Defining appropriate use of IT • Strategy 7: Examples • Strategy 10: Referencing Standards • Strategy 26: Lesson Implementation	• Strategy 2: Exemplars/Models/ Experts • Strategy 8: Mentoring/Consultation • Strategy 16: Present/Develop/Use Rubrics • Strategy 5: Modeling • Strategy 14: Problem- Based Learning/Project-Based Learning • Strategy 20: Made Technology Available • Strategy 22: Specific Assessment Tool • Strategy 11: Team Work/Group Discussion/Peer Discussion • Strategy 12: Grouping • Strategy 17: Special Funding/Special Incentives • Strategy 18: Collaborative Learning • Strategy 19: Telecollaboration • Strategy 21: Technology Support Teams • Strategy 24: Course/Curriculum Modification

Rank of Strategies Used per Indicator (continued)

Indicator 9: design an evaluation plan that applies multiple measures for evaluating technology-based students' products.

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
• Strategy 16: Present/Develop/Use Rubrics	• Strategy 3: Evaluation/Critique/ Assessment	• Strategy 13: Appropriate Lesson Development and Assessment	• Strategy 6: Presentation/Demo/ Hands on • Strategy 22: Specific Assessment Tool	• Strategy 1: Identifying/Defining appropriate use of IT • Strategy 2: Exemplars/Models/ Experts • Strategy 5: Modeling • Strategy 7: Examples • Strategy 10: Referencing Standards • Strategy 15: Standards Specific Training • Strategy 26: Lesson Implementation

Indicator 10: participate in online professional collaborations with peers and experts.

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
• Strategy 19: Telecollaboration	None	None	• Strategy 6: Presentation/Demo/ Hands on	• Strategy 9: Appropriate (Lesson/Learning Activity) Development • Strategy 17: Special Funding/Special Incentives • Strategy 20: Made Technology Available • Strategy 18: Collaborative Learning • Strategy 1: Identifying/Defining appropriate use of IT • Strategy 5: Modeling • Strategy 8: Mentoring/Consultation • Strategy 21: Technology Support Teams • Strategy 25: Resources Development

Rank of Strategies Used per Indicator (continued)

Indicator 11: design and facilitate learning experiences that use assistive technologies to meet the special physical needs of students.

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
None	None	None	• Strategy 6: Presentation/Demo/ Hands on • Strategy 1: Identifying/Defining appropriate use of IT • Strategy 9: Appropriate (Lesson/Learning Activity) • Strategy 8: Mentoring/Consultation • Strategy 20: Made Technology Available • Strategy 7: Examples	• Strategy 2: Exemplars/Models/ Experts • Strategy 12: Grouping • Strategy 17: Special Funding/Special Incentives • Strategy 18: Collaborative Learning • Strategy 19: Telecollaboration • Strategy 3: Evaluation/Critique/ Assessment • Strategy 5: Modeling

Indicator 12: guide collaborative learning activities in which students use technology resources to solve authentic problems in the subject area (s).

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
None	• Strategy 14: Problem- Based Learning/Project-Based Learning	• Strategy 9: Appropriate (Lesson/Learning Activity)	• Strategy 5: Modeling • Strategy 2: Exemplars/Models/ Experts • Strategy 6: Presentation/Demo/ Hands on • Strategy 1: Identifying/Defining appropriate use of IT • Strategy 3: Evaluation/Critique/ Assessment • Strategy 7: Examples	• Strategy 8: Mentoring/Consultation • Strategy 26: Lesson Implementation • Strategy 18: Collaborative Learning • Strategy 11: Team Work/Group Discussion/Peer Discussion • Strategy 19: Telecollaboration • Strategy 24: Course/Curriculum Modification • Strategy 25: Resources Development • Strategy 10: Referencing Standards • Strategy 12: Grouping • Strategy 17: Special Funding/Special Incentives

Rank of Strategies Used per Indicator (continued)

Indicator 13: arrange equitable access to appropriate technology resources that enable students to engage successfully in learning activities across subject/content areas and grade levels.

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
• Strategy 20: Made Technology Available	None	• Strategy 1: Identifying/Defining appropriate use of IT	• Strategy 6: Presentation/Demo/ Hands on • Strategy 3: Evaluation/Critique/ Assessment • Strategy 11: Team Work/Group Discussion/Peer Discussion	• Strategy 2: Exemplars/Models/ Experts • Strategy 7: Examples • Strategy 8: Mentoring/Consultation • Strategy 14: Problem- Based Learning/Project-Based Learning • Strategy 5: Modeling • Strategy 10: Referencing Standards • Strategy 17: Special Funding/Special Incentives • Strategy 18: Collaborative Learning • Strategy 19: Telecollaboration • Strategy 26: Lesson Implementation

Rank of Strategies Used per Indicator (continued)

Indicator 14: plan and implement technology-based learning activities that promote student engagement in analysis, synthesis, interpretation, and creation of original products.

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
• Strategy 9: Appropriate (Lesson/Learning Activity)	None	• Strategy 1: Identifying/Defining appropriate use of IT • Strategy 14: Problem-Based Learning/Project-Based Learning	• Strategy 2: Exemplars/Models/ Experts • Strategy 6: Presentation/Demo/ Hands on • Strategy 26: Lesson Implementation • Strategy 3: Evaluation/Critique/ Assessment • Strategy 7: Examples	• Strategy 5: Modeling • Strategy 8: Mentoring/Consultation • Strategy 10: Referencing Standards • Strategy 11: Team Work/Group Discussion/Peer Discussion • Strategy 16: Present/Develop/Use Rubrics • Strategy 17: Special Funding/Special Incentives • Strategy 18: Collaborative Learning • Strategy 19: Telecollaboration • Strategy 21: Technology Support Teams • Strategy 4: Observation • Strategy 13: Appropriate Lesson Development and Assessment • Strategy 20: Made Technology Available

Rank of Strategies Used per Indicator (continued)

Indicator 15: facilitate students' use of technology that addresses their social needs and cultural identity.

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
	• Strategy 6: Presentation/Demo/ Hands on	• Strategy 1: Identifying/Defining appropriate use of IT • Strategy 8: Mentoring/Consultation • Strategy 9: Appropriate (Lesson/Learning Activity)	• Strategy 26: Lesson Implementation • Strategy 11: Team Work/Group Discussion/Peer Discussion	• Strategy 2: Exemplars/Models/ Experts • Strategy 3: Evaluation/Critique/ Assessment • Strategy 5: Modeling • Strategy 7: Examples • Strategy 14: Problem- Based Learning/Project-Based Learning • Strategy 17: Special Funding/Special Incentives • Strategy 18: Collaborative Learning • Strategy 19: Telecollaboration • Strategy 21: Technology Support Teams • Strategy 25: Resources Development

Indicator 16: facilitate students' use of technology that promotes their interaction with the global community.

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
• Strategy 19: Telecollaboration	None	• Strategy 1: Identifying/Defining appropriate use of IT	• Strategy 6: Presentation/Demo/ Hands on • Strategy 2: Exemplars/Models/ Experts • Strategy 3: Evaluation/Critique/ Assessment	• Strategy 8: Mentoring/Consultation • Strategy 14: Problem- Based Learning/Project-Based Learning • Strategy 18: Collaborative Learning • Strategy 9: Appropriate (Lesson/Learning Activity) • Strategy 21: Technology Support Teams • Strategy 23: Faculty Research (Presentations/Conferences) • Strategy 26: Lesson Implementation

Rank of Strategies Used per Indicator (continued)

Indicator 17: structure a learning environment where student collaboration is the common practice when using technology.

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
None	None	• Strategy 1: Identifying/Defining appropriate use of IT	• Strategy 5: Modeling • Strategy 6: Presentation/Demo/ Hands on • Strategy 11: Team Work/Group Discussion/Peer Discussion • Strategy 14: Problem-Based Learning/Project-Based Learning • Strategy 9: Appropriate (Lesson/Learning Activity) • Strategy 18: Collaborative Learning • Strategy 8: Mentoring/Consultation • Strategy 19: Telecollaboration	• Strategy 2: Exemplars/Models/ Experts • Strategy 3: Evaluation/Critique/ Assessment • Strategy 20: Made Technology Available • Strategy 7: Examples • Strategy 17: Special Funding/Special Incentives • Strategy 26: Lesson Implementation • Strategy 10: Referencing Standards • Strategy 19: Telecollaboration • Strategy 21: Technology Support Teams

Rank of Strategies Used per Indicator (continued)

Indicator 18: use students' interests, experiences when planning a variety of computer-related activities.

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
None	• Strategy 9: Appropriate (Lesson/Learning Activity)	None	• Strategy 3: Evaluation/Critique/ Assessment • Strategy 5: Modeling • Strategy 6: Presentation/Demo/ Hands on • Strategy 8: Mentoring/Consultation • Strategy 1: Identifying/Defining appropriate use of IT • Strategy 14: Problem-Based Learning/Project-Based Learning • Strategy 26: Lesson Implementation	• Strategy 2: Exemplars/Models/ Experts • Strategy 11: Team Work/Group Discussion/Peer Discussion • Strategy 7: Examples • Strategy 10: Referencing Standards • Strategy 17: Special Funding/Special Incentives • Strategy 18: Collaborative Learning • Strategy 24: Course/Curriculum Modification

Indicator 19: implement project-based learning that emphasizes critical content and higher-order thinking skills (e.g., analysis, synthesis, evaluation) using the available computers.

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
None	• Strategy 6: Presentation/Demo/ Hands on	• Strategy 5: Modeling • Strategy 9: Appropriate (Lesson/Learning Activity) • Strategy 14: Problem-Based Learning/Project-Based Learning • Strategy 3: Evaluation/Critique	• Strategy 7: Examples • Strategy 1: Identifying/Defining appropriate use of IT • Strategy 2: Exemplars/Models/ Experts	• Strategy 10: Referencing Standards • Strategy 26: Lesson Implementation • Strategy 11: Team Work/Group Discussion/Peer Discussion • Strategy 16: Present/Develop/Use Rubrics • Strategy 18: Collaborative Learning • Strategy 8: Mentoring/Consultation

Rank of Strategies Used per Indicator (continued)

Indicator 20: design and implement web-based projects that emphasize complex thinking skill strategies such as problem-solving, scientific inquiry, or decision-making.

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
• Strategy 9: Appropriate (Lesson/Learning Activity) • Strategy 14: Problem- Based Learning/Project-Based Learning	None	None	• Strategy 6: Presentation/Demo/ Hands on • Strategy 7: Examples • Strategy 26: Lesson Implementation	• Strategy 1: Identifying/Defining appropriate use of IT • Strategy 19: Telecollaboration • Strategy 2: Exemplars/Models/ Experts • Strategy 3: Evaluation/Critique/ Assessment • Strategy 11: Team Work/Group Discussion/Peer Discussion • Strategy 21: Technology Support Teams • Strategy 24: Course/Curriculum Modification • Strategy 10: Referencing Standard • Strategy 5: Modeling • Strategy 8: Mentoring/Consultation

Rank of Strategies Used per Indicator (continued)

Indicator 21: guide students' use of the Internet for collaboration with others.

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
• Strategy 19: Telecollaboration	None	• Strategy 1: Identifying/Defining appropriate use of IT	• Strategy 18: Collaborative Learning • Strategy 3: Evaluation/Critique/ Assessment • Strategy 6: Presentation/Demo/ Hands on • Strategy 11: Team Work/Group Discussion/Peer Discussion • Strategy 14: Problem-Based Learning/Project-Based Learning • Strategy 26: Lesson Implementation	• Strategy 7: Examples • Strategy 9: Appropriate (Lesson/Learning Activity) • Strategy 2: Exemplars/Models/ Experts • Strategy 5: Modeling • Strategy 8: Mentoring/Consultation • Strategy 21: Technology Support Teams • Strategy 22: Specific Assessment Tool

Rank of Strategies Used per Indicator (continued)

Indicator 22: use content-specific tools (e.g., software, simulation, web tools) to support learning.

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
None	• Strategy 6: Presentation/Demo/ Hands on	• Strategy 1: Identifying/Defining appropriate use of IT • Strategy 9: Appropriate (Lesson/Learning Activity)	• Strategy 26: Lesson Implementation • Strategy 3: Evaluation/Critique/ Assessment • Strategy 8: Mentoring/Consultation • Strategy 14: Problem-Based Learning/Project-Based Learning	• Strategy 2: Exemplars/Models/ Experts • Strategy 5: Modeling • Strategy 7: Examples • Strategy 11: Team Work/Group Discussion/Peer Discussion • Strategy 20: Made Technology Available • Strategy 21: Technology Support Teams • Strategy 24: Course/Curriculum Modification • Strategy 25: Resources Development • Strategy 17: Special Funding/Special Incentives

Indicator 23: use technology resources to facilitate knowledge construction.

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
None	None	• Strategy 9: Appropriate (Lesson/Learning Activity) • Strategy 1: Identifying/Defining appropriate use of IT • Strategy 6: Presentation/Demo/ Hands on	• Strategy 26: Lesson Implementation • Strategy 5: Modeling • Strategy 3: Evaluation/Critique/ Assessment • Strategy 14: Problem-Based Learning/Project-Based Learning	• Strategy 7: Examples • Strategy 11: Team Work/Group Discussion/Peer Discussion • Strategy 2: Exemplars/Models/ Experts • Strategy 8: Mentoring/Consultation • Strategy 24: Course/Curriculum Modification • Strategy 19: Telecollaboration • Strategy 21: Technology Support Teams

Rank of Strategies Used per Indicator (continued)

Indicator 24: apply technology tools and resources to collect, analyze, and interpret data and report results

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
None	• Strategy 3: Evaluation/Critique/ Assessment	• Strategy 6: Presentation/Demo/ Hands on	• Strategy 22: Specific Assessment Tool • Strategy 9: Appropriate (Lesson/Learning Activity) • Strategy 26: Lesson Implementation	• Strategy 1: Identifying/Defining appropriate use of IT • Strategy 7: Examples • Strategy 8: Mentoring/Consultation • Strategy 23: Faculty Research (Presentations/Conferences) • Strategy 2: Exemplars/Models/ Experts • Strategy 5: Modeling • Strategy 11: Team Work/Group Discussion/Peer Discussion • Strategy 10: Referencing Standard • Strategy 12: Grouping • Strategy 14: Problem- Based Learning/Project-Based Learning • Strategy 16: Present/Develop/Use Rubrics

Rank of Strategies Used per Indicator (continued)

Indicator 25: transfer what students' have learned in the classroom to real world situation when planning the use of technology in the classroom(e.g., student-generated recycling program, student-generated business).

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
None	• Strategy 8: Mentoring/ Consultation	• Strategy 5: Modeling • Strategy 6: Presentation/Demo/ Hands on • Strategy 9: Appropriate (Lesson/Learning Activity) • Strategy 26: Lesson Implementation	• Strategy 3: Evaluation/Critique/ Assessment • Strategy 7: Examples • Strategy 1: Identifying/Defining appropriate use of IT • Strategy 2: Exemplars/Models/ Experts • Strategy 14: Problem-Based Learning/Project-Based Learning	• Strategy 10: Referencing Standard • Strategy 11: Team Work/Group Discussion/Peer Discussion • Strategy 12: Grouping • Strategy 20: Made Technology Available • Strategy 21: Technology Support Teams • Strategy 22: Specific Assessment Tool

Rank of Strategies Used per Indicator (continued)

Indicator 26: design online collaborative projects with other entities (e.g., schools, businesses, organizations) to find solutions, make decisions, or seek a resolution to an issue of importance to the students.

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
None	• Strategy 19: Telecollaboration	• Strategy 5: Modeling • Strategy 6: Presentation/Demo/ Hands on • Strategy 7: Examples	• Strategy 26: Lesson Implementation	• Strategy 1: Identifying/Defining appropriate use of IT • Strategy 3: Evaluation/Critique/ Assessment • Strategy 8: Mentoring/Consultation • Strategy 9: Appropriate (Lesson/Learning Activity) • Strategy 18: Collaborative Learning • Strategy 20: Made Technology Available • Strategy 21: Technology Support Teams • Strategy 22: Specific Assessment Tool

Rank of Strategies Used per Indicator (continued)

Indicator 27: use technology in instruction to provide students with increased levels of interactivity.

Very Often Used >40	Often Used 40-31	Occasionally Used 30-21	Rarely Used 20-11	Very Rarely Used 10-1
None	None	None	• Strategy 1: Identifying/Defining appropriate use of IT • Strategy 9: Appropriate (Lesson/Learning Activity) • Strategy 5: Modeling • Strategy 7: Examples • Strategy 19: Telecollaboration • Strategy 14: Problem-Based Learning/Project-Based Learning • Strategy 26: Lesson Implementation	• Strategy 11: Team Work/Group Discussion/Peer Discussion • Strategy 2: Exemplars/Models/ Experts • Strategy 3: Evaluation/Critique/ Assessment • Strategy 6: Presentation/Demo/ Hands on • Strategy 8: Mentoring/Consultation • Strategy 12: Grouping • Strategy 18: Collaborative Learning • Strategy 24: Course/Curriculum Modification

APPENDIX M

RANK OF STRATEGIES USE ACROSS INDICATORS AND INDICATORS ADDRESSED BY EACH STRATEGY

Rank of Strategies Use Across Indicators and Indicators Addressed by Each Strategy

Strategies Most Often Used Across Indicators First Quartile: 78-60	**Indicators in which the most often used strategies appear in each of the five levels of use**[€]					
	5	4	3	2	1	0
Strategy 9: Appropriate (Lesson/Learning Activity) Development	2, 3, 4, 6, 8, 14, 20	7, 18	1, 12, 15, 19, 22, 23, 25	5, 11, 17, 24, 27	10, 16, 21, 26	9, 13
Strategy 6: Presentation/Demo/Hands on	0	15, 19, 22	1, 2, 23, 24, 25, 26	3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 17, 18, 20, 21	5, 27	0
Strategy 1: Identifying/Defining Appropriate Use of IT	1, 2	0	13, 14, , 15, 16, 17, 21, 22, 23	3, 4, 6, 8, 11, 12, 18, 19, 25, 27	5, 7, 9, 10, 20, 24, 26	0

[€] Level of Use: 5 Very Often Used, 4 Often Used, 3 Occasionally Used, 2 Rarely Used, 1 Very Rarely Used, and 0 Never Used

Rank of Strategies Use Across Indicators and Indicators Addressed by Each Strategy (continued)

Strategies Often Used Across Indicators Second Quartile: 59-41	**Indicators in which the often used strategies appear in each of the five levels of use**[€]					
	5	4	3	2	1	0
Strategy 3: Evaluation/Critique/Assessment	0	1, 2, 5, 9, 24	3, 7, 8, 19	4, 6, 12, 14, 16, 19, 25	11, 15, 17, 20, 26, 27	10
Strategy 14: Problem- Based Learning/ Project-Based Learning	20	12	14, 19	2, 3, 6, 17, 18, 21, 22, 23, 25, 27	1, 4, 5, 7, 8, 13, 15, 16	9, 10, 11, 26
Strategy 26: Lesson implementation	0	0	25	2, 3, 4, 5, 7, 8, 14, 15, 18, 20, 21, 22, 23, 24, 26, 27	1, 6, 9, 12, 13, 16, 17, 19	10, 11

[€] Level of Use: 5 Very Often Used, 4 Often Used, 3 Occasionally Used, 2 Rarely Used, 1 Very Rarely Used, and 0 Never Used

Rank of Strategies Use Across Indicators and Indicators Addressed by Each Strategy (continued)

Strategies Occasionally Used Across Indicators Third Quartile: 40-22	**Indicators in which the occasionally used strategies appear in each of the five levels of use**[e]					
	5	4	3	2	1	0
Strategy 5 Modeling	0	0	19, 25, 26	3, 4, 6, 12, 17, 18, 23, 27	1, 2, 5, 7, 8, 9, 10, 11, 13, 14, 15	16
Strategy 7 Examples	0	0	26	4, 8. 11. 12. 14. 19, 20, 25, 27	1, 2, 3, 5, 6, 7, 9, 13, 15, 17, 18, 21, 22, 23, 24	10, 16
Strategy 8 Mentoring/Consultation	0	25	15	3, 11, 17, 18, 22	1, 2, 4, 5, 6, 7, 8, 10, 12, 13, 14, 16, 19, 20, 21, 23, 24, 26, 27	0
Strategy 19 Telecollaboration	10, 16, 21	26	0	17, 27	3, 7, 8, 11, 12, 13, 14, 15, 18, 20, 23	1, 2, 4, 5, 6, 9, 19, 22, 24, 25
Strategy 2 Exemplars/Models/Experts	0	0	0	4, 5, 12, 14, 16, 19, 25	1, 2, 3, 6, 7, 8, 9, 11, 13, 15, 17, 18, 20, 21, 22, 23, 24, 27	10, 26

[e] Level of Use: 5 Very Often Used, 4 Often Used, 3 Occasionally Used, 2 Rarely Used, 1 Very Rarely Used, and 0 Never Used

Rank of Strategies Use Across Indicators and Indicators Addressed by Each Strategy (continued)

Strategies Occasionally Used Across Indicators Third Quartile: 40-22	**Indicators in which the occasionally used strategies appear in each of the five levels of use**[€]					
	5	4	3	2	1	0
Strategy 10 Referencing Standards	7	5	1, 4	8	2, 3, 6, 9, 12, 13, 14, 17, 18, 19, 20, 24, 25	10, 11, 15, 16, 21, 22, 23, 26, 27
Strategy 11 Team Work/Group Discussion/Peer Discussion	0	0	0	3, 13, 15, 17, 21	1, 2, 4, 5, 6, 7, 8, 12, 14, 18, 19, 20, 22, 23, 24, 25, 27	9, 10, 11, 16, 26
Strategy 18 Collaborative Learning	0	0	0	17, 21	2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 18, 19, 26, 27	1, 9, 10, 22, 23, 24, 25

[€] Level of Use: 5 Very Often Used, 4 Often Used, 3 Occasionally Used, 2 Rarely Used, 1 Very Rarely Used, and 0 Never Used

Rank of Strategies Use Across Indicators and Indicators Addressed by Each Strategy (continued)

Strategies Rarely Used Across Indicators Fourth Quartile: 21-4	**Indicators in which the rarely used strategies appear in each of the five levels of use**[€]					
	5	4	3	2	1	0
Strategy 21 Technology Support Teams	0	0	0	0	1, 2, 3, 4, 5, 6, 7, 8, 10, 14, 15, 16, 17, 18, 20, 21, 22, 23, 25, 26	9, 11, 12, 13, 19, 24, 27
Strategy 20 Made technology available	13,	0	0	11	1, 2, 6, 8, 10, 14, 17, 22, 25, 26	2, 4, 10, 11, 12, 13, 15, 16, 17, 18, 20, 21, 22, 23, 25, 26, 27
Strategy 16 Present/Develop/Use Rubrics	9	0	0	5	1, 3, 6, 7, 8, 14, 19, 24	2, 4, 10, 11, 12, 13, 15, 16, 17, 18, 20, 21, 22, 23, 25, 26, 27
Strategy 17 Special funding /special incentives	0	0	0	0	1, 2, 3, 6, 7, 8, 10, 11, 12, 13, 17, 18, 22	4, 5, 9, 16, 19, 20, 21, 23, 24, 25, 26, 27
Strategy 22 Specific assessment tool	0	0	0	5, 9, 24	1, 2, 3, 21, 25, 26	4, 6, 7, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 23, 27

[€] Level of Use: 5 Very Often Used, 4 Often Used, 3 Occasionally Used, 2 Rarely Used, 1 Very Rarely Used, and 0 Never Used

Rank of Strategies Use Across Indicators and Indicators Addressed by Each Strategy (continued)

Strategies Rarely Used Across Indicators Fourth Quartile: 21-4	**Indicators in which the rarely used strategies appear in each of the five levels of use**[€]					
	5	4	3	2	1	0
Strategy 13 Appropriate Lesson Development and Assessment	0	0	0	5, 7	1, 2, 3, 4, 14	6, 8, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27
Strategy 24 Course/Curriculum modification	0	0	0	0	3, 4, 6, 7, 8, 12, 18, 20, 22, 23, 27	1, 2, 5, 9, 10, 11, 13, 14, 15, 16, 17, 19, 21, 24, 25, 26
Strategy 12 Grouping	0	0	0	0	1, 2, 3, 7, 8, 11, 12, 24, 25, 27	4, 5, 6, 9, 10, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 26
Strategy 25 Resources Development	0	0	0	0	4, 5, 7, 9	1, 2, 3, 6, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27

[€] Level of Use: 5 Very Often Used, 4 Often Used, 3 Occasionally Used, 2 Rarely Used, 1 Very Rarely Used, and 0 Never Used

Rank of Strategies Use Across Indicators and Indicators Addressed by Each Strategy (continued)

Strategies Rarely Used Across Indicators Fourth Quartile: 21-4	**Indicators in which the rarely used strategies appear in each of the five levels of use**[€]					
	5	4	3	2	1	0
Strategy 4 Observation	0	0	0	0	1, 2, 3, 4, 5, 6, 14	7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27
Strategy 23 Faculty Research (Presentations/Conferences)	0	0	0	0	1, 2, 3, 4, 6, 16, 24	5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 25, 26, 27
Strategy 15 Standards Specific Training	0	0	0	0	4, 5, 7, 9	1, 2, 3, 6, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27

[€] Level of Use: 5 Very Often Used, 4 Often Used, 3 Occasionally Used, 2 Rarely Used, 1 Very Rarely Used, and 0 Never Used

APPENDIX N

DESCRIPTION OF THE MOST USED STRATEGIES ACROSS INDICATORS

Description of the Most Used Strategies Across Indicators

Strategy 9: Appropriate (Lesson/Learning Activity) Development.

Ind Code	Description of its Usage
I-2 Very Often Used	• Participants redesigned learning activities to incorporate use of IT • Required the design of lessons and activities that use technology tools to support critical thinking • Participants developed lessons/projects that could be used as models • Participants developed curriculum unit that integrate technology to promote critical thinking • Participants used Bloom's taxonomy to develop lessons • Required co-development and implementation of lesson plans that integrate technology to promote critical thinking • Participants used specific lesson development tool (e.g. Taskstream) to design technology enriched lesson plans
I-3 Very Often Used	• Provided discussion and mentoring to help the development of learning activities. • Required participants to design technology enriched unit that integrate different content areas and promote the development of problem-solving skills. • Use guiding questions to guide the design of technology enriched lessons that focus on problem solving skills. • Required the development of lessons that emphasize cooperative learning leading to enhancement of problem solving skills • Participants used different software to support the development of project-based units
I-4 Very Often Used	• Required and guided participants to develop learner-centered lessons and activities using technology to meet curricular goals • Participants developed technology rich lessons integrating different content/subject areas • Participants developed webfolios • Participants developed web based lessons based upon inquiry-based strategies that provided individual or group activities • Required lesson plans to include webquests • Required participants to co-develop lessons integrating technology appropriate to grade level/subject • Trained participants to design activities focusing on problem-solving • Required participants to write lessons integrating technology after best practices were demonstrated, practice, and discussed • Required potential faculty participants to detail how they intend to incorporate technology and how it would enhance students understanding of appropriate technology integration

Description of the Most Used Strategies Used Across Indicators (continued)

Strategy 9: Appropriate (Lesson/Learning Activity) Development (continued)

Ind Code	Description of its Usage
I-6 Very Often Used	• Required participants to develop student-centered project-based lesson plans • Required the inclusion of the development of webfolios in their lesson plans • Participants developed webquest units and webpages addressing curriculum goals • Required participants to develop online and classroom learning materials • Participants developed lessons or learning activities that included online research and/or construction of presentations using technology • Participants developed technology enriched lessons with the help of experts on their subject • Required participants to develop e-portfolios and include it as part of their lesson plans
I-8 Very Often Used	• Required participants to design technology-enriched learning activities that addressed students individual needs • Participants developed on-line self-pacing materials that addressed students' needs • Provided examples that could be used to inspire the development of technology-enriched lesson • Required participants to develop an e-portfolio and include it as part of their lesson plans • Required participants to write mini-lessons about each module (e.g. desktop publishing, spreadsheets, multi-media, etc). In each mini-lesson, the student is required to describe a special population – such as sight-impaired, dyslexic, etc, and then to describe how technology can be used to help that student • Provided guidelines for the development of technology-enriched learning activities • Required participants developed project-based learning activities
I-14 Very Often Used	• Participants developed learning activities that required Internet research and critical analysis and review of information found • Participants developed units that integrate webfolio system • Required participants to develop problem-based learning activities in the form of webquests • Participants used Bloom's taxonomy to develop technology-enriched lessons • Participants designed lessons integrating electronic field trips • Enlisted experts in the subject area to help the development of technology enriched lesson plans

Description of the Most Used Strategies Used Across Indicators (continued)

Strategy 9: Appropriate (Lesson/Learning Activity) Development (continued)

Ind Code	Description of its Usage
I-20 Very Often Used	• Participants developed lesson plans that included virtual field trips • Participants developed learning activities that focus on webquest • Participants created their own course oriented web pages • Participants used Harris' activity structures to develop learning activities • Participants used Bloom's taxonomy to develop technology-enriched lessons
I-7 Often Used	• Required participants to develop technology enriched lesson plans, and online materials that support content specific curriculum goals • Participants developed webquest units and webpages addressing curriculum goals • Required participants to identify ISTE National Educational Technology Standards for Students and Teachers and develop lesson plans that would address them. • Required participants to include a technology standard in their syllabus that matches the academic the academic state and national standards • Required participants to develop units that integrate technology and meet curriculum, state, and national goals • Supported the design of activities that include both the technology and content standards • Required participants to develop an e-portfolio and include it as part of their lesson plans
I-18 Often Used	• Participants created a technology fair based on a motivational theme that provided activities that involved students in exploring both technology and how the technology supports curricular goals. • Supported the development of technology enriched lesson plans that considered students' learning objectives and students' motivation and interests, and adjust to the special interest of students. • The Participants created webpages that addressed learning needs • Encouraged the development of lesson plans that focused on the use of content-based technology that support students creative work • Required participants to co-develop technology-enriched lessons

Description of the Most Used Strategies Used Across Indicators (continued)

Strategy 9: Appropriate (Lesson/Learning Activity) Development (continued)

Ind Code	Description of its Usage
I-1 Occasionally Used	• Participants designed curriculum units that integrate technology in the different content/subject areas • Participants designed lessons, webquest, and webpages to further implementation in their classrooms • Participants developed curriculum unit that integrate technology • Required participants to complete a set of assignments to demonstrate their understanding of appropriate and inappropriate use of technology • Taught participants how to develop technology-infused lesson plans that were grade specific
I-12 Occasionally Used	• Required participants to develop problem-based learning activities in the form of webquests • Grouped participants according to their subject area and supported the creation of content-based technology enriched units that addressed authentic problem solving skills
I-15 Occasionally Used	• Required the development of technology-enriched lesson plans • Participants developed lesson plans that required students to research their culture via Internet seeking databases throughout the country • Required participants to develop learning activities within their content areas
I-19 Occasionally Used	• Participants developed learner-centered lessons • Participants included webquests as part of their lesson plan activities • Participants used Bloom's taxonomy to develop technology-enriched lessons • Participants were required to integrate technology into their syllabi • Participants developed technology enriched lessons that focused on inquiry-based learning resulting in the creation of digital products
I-22 Occasionally Used	• Participants developed activities that used specific content related software to support learning goals • Participants developed technology-enriched lesson plans to address their content area • Participants developed web sites to support curriculum goals
I-23 Occasionally Used	• Used Inspiration to guide participants to develop technology-enriched learning activities • Participants developed webfolios and were asked to design lessons that incorporate the use of webfolios
I-25 Occasionally Used	• Participants selected technology based activities to integrate in their lesson plans

Description of the Most Used Strategies Used Across Indicators (continued)

Strategy 6: Presentation/Demo/Hands on

Ind Code	Description of its Usage
I-15 Often Used	• Presentation and review of available software and hardware. • Group workshop on the use of specific technology and its application to the classroom settings • Required participants to complete technology driven program
I-19 Often Used	• Specific training on evaluation strategies • Group workshops with experts in the area
I-22 Often Used	• Group workshops with experts in the area • Presentation of technology tools and hands-on training on their use • Training in content-specific instructional technology tools • Provided skills development workshops
I-1 Occasionally Used	• Group workshops with experts in the area • Presentation and review of available software and hardware. • Trained participants to use content-based software • On-site training sessions • Engaged participants in activities and projects related to appropriate integration of technology into instructional units • Invited outside guest speakers as part of the training • Summer workshops • Required participants to complete technology driven program • Provided specific training to participants on instructional technologies that they chose as relevant to their teaching area • Taught participants on different levels of technology integration: Low (fundamental use of an application), middle (application of technology to teaching, e.g. Powerpoint presentations) and high (building webquests).
I-2 Occasionally Used	• Group workshops demonstrating technology that supported critical thinking • Conduct workshops on the use of communication technologies that enhanced distance learning opportunities • Group workshops on specific theme with experts in the area. • Presentation and review of available software and hardware • Taught technology skills as lessons • Sessions on the use of webquest to promote critical thinking • Introduction to content-related software and learning activities

Description of the Most Used Strategies Used Across Indicators (continued)

Strategy 6: Presentation/Demo/Hands on (continued)

Ind Code	Description of its Usage
I-23 Occasionally Used	• Group workshops with experts in the area • Presentation and review of available software and hardware • Taught the use of PDAs in the classroom • Training in specific software applications: web authoring software, video editing, and concept map. • Adopted a learner-centered approach to the hands-on sessions on instructional technology tools
I-24 Occasionally Used	• Training on spreadsheet • Group workshop on content-specific software • Content specific workshops • Required participants to complete technology driven program
I-25 Occasionally Used	• Group workshops with experts in the area • Offered workshops sessions on specific technology-content related topics, e.g,, Intro to Palm Pilots, Powerpoint, How to Create a Website..
I-26 Occasionally Used	• Group workshops with experts in the area

Description of the Most Used Strategies Used Across Indicators (continued)

Strategy 1: Identifying/Defining Appropriate Use of IT

Ind Code	Description of its Usage
I-1 Very Often Used	• Offered guidelines on appropriate use of technology, based on instructional objectives and students' developmental stages. • Workshop on plagiarism, ethics and appropriate use of Internet. • Discussion on the use of technology as a tool to enhance learning. • Explicitly instruction in how to select appropriate software according to content and grade levels. • Required participants to critically assess the use of technology and its purpose on a unit. • Required participants to describe the how and why a technology would be used when developing lesson plans. • Development of an inquiry project in which participants elaborate their own questions regarding appropriate technology use.
I-2 Very Often Used	• Instructional technology as a topic in methods courses. • Lecture on effective use of technology. • Guidelines that lead participants to an active role in their teaching. • Group discussion on the use of technology to support critical thinking. • Development of web site with participants' work that included technology to support critical thinking. • Training on how to model the use of technology for critical thinking • Focus on communication-based technologies to promote reflection and critical thinking.
I-13 Occasionally Used	• Workshop sessions on appropriate/effective use of technology in teaching • Workshop sessions addressing equity issues • Promoted discussions about equity related articles as Digital Divide
I-14 Occasionally Used	• Workshop sessions on appropriate/effective use of technology in teaching • Provided guidelines to the development of learner-centered technology enriched lesson plans • Workshop sessions addressing equity issues • Required participants to select technology-enriched activities that would support learning and justify their choices • Supported participants on integrating the skills they acquired during the professional development and integrate it on their content area respecting their own pedagogical believes

Description of the Most Used Strategies Used Across Indicators (continued)

Strategy 1: Identifying/Defining Appropriate Use of IT (continued)

Ind Code	Description of its Usage
I-15 Occasionally Used	• Workshop sessions on appropriate/effective use of technology in teaching • Supported participants on integrating the skills they acquired during the professional development and integrate it on their content area respecting their own pedagogical believes • Promoted discussions about digital equity
I-16 Occasionally Used	• Guided participants in identifying appropriate/effective use of technology • Promoted discussions about digital equity • Shared web resources with participants and guided them on evaluating and identifying appropriate use of technology
I-17 Occasionally Used	• Workshop sessions on appropriate/effective use of technology in teaching • Presented methods in which collaboration could be facilitated through the use of technology • Workshop sessions on pedagogical use of technology • Supported participants on integrating the skills they acquired during the professional development and integrate it on their content area respecting their own pedagogical believes • Guided participants on selecting and developing technology enriched activities for a certain content area and grade level
I-21 Occasionally Used	• Workshop sessions on appropriate/effective use of technology in teaching • Participants were instructed on how to appropriately use web resources in instruction • Modules on computer ethics & copyright issues
I-22 Occasionally Used	• Workshop sessions on appropriate/effective use of technology in teaching • Guided the use of specific software across subject and discipline area • Explored the different uses of specific software applications (e.g. Inspiration) in helping appropriate lesson development • Participants learned to use the tools and effective ways in which they might be used to support learning • Participants were instructed on how to appropriately use web resources in instruction • Exposed participants to different kinds of instructional technologies and their different uses in the educational setting • Supported participants selecting content related software that would best facilitate learning
I-23 Occasionally Used	• Workshop sessions on appropriate/effective use of technology in teaching • Guided the use of specific software across subject and discipline area • Participants were required to identify appropriate materials that would promote independent learning • Exposed participants to different kinds of instructional technologies and their different uses in the educational setting

Description of the Most Used Strategies Used Across Indicators (continued)

Strategy 3: Evaluation/Critique/Assessment

Ind Code	Description of its Usage
I-1 Often Used	• Participants' lesson plans were evaluated by peers, mentors, and program coordinators on the appropriate use of technology. • Participants reviewed lesson samples by evaluating its efficiency after its implementation. • Required participants to critique each other lesson plans and explore solutions as a group. • Participants reviewed websites, and educational software. • Required participants to write a reflection on how and why of using a technology as part of a lesson or project. • Promoted followed-up discussions on the effectiveness of the chosen technology.
I-2 Often Used	• Required participants to self-analyze the use of IT to promote critical thinking in a lesson plan • Required participants to share the lessons learned and group critique on ways to better promote critical thinking • Provided feedback on lesson development • Required participants to reflect on results of lesson implementation
I-5 Often Used	• Participants lessons were evaluated on how they addressed standards • Required participants to self-analyze the integration of technology in their lesson plans and write a reflection about the lesson after it was taught • Participants analyzed samples of technology-enriched lesson plans and pre/post test to assess the effectiveness of the unit • Required participants to reflect on results of technology enriched lesson implementation and how they could improve it • Participants learned how to use portfolios as part of learning assessment • Guided participants to align assessment within the goal of the lesson and the technology standards • Required participants to field test the lessons • Faculty participants were encouraged to create case studies for teaching and to help students assess their practice • Participants lesson plans were assessed before they were accepted to the program, suggestions were given during the program for the improvement of the integration of technology in the lesson plan

Description of the Most Used Strategies Used Across Indicators (continued)

Strategy 3: Evaluation/Critique/Assessment (continued)

Ind Code	Description of its Usage
I-9 Often Used	• Participants lessons were evaluated on how they addressed standards • Discussed in workshops the importance of evaluating the process as well as the products during instructional time with technology • Required participants to design and develop a webfolio assessment system that allowed for multiple measurement options • Integrated a matrix to evaluate lesson plans for assessing multiple learning and teaching strategies based on Gardner's theory and others mainly Vygotsky • Required participants to generate a teaching webfolio to demonstrate their learning. The webfolio are jointly reviewed by the programs experts
I-24 Often Used	• Required participants to self-analyze the integration of technology in their lesson plans and write a reflection about the lesson after it was taught • Required participants to design and develop a webfolio assessment system that allowed for multiple measurement options • Made available to participants online quiz and report generators that tested participants' students progress and provided report to participants • Participants used specific software (e.g. Excel, SPSS) to collect, interpret data from eight schools and evaluate which school was a best match for them • Used Profiler tool to measure participants' technology development

Description of the Most Used Strategies Used Across Indicators (continued)

Strategy 3: Evaluation/Critique/Assessment (continued)

Ind Code	Description of its Usage
I-3 Occasionally Used	• Required participants to self-analyze the integration of technology in their lesson plans and write a reflection about the lesson after it was taught • Participants lesson plans were assessed before they were accepted to the program, suggestions were given during the program for the improvement of the integration of technology in the lesson plan • Participants analyzed samples of technology-enriched lesson plans and pre/post test to assess the effectiveness of the unit • Experts reviewed technology enriched lessons developed by participants • Used iMovie as a reflection tool to document teaching performance then edit and record voice-over reflections
I-7 Occasionally Used	• Required participants to self-analyze the integration of technology in their lesson plans and write a reflection about the lesson after it was taught • Required participants to developed technology-enriched content units that contained state and national standards, including the NETS standards. Participants were evaluated on how well these standards matched their activated and objectives • Participants reviewed and evaluated web resources that connected to state and content standards • Required participants to design and develop a webfolio assessment system that allowed for multiple measurement options • Participants technology integrated lessons were evaluated by peers and program coordinators
I-8 Occasionally Used	• Required participants to self-analyze the integration of technology in their lesson plans and write a reflection about the lesson after it was taught • Interns had to show how they differentiated instruction to meet the needs of all of their students. Interns also had to shadow a student for one day to see how differentiation occurred for that student. They had to write a paper describing the differentiation • Administered a pre survey to establish: level of training, content of training, platform, best dates for training. Training reflected the results of the survey • Participants used NETS as a framework to evaluate appropriate uses of technology to meet content and grade level.
I-19 Occasionally Used	• Required participants to self-analyze the integration of technology in their lesson plans and write a reflection about the lesson after it was taught • Participants technology integrated lessons were evaluated by peers and program coordinators • Participants analyzed web sites and software packages on the basis of promoting higher order thinking skills

Description of the Most Used Strategies Used Across Indicators (continued)

Strategy 14: Problem- Based Learning/ Project-Based Learning

Ind Code	Description of its Usage
I-20 Very Often Used	• Required participants to design and document web-based projects • Participants are exposed to webquests and include it in their lesson plans • Required participants to integrate web-based projects on their lesson plans • Participants designed questions that promoted critical thinking and guided the design of webquests and thinkquests
I-12 Often Used	• Required participants to develop content related projects (e.g. AIDS project) in which students do research online and use technology to share and report the results • Participants focused on the design of webquest related to the subject area • Required participants to complete online case-based problem solving exercises individually and then discuss and collaborate on their answers before moving to the next case • Encouraged and trained participants on the use of Thinkquest in the subject area
I-14 Occasionally Used	• Participants are exposed to webquests and include it in their lesson plans • Required participants to design project based activities and include in their lesson plans • Trained participants on Thinkquest and the development of digital storytelling projects • Required participants to conduct a case study on extended inquiry projects with the purpose of analyzing how extended inquiry projects are designed, developed and implemented
I-19 Occasionally Used	• Conducted workshops on the use and application of webquests in the subject area • Required participants to design project based activities and include in their lesson plans

Strategy 26: Lesson Implementation

Ind Code	Description of its Usage
I-25 Occasionally Used	• Required participants to field test their technology infused lesson plans testing their lesson plan in a real world setting • Required participants to teach their technology infused lesson plans.

APPENDIX O

DESCRIPTION OF THE OCCASIONALLY USED STRATEGIES ACROSS INDICATORS

Description of the Occasionally Used Strategies across Indicators

Strategy 5: Modeling

Ind Code	Description of its Usage
I-19 Occasionally Used	• Modeled a problem-centered approach to technology in the workshops • Workshop activities modeled a project based learning activities • Professional development modeled technology-enhanced, student-centered learning, problem-based learning, and cooperative learning principles and methods
I-25 Occasionally Used	• Modeled problem-centered learning strategies and constructivist practice during workshops • Participants who are professors are encouraged to serve as models on the integration of technology in the classroom to their students
I-26 Occasionally Used	• Modeled problem-centered learning strategies and constructivist practice during workshops • Participants who are professors are encouraged to serve as models on the integration of technology in the classroom to their students

Strategy 7: Examples

Ind Code	Description of its Usage
I-26 Occasionally Used	• Required participants to share their technology enriched lesson plans/activities with the other participants • As a follow-up to the training sessions, special sessions were scheduled for participants to share projects and ideas about how they were applying what they learned in the training sessions

Description of the Occasionally Used Strategies across Indicators (continued)

Strategy 8: Mentoring/Consultation

Ind Code	Description of its Usage
I-25 Often Used	• Participants were coached on appropriate/effective incorporation of technology in teaching • Mentor participants in-site guiding them on ways to better integrate technology in their subject area • Participants could individually discuss with their mentors the application of technology in their unit • Participants mentored the teachers from the schools they were placed on how to integrate technology in their classroom
I-15 Occasionally Used	• Participants were coached on appropriate/effective incorporation of technology in teaching • Technology consultants were available to work on one-one mentoring. • Placed an experienced classroom teacher working full time for the project, and serving as a consultant for teachers on the integration of technology into their classrooms • Provided a center that included a highly trained staff where participants could get individual help on the integration of technology into their units • Provided individual sessions to address issues of specific concern to the participants

Description of the Occasionally Used Strategies across Indicators (continued)

Strategy 19: Telecollaboration

Ind Code	Description of its Usage
I-21 Very Often Used	• Required participants to subscribe to professional discussion groups • Required participants to participate in online discussion forums and real time chats • Encouraged the use of e-mail to support learning activities • Participants used virtual field trips as part of their lesson activities • Participants developed activities that used video-conferencing • Participants elaborated learning activities in which their students collaborated with other school's students in a same project, through WebCt discussion and chat • Participants were grouped with overseas students to work together on distance education issues over the Internet • Participants from two districts (rural and one urban) collaborated on a community project. Participants from each district researched and created brochures and presentations to inform each other about their communities • Participants used e-pals when designing their learning activities • Encouraged the use of online collaborative learning projects • Required participants to use listservs for group discussion • Advocated Judi Harris' model and strategies for online collaboration
I-26 Often Used	• Encouraged the use of e-mail and instant messaging to support learning activities • Participants used e-pals when designing their learning activities • Participants were exposed to and developed activities that used video-conferencing • Participants teamed-worked with outside experts and other schools on thinkquest projects

Strategy 2: Exemplars/Models/Experts

Ind Code	Description of its Usage
	• This strategy did not have any indicator in which it was highly used, but this strategy was present in almost all the indicators in some degree

Description of the Occasionally Used Strategies across Indicators (continued)

Strategy 10: Referencing Standards

Ind Code	Description of its Usage
I-7 Very Often Used	• Participants designed performance assessment to measure standards for students' grade level and content area • Required participants to design projects involving integration of technology to address content, state, and national standards. • Required participants to identify and implement NETS standards when designing their lesson plans • Participants were exposed to many web resources that connected to NETS, state, and content standards • Participants were couched on addressing technology standards when designing learning activities on a subject area • Required participants to include a technology standard in their syllabus matching the academic, state, and national standards • Each workshop began with the discussion of the standards that might be addressed • Introduced participants to NETS, and supported their design activities to include both the technology and content standards • Required participants to create e-portfolios based on state and content standards • One of the goals of the project was to ensure that all participants were able to demonstrate mastery of the NETS standards and thus all the activities were related to the achievement of this goals • Participants developed rubrics that measured technology standards in the lesson plan
I-5 Often Used	• Required participants' lessons to be aligned with NETS. • Participants attended training sessions on NETS-S, state and content standards, and assessment methods • Training sessions on how to assess the uses of technology using NETS and LoTi (Levels of Technology Integration) • Required participants to review national technology standards and their application on the subject area • Participants developed rubrics to assess the use of technology to address NETS • Participants modeled their lesson from ISTE lessons which addressed NETS • Participants' achievements were measured and evaluated by the Profiler tool for National Education Technology Standards
I-1 Occasionally Used	• The project designed performance assessments to measure standards for students' grade level and content area • Required participants' lessons to be aligned with NETS. • Participants' lesson activities were linked to state and national technology standards for the appropriate age group • Participants developed sample lesson plans linking state standards with instructional technology applications • Required participants to develop a matrix correlating technology, content, and state proficiency standards
I-4 Occasionally Used	• Group discussion on the use of NETS • Required participants to review national technology standards and their application on the subject area • Offered training sessions on National Educational Standards for Students and Teachers and required participants to identify them as they developed their lessons and activities

Description of the Occasionally Used Strategies across Indicators (continued)

Strategy 11: Team Work/Group Discussion/Peer Discussion

Ind Code	Description of its Usage
	• This strategy did not have any indicator in which it was highly used, but this strategy was present in almost all the indicators in some degree

Strategy 18: Collaborative Learning

Ind Code	Description of its Usage
	• This strategy did not have any indicator in which it was highly used, but this strategy was present in almost all the indicators in some degree

K A R L A R . A S S I S , E d . D

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SUMMARY OF QUALIFICATIONS

- 9 years of teaching experience from which 4 years were in Brazil and 5 years were in the USA
- Strong love and commitment to teaching
- Particular strength in bridging cultural gaps among people through educational and interpersonal relations
- Teaching experience for all age groups. Experience in Teaching English as a Second/Foreign Language (TESOL/TEFL) and experience in guiding faculty members on the use of technology for instructional purpose

EDUCATION

2001–2004 ***West Virginia University*** ***U.S.A - Morgantown, WV***

- **Doctoral Degree - Ed.D, Technology Education – Minor : Instructional Technology**

Dissertation Topic:: Strategies for Sustainable Professional Development Programs to Promote Effective Pedagogical Use of Technology in Teaching

1998–2001 ***West Virginia University*** ***U.S.A - Morgantown, WV***

- **MA, Technology Education – Minor: Instructional Technology**

Thesis Topic: Fourth Grade Elementary Students' Perception of the Motivational Aspects of Using Computers to Write in the "Student as Authors" Project

1992–1995 ***Universidade Federal do Espirito Santo*** ***Brazil- Vitoria, ES***

- **B.A. English Language and Literature**.

PROFESSIONAL EXPERIENCE

2002–present ***Teaching and Learning Technologies Center*** ***U.S.A - Morgantown, WV***
West Virginia University

Teaching and Instructional Technology Support

- Developed a web page for West Virginia Partnership for Teacher Quality – WVPTQ
- Trained students and faculty at College of Human Resources and Education on how to use different instructional technologies
- Supported the creation of e-portfolios by College of Human Resoucers and Education students
- Acted as a technology resource person to faculty and students at the College of Human Resources and Education
- Conducted workshops and prepared the tutorials for a variety of software such as Inspiration, FrontPage, and DreamWeaver.
- Assisted in the teaching of the graduate course SPED 609 Computer Application in Special Education

June 2002–August 2002 ***Trek 21- Grant funded Project*** ***U.S.A - Morgantown, WV***

Educating Teachers as Agents of Technological Changes- West Virginia University

Teaching and Instructional Technology Support for K-12 teachers and Human Resources Education faculty members

- Presented examples of the integration of instructional technologies into teaching
- Demonstrated how to use such instructional technologies as voice e-mail, voice web board, and audio/video instructional tools
- Guided the development of units integrating instructional technologies by K-12 and faculty members participating in the project
- Guided the decision making process of the implementation of the instructional technologies into the particpants' lesson plans

1998– May 2002 ***Intensive English Program*** ***U.S.A - Morgantown, WV***

West Virginia University

Designer of a partial online course and Coordinator/Creator of the English as a Second Language Tutoring Program

- Designed and co-created the partial online course ESL 250 Listening and Speaking skills
- Created and coordinated the Tutoring Program
- Developed materials and trained teachers for the tutoring program

August 1997– November 1997 ***Central Elementary School*** ***U.S.A - Morgantown, WV***

Asssistant of Title I Reading Specialist

- Tutored English as a Second Language to elementary school students
- Used e-books and e-mailing to guide the reading and writing of English as a Second Language students
- Participated on the "Student as Authors" Project

August 1996– July 1997 ***Prefeitura Municipal de Vitoria*** ***Brazil - Vitoria, ES***

Coordinator of the Computer Lab

- Coordinated the computer lab activities
- Trained teachers and students on the development of basic computer skills
- Supported teachers to develop projects to integrate technology to their teaching

1994– July 1996 ***Point Language Services*** ***Brazil - Vitoria, ES***

English as a Foreign Language Teacher

- Taught English to children, adolescents, and adults using the communicative approach

INSTRUCTIONAL MATERIALS DEVELOPED

- Manual and instructional material resources for the Tutoring Program at West Virginia University
- Developed the online material for the ESL 250: Listening and Communication Skills course offered by the Department of Foreign Languages at West Virginia University
- Workshop materials used by K-12 educators and faculty at West Virginia University's College of Human Resources and Education on how to use software such as FrontPage, DreamWeaver, PowerPoint, Word, Inspiration, Audio Visual Tools, their related software, and develop instructional materials to be integrated as part of their classroom
- Tutorials to be used to instruct participants of the Instructional Technology Training Programs offered by the department of Human Resources and Education.

PRESENTATIONS

- Assis, K. R., Dingess, T., & Huntley, H. (April, 2002). *IEP Tutoring Fills the Gap*. Presentation at the International TESOL Convention. Salt Lake City, Utah.
- Assis, K. R., Dingess, T., & Huntley, H. (April, 2002). *ESL Speaking and Listening online?* Presentation at CALL Internet Village – Internet Fair at the International TESOL Convention. Salt Lake City, Utah.
- Assis, K. R. (2001). *Tutoring at an Intensive English Program*. Three Rivers TESOL. West Virginia, Morgantown.
- Presentations on the online course material of the ESL 250: Listening and Communication Skills course offered by the Department of Foreign Languages at West Virginia University.

PUBLICATIONS

Dissertation

Cezarino, K. R. A.(2004). Strategies for sustainable professional development programs to promote effective pedagogical use of technology in teaching. Unpublished doctoral dissertation, West Virginia University, West Virginia.

Thesis

Assis, K. R. (2001). Fourth grade elementary students' perception of the motivational aspects of using computers to write in the "Student as Authors" Project. Unpublished master's thesis, West Virginia University, West Virginia.

Published Article

Assis, K. R. (2001). Tutoring program at West Virginia University Intensive English Program. Three Rivers Tesol,10, 8.

LANGUAGES

Portuguese (native), English (fluent), Spanish (working knowledge)