# EFFECTIVE K-2 TEACHERS' USE OF TECHNOLOGY TO SUPPORT EMERGENT LITERACY

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We certify that we have read this dissertation and that, in our opinion, it is satisfactory in scope and quality as a dissertation for the degree of Doctor of Philosophy in Education.

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*He who began a good work in you will be faithful to complete it.*
*Phil. 1:6*

## ABSTRACT

This research is a qualitative multiple case study of the use of technology in two multi-grade K-1 and two multi-grade 1-2 private-school classrooms in Honolulu, Hawaii. It investigated how each teacher's pedagogical perspective affected the use of technology in the literacy curriculum, examined how the teachers implemented technology as well as the support system currently in place for such use, and evaluated the similarities and differences among the participants. The findings were based on interviews, document reviews, and classroom observations. Classrooms were chosen based on the teachers' fulfillment of Pressley's model of exemplary teachers.

The study found that the four teachers used technology to reinforce previously learned reading and writing skills throughout the school day. The teachers each allowed restricted, monitored Internet use to practice skills, and gather and share information. Digital photography was used to document classroom activities and as a means of illustrating narration. Each setting offered computer use during free-choice periods; however, teachers in multi-grades K-1 implemented less structured activities than those in multi-grades 1-2. Teachers adjusted technology use to the development of their students, indicating the importance of teachers' learning theories in decision-making. Technology use was strongly supported by administration through supplying access to current devices and programs, offering workshops, full-time support staff, and a community of colleagues who openly shared perspectives and appropriate lessons.

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# CHAPTER I

# INTRODUCTION

## *Problem Statement*

Anderson, Hiebert, Scott, and Wilkinson (1985) wrote that "reading is a basic life skill. It is the cornerstone for a child's success in school and, indeed, throughout life. Without the ability to read well, opportunities for personal fulfillment and job success inevitably will be lost" (p. 38). Educational research has never been as focused on reading instruction in the United States as it is today – by public or private institutions (Reutzel & Mitchell, 2003). Educators now understand that the years from birth through the age of eight are the most important for literacy development (Darling & Lee, 2003). This journey to determine the best reading method has been progressing for well over a century, and will hopefully continue as we uncover new strategies to help children learn.

It is the responsibility of the education profession and parents to ensure that children receive the best possible education we can offer. Valuing the way children learn must be the fulcrum of all pedagogical decisions. Although a quintessential reading program does not exist, there are excellent choices to draw upon. Having a broad understanding of expectations for students is the first step; being able to effectively reach and teach students is the next. One should not be concerned with the pedantics of reading instruction but should begin with the child, observe him, understand his strengths and weaknesses, and develop an individual program to meet his needs.

Those who are and are not associated with the field of education often postulate that technology is capable of solving the woes of the educational system. Roblyer (2003) eloquently sums up the situation by stating: "Simply having students use computers does

not raise achievement" (p. 11). It's how technology is used to support education that makes the difference. Alessi and Trollip (2001) agree with Howard Gardner's (1999) theory on multiple intelligences and suggest that, as with traditional instruction, the teaching of technology should adhere to the notion that "not all people learn alike or at the same rate. Similarly, some instructional methods are better for some learners than for others" (Alessi & Trollip, 2001, p. 30).

The push for the inclusion of technology to support literacy has been at the forefront of administration and Board of Education meetings for the past two decades. Teachers are mandated to include the use of technology in the classroom, but most have not been given the direction to understand either the technology, the rationale for its use, or the ways to effectively implement it to meet the needs of their students. Hundreds of studies are published that speak of the current uses of technology, teachers' perceptions, and the pitfalls and celebrations of specific programs. However, a study examining how *effective* kindergarten-through-grade-2 private-school teachers in Hawaii utilize technology to support emergent literacy in the early childhood setting has yet to be completed.

**Purpose of Study**

Implementing technology in the classroom for the sake of using technology does not fit best practices in reading, early childhood education, or technology. Morrow, Barnhart, and Rooyakkers (2002) state that "computer technology is effective when it is used to supplement, not supplant, the teacher" (p. 218). The purpose of this study is to examine effective teachers' use of technology to support emergent literacy in four early childhood (K – 2) settings.

I believe that the observation of exemplary practices in these classrooms will further allow the sharing of critical, useful, and pertinent information with teachers who would like to implement or enhance the use of technology in their classrooms.

***Research Questions***

This study addresses the following research questions:

1. How do effective K-2 teachers' pedagogical perspectives of reading acquisition influence their use of technology in the literacy curriculum?
2. How do effective K-2 teachers use technology to support emergent literacy? How is this technology use supported?
3. What are the similarities and differences in technology use among teachers in the study?

# CHAPTER II

# LITERATURE REVIEW

The literature review includes best practices in language-arts instruction in the early childhood setting (grades K-3). This section focuses on the interdependency of reading and writing; multiple daily read-alouds; purposeful reading and writing; standards of success; firm foundations and scaffolding of skills; assessment; sufficient time to read and write; home support; and teachers' background.

Next, the uses of technology to support reading acquisition are reviewed by relating the perspectives of learning theories - behaviorist, information processing, developmental, and cognitivist - to the use of technology. Additionally, the theoretical framework for this study is discussed, and the section concludes with current uses of technology to support reading acquisition.

## ***Best Practices In Language Arts Instruction In The Early Childhood Setting (K-3)***

After reviewing the research on best practices in early childhood emergent literacy, and without discussing the idiosyncrasies of instructional techniques, in which teachers can match instructional practices with the needs of their students, I contend that an exemplary, inclusive, skilled reading program should comprise:

1. the concept that reading and writing are interdependent;
2. multiple daily read-alouds;
3. abundant opportunities to read and write purposefully;
4. high standards of success for all students;
5. a firm foundation – matching practices to students' needs;
6. frequent and valid assessment;

7. sufficient time to read and write;
8. inclusion of home support; and
9. highly trained, motivated, and committed teachers with a strong pedagogical background.

Pressley, Allington, Wharton-McDonald, Block, Mandel and Morrow conducted a study to determine characteristics of exemplary first-grade teachers. The participants in their study were selected by 50 reading supervisors around the nation. Each supervisor was a member of the International Reading Association, and was asked to nominate "one first-grade teacher in their district who was most effective in educating a large proportion of his or her students to be readers and writers" (Pressley et al., 2001, p. 35). Each of the participants was found to display many of the above characteristics.

***The Interdependency of Reading and Writing***

Although reading was once viewed as a prerequisite for writing, educators now understand that the relationship between the two is actually complementary and reciprocal (Rosenblatt, 1989; Tierney, 1992). Lipson and Wixson (1997) suggest that reading and writing are actually two facets of the same process, and that they emerge simultaneously in terms of literacy development. Therefore, as the skills are interdependent, they should be concurrently taught. The basic idea of decoding is the understanding of how to break down words into their individual sound units, or phonemes, and then blend phonemes together to form a word. Reading, however, is much more complicated than the basic idea of decoding and blending, just as writing is more complex than segmenting and graphically representing sounds on paper. Gee (2001) believed that:

> reading and writing cannot be separated from speaking, listening, and interacting on one hand, or using language to think about and act on the world on the other. Thus, it is necessary to start with a viewpoint on language (oral and written) itself, a viewpoint that ties language to embodied experience, and situated action in the material and social world (p. 714).

Best practice in reading research tells us that there are five essential components of effective reading instruction: phonemic awareness, phonics, vocabulary, fluency, and comprehension (Drake, 2001; Pressley et al., 2001; Slaughter, 1988). Theoretically, in order to meet the needs of students, each component must be included in instruction. Professionally, the No Child Left Behind Act, signed by President George W. Bush on January 8, 2002, made it a requirement that each of these components be addressed.

When considering or developing an excellent language-arts curriculum, educators must also consider factors that lead to excellent writing as well. Therefore, in addition to the five essential components of effective reading instruction, educators should also include word identification, rate and fluency, and spelling, as well as grammar usage and mechanics. The utilization of each skill can be taught and assessed in various ways. Former teacher and author Vicki Spandel developed the organizational philosophy behind the 6-Traits of writing. Ms. Spandel (2001) speaks of the 6-Traits as a way for children to have six chances to do well through teacher, personal, and peer assessment. The various modes of measuring success in writing are ideas, organization, voice, word choice, sentence fluency, and conventions.

***Multiple Daily Teacher Read-Alouds***

Reading aloud should not only be a part of every classroom, but should take place throughout the day – regardless of a student's age. The landmark study *Becoming a Nation of Readers* concluded that "the single most important activity for building the knowledge required for eventual success in reading is reading aloud to children" (Anderson, Hiebert, Scott, & Wilkinson, 1985, p. 23).

Reading aloud has been shown to increase not only the interest children have for print, but vocabulary recognition as well. The Brett, Rothlein, and Hurley (1996) study stated that students who were exposed to vocabulary words, along with their definitions during reading, were better able to recall the same words six weeks after hearing the story than their peers who were exposed to the same vocabulary but not assisted with definitions.

Trelease (2001) wrote:

> Consider the word "enormous." If a child has never *heard* the word "enormous," he's unlikely ever to *say* the word. And if he's neither *heard* nor *said* it, imagine the difficulty when it's time to *read* it and *write* it. The listening vocabulary is the reservoir of words that feeds the speaking vocabulary, the reading vocabulary and the writing vocabulary – *all at the same time*" (p. 8-9).

Kerwin (1994) wrote in a report for the Hawaii Association of Independent Schools that in addition to building vocabulary, "reading aloud to children is highly correlated with a child's language development, ability to become an early reader, success in school, academic readiness, later achievement in reading, increased

competency in reading comprehension, and improved reading performance" (p. 15). Additionally, reading aloud exposes children to text they would not have access to with independent reading, exposes them to grammar usage (especially valuable for ESL students), provides the opportunity to enrich mandated curriculum with beautiful text, and models a love of reading.

***Abundant Opportunities to Read and Write Purposefully***

Teale and Martinez (1989) wrote that the audience and purpose of reading and writing are especially important in the social aspects of the skills. "Long after the initial fascination with making marks on the page has worn off, the reason for this continuing motivation is that they see it . . . as a vehicle leading to new social goals" (p. 183).

Vygotsky (1978) and Piaget (1950) believed that we learn first socially and then psychologically; meaning is constructed by learning in a social setting and then transferred to a psychological level where it can be internalized. To the educator, this means that we must promote a classroom environment that not only allows, but also encourages, the social interactions among students to assist children in internalizing knowledge gained through their experiences with their peers.

> Language and literacy acquisition in particular may be impeded when the social organization of teaching and learning ignores these differences, and fails to provide opportunities and activities that permit students to integrate and build upon the culture, cognitive patterns, and skills they bring to the classroom (Olneck, 1995, p. 317).

Purposefulness in scholastic activities through social interactions was nourished heavily by whole language proponents, who encouraged students to take ownership of

their learning (Goodman, 2003). Through teacher direction, ownership is believed to be central to motivating children to be accountable for their learning, as well as to promote a desire for deeper exploration of literacy (Au, Carroll, & Scheu, 2001; Valencia, Au, Scheu, & Kawakami, 1990). The concept of ownership goes beyond the skills needed to read. Ownership "involves looking at the affective as well as the cognitive dimensions of students' literacy development" (Valencia, Au, Scheu, & Kawakami, 1990, p. 154).

Kathryn Au, et. al (2001), in *Balanced Literacy Instruction*, offers the suggestion of employing readers' and writers' workshops. She explains that the function of the workshop is to provide a block of time, usually between 1½ to 2 hours long, in which students:

- read (independently, with partners, with stories on computer, with book/audiotape packages),
- listen and share (teacher read-alouds, book talks by the teacher and other students),
- respond (in writing and drawing, through discussion), and
- participate in instruction (through mini-lessons, shared reading, and small group lessons).

Au and her colleagues further explain that the amount of time needed for independent reading will depend on the child's reading level. More advanced readers will be able to draw upon their independent reading to gather information and will be reading longer passages, while less capable readers will require more time in small group settings to develop skills needed for reading. The small group setting is especially helpful as it allows students to learn from each other as well as the teacher, to practice

skills, and to receive immediate feedback. It also honors the need for social interactions. This mode of instruction strongly follows the constructivist theory that cognition is an outcome of social processes.

***High Standards Of Success For All Students***

Setting and maintaining national, state, school, and classroom standards in education is not the means to an end, it is the springboard from which to work. Vygotsky's construct of the zone of proximal development can aid teachers determining a child's level on various learning tasks. His theory examines the difference between a child's capacity to solve problems independently and with instruction (Webb & Palincsar, 1996). The zone of proximal development, then, is the level between assisted and unassisted learning, and is where instruction should take place. Vygotsky (1978) described the zone of proximal development as follows:

"The distance between the [child's] actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p.86)

The implications for teaching are to begin with a clear understanding of student abilities through valid assessment to determine the appropriate level of instruction. Once this has been done, expectations can be set. When given the opportunity and proper guidance, young children are able to set and maintain goals. The setting of personal goals will further allow the children to accept responsibility for their own learning.

***A Firm Foundation – Matching Practices to Students' Needs***

Matching instructional practices with student's needs should remain at the forefront of each lesson. Piaget (1950) and Vygotsky (1978) both conceptualized the theory of developmentally appropriate practice long before it became the buzz phrase in early childhood education. Vygotsky believed that we must understand both the instructional and independent levels of a child's development if we wish to fully be able to encourage the student to reach their potential. Katz (1995) states, "In a developmental approach to curriculum design . . . what should be learned and how it would best be learned depend on what we know of the learner's developmental status and our understanding of the relationships between early experience and subsequent development" (p. 109). NAEYC (National Association for the Education of Young Children) believes that "developmentally appropriate practice is based on knowledge about how children develop and learn" (NAEYC, 1997, p. 5). Therefore, understanding a child's individual instructional and independent work levels is related to their cognitive development – it is knowing what information and when to introduce it to the student that makes it appropriate.

After assessments have been conducted (to be discussed later), and the teacher has a clear understanding of her students' strengths and weaknesses, instructional plans must be developed for the needs of each student – not just those who are struggling. Developing goals and steps with which to enable a child to attain those goals is the key to ensuring that all students reach their potential.

> Every response, whether it be an act directed towards the outside world or an act internalized as thought, takes the form of an adaptation or, better, of a re-

> adaptation. The individual acts only if he experiences a need, i.e., if the equilibrium between the environment and the organism is momentarily upset, and action tends to re-establish the equilibrium, i.e., to re-adapt the organism (Piaget, 1950, p. 4).

In other words – start with what she is already familiar with, and express the need to get to another level. Before she sees the need to go further with her learning, she will be stifled. Helping her create the feeling or internal desire to reach her goal will further encourage her to value the process and the accomplishment of achieving her goals.

Repetitious drills are not the answer to developing accomplished readers. Ellin Keene (1997), co-author of *Mosaic of Thought*, discusses the importance of moving students from passive reading to an active stance. The overuse of disconnected skill drills will develop students who might be able to correctly answer comprehension questions at the end of abridged stories, but will not empower them to deeply understand the author's message and intent. Time discussing stories with other students will. Howard Gardner (1999) warns educators to remember that our goal is not to produce students who can recall individual skills, but students who can use the skills they have been taught to solve problems.

This is not to say that skills instruction should be eliminated from the curriculum. The specific phonemic awareness skills of blending, segmenting, and phoneme manipulation are imperative to building the early reading foundation, as are phonics instruction starting from learning simple words where each phoneme is represented by one letter, gradually moving on to reading and writing adjacent consonants, and finally, the introduction of multiple letters representing individual phonemes and multi-syllable

management of words (McGuinness, McGuinness, & McGuinness, 1996). Dorothy Strickland (1994-1995) advised:

> *Don't waste time debating whether or not to teach phonics, spelling, grammar, and other "skills" of literacy.* Obviously, young children cannot read or write without encountering the use of phonics, grammar, spelling, and other conventions of written language. Do spend time discussing how to teach them in a way that contributes to the learners' self-improvement (p. 299; italics in original).

Furthermore, the National Association for the Education of Young Children wrote in their position statement on developmentally appropriate practices, "[h]eated debates have broken out about whether children in the early grades should receive whole language or phonics instruction, when, in fact, the two approaches are quite compatible and most effective in combination" (NAEYC, 1997 , p. 15).

***Frequent And Valid Assessment***

Educators often confuse assessment with evaluation. "Assessment is diagnostic and formative. Evaluation . . . is a summation and used upon completion of instruction" (Cobb, 2003, p. 386). Assessment and instruction have a reciprocal relationship in which one informs the other. Excellent instruction must begin with assessment – not evaluation. Assessment should drive instruction and should not be carried out unless it is purposeful. Purposeful assessment will provide the student and teacher with a specific understanding of the student's strengths and weaknesses as well as a starting point for instruction.

Norm-referenced testing is not the best means for understanding a student's abilities. Many educators, including myself, find them to be a waste of time, energy, and

opportunity. Slaughter (1993) wrote, "The importance of the score relates to the validity and importance of the items on the test, and whether or not the method of testing is itself fair and provides reliable information" (p. 4).

To get an accurate depiction of a child's reading ability, Ken Goodman (2003) suggested conducting a Miscue Analysis in which words read incorrectly are noted, and later analyzed, to inform the teacher of instructional needs. Goodman defined a miscue as "any observed oral response (OR) to print that does not match the expected response (ER). Miscue analysis reveals the reader's strengths and weaknesses and provides a continuous window on the reading process" (2003, p. 125). Goodman's analysis would specifically provide the teacher information about the types of reading errors, whether they were omissions or additions, as well as the amount of time needed to complete the reading.

To expand on Goodman's Miscue Analysis, attaching a comprehension section to the end of the reading with various levels of thinking could later translate to small and individual group instruction. Assessment should not only inform the teachers, but the students as well. Vicki Spandel (2001) wrote:

> The key to good assessment that communicates to young readers is observing signs of growth and change – not putting numbers on their performance. For younger students, describe what you see, as clearly as you can, using language that makes sense to them, but do not worry about whether it's a 2 or 3 or 4 – or for that matter an A, B, C or an E or N. Numbers are most effectively used with students who can begin to understand the meaning behind those numbers (p. 324).

Finally, the relationships among instruction, curriculum, and assessment are both interdependent and reciprocal (Cobb, 2003). They each inform and drive the others. You cannot have any of these components without the others, as they each ask and answer different questions about what is being learned. When one aspect of the three is missing, educators no longer have a clear understanding of the child's progress. When assessment is meaningful and relevant, it will drive instruction and serve as a worthwhile tool to understand the needs of students.

***Sufficient Time To Read And Write***

Students must be provided with sufficient time to read and write. The Center for the Improvement of Early Reading Achievement found that primary "teachers in the most effective schools spent 134 minutes a day on reading instruction (including small- and whole-group reading instruction, independent seatwork, independent reading and writing in response to reading)" (Taylor, Pearson, Clark, & Walpole, 1999, p. 158). They also found that students in higher achieving schools, on average, spent 22 more minutes per day in small groups (60 minutes for the most effective and 38 minutes for the least) and nine minutes more each day reading independently (28 minutes for the most effective and 19 minutes for the least), when compared with least effective schools. Furthermore, the center found that "teachers in the most effective schools mentioned time for students to read authentic texts as a factor contributing to their success" (Taylor, Pearson, Clark, & Walpole, 1999, p. 157). The key here is the fact that the students in these schools were reading authentic text and not busying themselves with detached worksheets.

Anderson's (1985) position is that "reading is a continuously developing skill – it is not something that is mastered once and for all at a certain age. It is a skill that

continues to improve through practice" (p. 17). Therefore, students need to have sufficient time to read and reflect on their own writing. Once guidelines are implemented and standards are set, students will need time to review their own writing in order to improve (Spandel, 2001).

***Inclusion Of Home Support***

Regie Routman (2000) advises teachers to "assume that all parents want the very best education for their children, and keep communication open" (p. 553). She continues to share that, at times, a parent's lack of participation is due to feelings of helplessness and inadequacy or worry about receiving bad news – not because of a disconnection from the child or the child's academic progress.

Darling and Lee (2003) discussed the direct correlation between a child's success in reading to his parent's educational level, stating that parents who had more education were generally better able to assist their child in reading. Regardless of academic or socio-economic backgrounds, holding multiple workshops during the day as well as at night empowers parents with tools needed to support their child. Often the reason some families are not able to attend is simply due to their work schedule or availability of child-care. Therefore, providing ample notice of upcoming events, offering multiple workshops, and videotaping the sessions (so that those not in attendance are able to check them out) help support families.

In addition to workshops, keeping families informed through various subscriptions such as the monthly *Home-School-Connection* in which tips are offered to help parents with their children's academic growth, weekly newsletters, phone calls, and occasional notes will make communication during challenging times easier.

Home support is crucial to the overall scholastic development of a child, regardless of socio-economic background. Understanding and respecting a family's individual situation that keeps parents from participating in school activities is the first step to building a working team. Allowing an open door and being available to talk with parents is what keeps the team together.

***Highly Trained, Motivated, and Committed Teachers***

Understanding the complex relationship between the teacher and learner is critical to the learning environment. "Teachers' expectations play an integral role in influencing students' expectations for themselves and their subsequent achievement" (Bailey et al., 1996, p. 21). Bailey (1996) believes that the relationship between the teacher and learner is so critical to the learning environment, it is more important than methodology. Furthermore, Goodman (1986) stated that "the teacher is the difference between whether some pupils will become fully literate or all will" (p. 80).

Enthusiastic teachers are an important aspect of a classroom climate; however teachers can be highly motivating and have access to the latest curriculum and technology, but without a clear understanding of their goals for their students and a strong pedagogical background in reading, limitations for success will exist. Lessons can be fun and exciting but fragmented and meaningless at the same time.

A position statement by the International Reading Association described excellent reading teachers as having internalized the understanding that "reading development begins well before children enter school and continues throughout a child's school career" (Au et al., 2000, p. 237). Teachers in successful schools were found to be articulate and knowledgeable about their curricula (Mosenthal, Lipson, Torncello, Russ,

& Mekkelsen, 2004). Before a teacher steps into the classroom, she must fully understand the reading expectations, and be able to instruct students two years above and below her students' grade level, as she will most likely have students in her classroom who fall into this spectrum. Based on current knowledge of reading acquisition, "it is incorrect to suppose that there is a simple or single step which, if taken correctly, will immediately allow a child to read" (Anderson, Hiebert, Scott, & Wilkinson, 1985, p. 4). Teachers must continually search for current available resources, programs, and techniques to support the multiple learning styles and needs of their students. "Excellent reading teachers are constantly observing children as they go about their daily work" (Au et al., 2000, p. 237). They are keen to recognize opportunities to encourage students with additional instruction or time to come to an independent understanding. They notice when group or individual instruction will work best, as well as when to offer additional resources – and then match these resources with the student's learning style.

***Uses Of Technology To Support Reading Acquisition***

Since the introduction of the microcomputer into the public school system in the mid-1980s, billions of dollars have been allocated to bringing technology to students across the United States with the promise of increasing student achievement. But has this promise been fulfilled? Studies are claiming that the use of technology is producing scholastic gains in the classroom; however, the lack of quality studies on how technology impacts education is apparent (Kirkpatrick & Cuban, 1998; McKenzie, 1999; Mokhiber & Weissman, 2000; Roblyer, 2003). Additionally, Mokhiber and Weissman (2000) feel that the cost of technology is taking funds away from "field trips in nature, music, the arts, library books, and time for play at recess and could be better spent on proven

strategies, teacher salaries, and early intervention services for families with young children" (p. 2).

The study released by The National Center for Education Statistics (NCES) on February 24, 2005, from their 2002-2003 surveys stated that although 82 percent of the public schools indicated that they offered training to their teachers on the use of the Internet, only 1 to 25 percent of the teachers in those schools attended such training (Parsad & Jones, 2005, p. 14).

Seymore Papert (1992), former MIT professor, colleague of Piaget, creator of LOGO, and technology guru, believes that the use of technology in the classroom has the potential to level the ability to disseminate information throughout classrooms -- regardless of the economic background -- as everyone will have the same information available to them. However, the technology itself -- the speed of the processors, the number of children able to activate the site simultaneously, and the amount of add-ons (SMARTBoards™, LCD projectors, T-lines, servers) will continue to depend upon funding. Those with more funds are allowed to purchase more technology to allow more children access to the information. "Without enough of the right equipment or the right training, technology's leverage is lost" (Gordon, 2002, p. 5). So, no, Papert's idea of equalizing education will not be realized under the current system. The potential is there; however, so too is the economic reality. This access to technology later became known as the Digital Divide, and will be subsequently discussed in this paper.

***Current Learning Theories and Technology Instruction***

Understanding current learning theories and technology instruction is imperative to successfully plan and implement quality curriculum. Theories and practice should be

matched to specific learners in order to best meet the needs of learners. The following section will first discuss the behaviorist theory, information processing, and constructivist theory. Then, current views of technology in the classroom, current classroom uses, the digital divide, early childhood practice, and specific types of technology will be discussed.

**Behaviorist Theory**

The behaviorist theory foundation is focused on learning objectives and operant conditioning through reinforcement of desired behavior. Sociology professor at the University of Albany, Dr. Richard H. Hall wrote, "[t]he first basic characteristic of behaviorism is that behaviorists emphasize the importance of empirical, observable behaviors" (2001, p. 2).

Russian psychologist, Ivan Pavlov (1849-1936), led the way of the behaviorist approach with classical conditioning. Classical conditioning is the theory that behavior can be augmented by pairing a stimulus with conditioning to elicit a desired response (Graham, 2007). Pavlov's work with dogs began through an understanding of the digestive system and salivary glands. Pavlov found that dogs, after repeated exposure to a stimulus (ringing a bell prior to serving food), could produce an anticipatory response (salivation). Pavlov believed this response to be reflexive and involuntary.

Current perspective believes Pavlov's work to be rudimentary, yet an imperative springboard to understanding voluntary response. American psychologist Edward Thorndike (1874-1949) worked not with dogs but cats to gain insight, and developed the concept of operant conditioning. Operant conditioning is the theory that purports consequences, whether positive or negative, modifying the occurrence and form of

behavior (Graham, 2007). This differs from Pavlov's conditioning as it deals with the voluntary response due to consequences, while the Pavlovian theory deals with conditioning behavior.

B.F. Skinner built his understanding on Thorndike's work and used the terms *experimental psychology and behavior modification.* Skinner believed that operant conditioning and behavior modification should be used for the betterment of society. Furthermore, Skinner considered the term *behavior* to be etymologic in nature. Skinner wrote, "Every scientific field broadens and changes" (1997, p. 1012). Skinner further believed that these changes should not to be seen as a dissent from the theory, but a broadening or fine-tuning of what is already known.

Utilizing the behaviorist theory in technology is most similar to traditional teaching practice in which the teacher is the fulcrum and information is *delivered* to students (Jonassen, Howland, Moore, & Marra, 2003; Morrison & Lowther, 2002). The behaviorist theorists generally suggest conducting a pre-assessment, then introducing stimuli (a lesson or concept), and conclude with post-assessment.

Computerized drill and practice lessons, as well as tutorials, generally fall within the parameters of the behaviorist theory as children complete lessons or tutorials directed to encourage the development of specific skills via the computer. There is little difference between these computer-based lessons and the lower-level question-answer worksheets students complete at their desk. Often, they are completed with little assistance, and they generally require children to answer basic level questioning. The opportunity for students to develop higher order thinking is not available, nor are the experiential, hands-on, interactive activities required for deeper learning through these

lessons. Instead, activities are presented to produce selected responses in progressively reduced amounts of time.

The strength of this type of instruction is its ability to free teachers from drill and practice lessons to work with students individually or in small groups. Furthermore, once a skill is learned, these techniques can be used to build fluency. In Drake's 2001 dissertation study on the technology-based best practices in Palm Springs, he found that software created to extend practice time was highly motivating. As we have learned from best practices in traditional settings, "practicing a skill once or answering a single question does not guarantee retention. Repeated practice is often required to retain information and to become familiar with it . . . practice not only enhances speed and fluency but also retention" (Alessi & Trollip, 2001, p. 9). Lessons offered via a computer can offer highly motivating, extended practice time for students to practice what has already been learned.

Alessi and Trollip (2001) believe that the behaviorist theory does not match the current pedagogical thinking, stating that the "strict behavior approach, paying attention only to observable learner behaviors and ways to influence them, is not appropriate for multimedia design," and they recommend a more student-centered model (p. 36). Morrison and Lowther (2002) concur, and feel that after twenty years of using computers in schools as a delivery device, we have not achieved anticipated results. Furthermore, they predict that "if we integrate computers into the curriculum as a tool for solving real-world problems, we will start a revolution that will affect how students learn" (Morrison & Lowther, 2002, p. 14).

**Information Processing**

The bottom-up information processing theory states that learning is done sequentially (McInerney, 2005). Information processing is comprised of the following abilities: attention, perception, and memory. Each of these abilities must be nurtured in order for learning to take place. Lipson and Wixson (1997) wrote that when information processing theory is applied to reading and writing, there are three basic assumptions:

1) reading and writing consist of a number of sub-processes used to perform specialized tasks;
2) readers and writers have limited capacity for attention so that trade-offs occur across the sub-processes; and
3) competence in reading and writing is determined by the degree of attention needed to operate sub-processes (p. 6).

The information processing theory suggests that the initial sub-processes required for reading are "so demanding of attentional resources that higher-level processes cannot be employed" (Lipson & Wixson, 1997, p. 7). Furthermore, it is not until these sub-processing skills are acquired, to the level of automaticity, that higher-level reasoning and comprehension will take place.

Therefore, when applying the information processing theory to computer technology, the technology could reinforce sub-processes through frequent practice of specific phonemic and phonetic skills, as well as scaffolded comprehension questions. As computer programs are able to effectively limit the amount of information given to a child, assurance of the match between information and level of proficiency will be addressed as the child's responses are reviewed by the system. Additional background

information can also be retrieved, as needed, to aid in connecting the learner's perception of the material to the lesson. This match of appropriate learning materials, theoretically, will allow the child to maintain interest in the material presented, as it is at the appropriate learning level, and will allow the sub-processing skills to be mastered.

**Developmental Theory**

The developmental follows the ideology that humans progress in stages. Erik Erikson's (1950) stages highlighted psychosocial development, Freud described unconscious desires in psychosexual stages, Kohlberg (1987) studied the development in reasoning in morals, Maria Montessori (1967) categorized sensitive periods between birth and age six, Maslow observed a hierarchy of needs, and Piaget (1987) discussed a child's reasoning based on interactions with their surroundings. Although there are multiple theories, the ideology of a progression of maturation is prevalent throughout each theorist's assumptions.

With respect to education, developmental theory collectively categorizes children between the ages of five and eight as waningly egocentric, concerned with rules, utilizing all senses, and between the pre-operational and concrete operational stages. Table 2.1 is an amalgamation of developmental stages posed by Erik Erikson (1950), Lawrence Kohlberg (1987), Maria Montessori (1967), and Jean Piaget (1978).

The developmental theory offers teachers a guideline to understanding the mental capabilities of learners at various levels. Children should not be grouped primarily based on age, but by the developmental stage in which they are currently functioning. The use of technology to support development at correlated stages for children between kindergarten and second grade should be concrete, tactile, consistent, individualistic, and

broken into steps to allow success for all learners, and provide opportunities to rouse senses.

**TABLE 2.1**

**DEVELOPMENTAL STAGES**

| Theorist | Description | Age/Perspective Range |
|---|---|---|
| **Erikson, Erik** (1902 – 1994) | ***Eight Ages of Man*** | |
| | Basic Trust vs. Basic Mistrust | Infancy |
| | Autonomy vs. Shame and Doubt | Toddler |
| | Initiative vs. Guilt | Kindergarten |
| | Industry vs. Inferiority | Around 6 – puberty |
| | Identity vs. Role Confusion | Teenager |
| | Intimacy vs. Isolation | Young adult |
| | Generativity vs. Stagnation | Mid-life crisis |
| | Ego Identity vs. Despair | Old age |
| Kohlberg (1927 – 1987) | ***Stages of Moral Development*** | |
| | Level 1: Pre-Conventional | |
| | 1. Heteronomous Morality | Egocentric |
| | 2. Individualism, Instrumental Purpose, and Exchange | Concrete individualistic |
| | Level 2: Conventional | |
| | 3. Interpersonal accord and conformity | Individual in relationships with other individuals |
| | 4. Authority and social-order maintaining orientation | Differentiates societal point of view from interpersonal |
| | Level 3: Post-Conventional | |
| | 5. Social contract orientation | Prior-to-society |
| | 6. Universal ethical principals | Moral point of view |
| Montesorri, Maria (1870 – 1952) | ***Sensitive Periods*** | |
| | Absorbent mind | Birth to 3 years |
| | Language Explosion | 1 ½ to 3 years |
| | Development and coordination of fine and large muscles | 1 ½ to 4 years |
| | Very mobile with greater coordination | 2 to 4 years |
| | Incorporated all five senses | 2 ½ to 6 years |
| | Interest and admiration of the adult worlds | 3 to 6 years |
| | Tactile senses are very acute | 4 to 5 years |
| | Reading and math readiness | 4 ½ to 6 years |
| Piaget, Jean (1896 – 1980) | ***Stages of Cognitive Development*** | |
| | Sensorimotor | Birth – 2 years |
| | Preoperational | 2 – 7 years |
| | Concrete Operational Stage | 7 – 11 years |
| | Formal Operational Stage | 11+ years |

**Constructivist Theory**

Patton (2002) believes constructivism is based on the "premise that the human world is different from the natural, physical world and therefore must be studied differently" (p. 96). He further explained that "constructivists study the multiple realities constructed by people and the implications of those constructions for their lives and interactions with others" (Patton, 2002, p. 96). Additionally, constructivists understand that although two people may live in the same environment, the environment does not entirely define their ideology, and they are still individualistic in their thought processes.

Michael Crotty (1998) discussed the difference between constructivism and constructionism, as well as the apparent misuse of terms. Constructivism refers to the concept that meaning is created individually, while constructionism is influenced by societal cultures.

> Constructivism . . . points out the unique experience of each of us. It suggests that each one's way of making sense of the world is a valid and worthy of respect as any other . . . on the other hand, social constructionism emphasizes the hold our culture has on us: it shapes the way in which we see things (even in the way we feel things!) and gives us a quite definite view of the world (Crotty, 1998, p. 58).

Papert (1992) believes that in a time of enormous historical changes in the way the professionals conduct and carry out business, education has not substantially grown with its use of technology. In business and the medical profession, computers are used as a tool to solve problems. However, "the use and conceptualization of computers as tools in the workplace stands in stark

contrast to an educator's view of computers as instructional delivery mechanisms" (Morrison & Lowther, 2002, p. 4). Utilizing technology as a tool for constructing individual knowledge is the most prominent difference in theoretical perspectives (Alessi & Trollip, 2001; El-Hindi, 1998; Jonassen, Howland, Moore, & Marra, 2003; Labbo et al., 2003). The utilization of technology as a tool follows the constructivist theory.

Teachers who are already comfortable with the Piagetian way of thinking, that all children learn only from what they have created themselves, will find solace in the opportunities presented through experiential play with technology during which children can express themselves in multiple venues.

Having the understanding of multiple perspectives – behaviorist, information processing, and constructivist – on technology will allow teachers the opportunity to pick and choose lessons to support learning. The impetus, then, is not to find a situation where learning will fit with a specific theory, but to determine when technology will enhance learning. Alessi and Trollip (2001) wrote that "in some situations, providing instruction is appropriate; in others, providing tools for learning is appropriate. Dogmatism on either side is unnecessary and underproductive" (p. 7). The challenge educators face is "finding the right balance between time-honored delivery systems and the more student-centered learning styles which are made possible by the new information technologies" (Drake, 2001, p. 16).

***Current Views Of Technology Use in the Classroom***

Before beginning to utilize technology in the classroom, there must be the understanding that the terms "technology" and "computers" are not synonymous. Uses

of technology can range from speaking into a microphone while sharing a story in the author's chair, listening to a friend read a story on a tape player, or watching a video to documenting the learning process with a digital camera or surfing the Internet for background information. There are multiple uses and definitions of technology. Kozma (1994) warns, "because technology changes over time, so too does the definition" (p. 11). We need, then, to be careful when we hold to a specific definition, as technology will continue to evolve, and our understanding may become obsolete. He suggested instead to first recognize what the technology is capable of, then understand when and how to employ its capabilities.

Drake (2001) described technology best practices to be "identified, successful, education practices which utilize technology to support literacy learning and create an objective measure for achieving improved performance goals (p. 12). As Piaget (1950), Dewey (1896), and Vygotsky (1978) believed with traditional education, Gordon adhered to the notion that technology should match a student's age and ability levels in order to be developmentally appropriate. Roblyer (2003) suggests that, whenever possible, technology should be threaded throughout multiple language-arts skills (reading, writing, speaking, and listening) and should "assist students in achieving established proficiency standards" (p. 238). Labbo (2003) adds that "technology should add substantively to your literacy curriculum and not be used merely for its own sake" (p. 301).

These suggestions – age appropriateness, matching lessons with ability level, teaching what is meaningful and relevant in a social environment, and addressing the standards – are similar to best practices in reading. Using technology for the sake of

using technology would not follow best practice, just as teaching phonemic awareness to a fluent reader would be unproductive.

As mentioned earlier, Morrow, Barnhart, and Rooyakkers (2002) warn that computer technology should supplement and not supplant the teacher. Computers should not be the cornerstone of a learning environment but an addition to what already exists. Alessi and Trollip (2001) suggest looking for "situations where the computer is likely to be beneficial. These situations include those in which the cost of instruction by other methods is high" (p. 6). Offering one-on-one tutoring to a student who needs additional practice with phoneme and grapheme relationships is costly; allowing a child to complete lessons on a computer to reinforce skills previously learned as a group or individually is affordable.

After affirming their own pedagogical perspectives, the teacher's first step should be to help children regard technology as meaningful and relevant. Just as it is imperative for students to view their teachers as avid readers and writers, students need to observe educators using technology in their daily lives in order to recognize its importance. Conveying the relevance of technology is correlated with how adults rely on it to complete tasks. Therefore, in order for educators to convey the ideology that technology is meaningful, they must utilize and view technology as a useful tool in their own lives. When teachers rely upon technology to deliver messages (via e-mail), gain background information (through Internet searches), edit papers (through word processing), document classroom activities (through digital cameras), or manage grades (through spreadsheets), they believe technology is an important tool for completing work and will transfer that ideology to their students (Morrow et al., 2002).

Just as with education in general, the key to future successful technology use is with early and appropriate exposure. Drake (2001) wrote that the "early emphasis on effective technology use in the elementary grades will not only support literacy instruction, but also prepare students for specialized secondary studies and then competitive skills required in the workplace" (p. 7). Practicing backwards mapping, where teachers look to their ultimate goal and work backwards to scaffold lessons to enable students to reach their potential, can help illustrate the need for beginning at the onset of school.

***Multiple Literacies***

Lankshear and Knobel (2003) discussed the differences in literacies as a distinction between reading as a function to "encode and decode alphabetic print and literacy" or a "competent handling of texts that are meaningful to 'insiders' of particular sociocultural practices and discourse communities" (p. 73). They stated that research generally tends to focus on one aspect or the other. Moreover, Lankshear and Knobel believed that there is also a distinction between printed and multi-modal literacies. "Digital code allows meaningful texts to be produced, distributed, and exchanged in varying ratios and with more or less equal ease among numerous formats including print, sound, icons, graphics, and animations" (Lankshear & Knobel, 2003, p. 73).

Johnson & Kress (2003) stressed that the world is exponentially changing, and our classroom curriculum must continue to develop in order to meet the demands of our students' future careers:

> In the rapidly changing global context in which the world of work, as much as our social and private world, is being reconfigured, we need to re-think the nature of

> knowledge, of the school curriculum and pedagogy, and in particular we need to focus on the forms and – the concern of this issue – on the representational modes, the literacy aspects of assessment (p. 8).

Furthermore, Gunther Kress (2000) discussed the difference in literacy generally associated with social status, and "spelling is one social convention among many" (p. 26). Those with more education, and subsequently able to read and write well, are more adept to finding themselves in positions of status. However, Kress also believed that as countries with multiple languages and cultures become more prevalent, economic opportunities will continue to arise, and educators will need to prepare students for a more visual work environment. "Visualization represents one of the major drives for electronic industries, and the visual will reconfigure our societies' use of language – whether as speech or as writing – quite fundamentally" (Kress, 2000, p. 13).

***Current Classroom Uses of Technology***

Currently, the use of technology in the classroom is as varied as teachers' pedagogical perspectives. Classrooms follow behaviorist (i.e., pre-assessments are given, stimuli is introduced, and growth is measured), information processing (i.e., information is given sequentially, new information is not shared until previous information is mastered), and constructivist (i.e., guided exploration of media) theories toward implementation of technology. Those more comfortable with drill and practice generally utilize basic skills programs that encourage phonemic and phonic instruction, typing practice, spelling, and vocabulary lessons. Those more comfortable with technology and inclusion will adhere to using it to access electronic resources, document learning through creating multimedia projects and presentations, and share information

with those in distant environments. Modern uses of technology include tutorials and practice software, talking books, text-to-speech software, hypermedia, web-based communication, and assessment administration.

Technology use is not a magic pill that will take away learning challenges and instructional variances, and ensure that all children will succeed scholastically. It is, however, an extremely essential tool that will enable our students to compete in the world into which they will graduate. Remembering our educational goals, remaining true to our pedagogical perspectives, and reaching for excellence is the way to unlock the gate to success. The perspective of what constitutes good literacy instruction should not change- it is the delivery system that should reflect the best resources available to ensure we are reaching the short- and long-term goals of our students. In order to encourage students to develop to their greatest potential, we must enable them with the tools needed to get there.

**Digital Divide**

Ironically, the general public believes that technology and the Internet will solve the inequities in education among various socio-economic, racial, and gender groups. Unfortunately, this is not the case. The term *Digital Divide* was coined by Lloyd Morrisett in 1978 to represent "a discrepancy in access to technology resources between socioeconomic groups" (Roblyer, 2003, p. 191). Cooper and Gallagher (2004), in their report jointly published by the Economic and Statistics Administration and the National Telecommunications and Information Administration, found that although more households and schools throughout the United States have access to computers, a new gap has been created, one that affects the way in which information is obtained. This

new gap is the use of broadband connections to access the Internet. "Persons with broadband at home are more likely than other Internet users to use the Internet frequently and engage in a wider variety of online activities, such as entertainment and information gathering" (Cooper & Gallagher, 2004, p. 4).

A superficial glance might lead one to believe that home use would not affect public schools, as the government push and support for schools to be equipped with high-speed Internet connections has been successful. Not so, claim Chen and Price. They found that teachers who did not use technology personally were not as able to use it professionally as their technology-savvy colleagues. They also believe that, although schools may be wired, there is a "disparity in teachers' readiness to use computers. Many teachers from the inner city are not equipped with the computer skills needed to successfully apply and integrate technology in their classrooms" (2006, p. 399). Furthermore, they believe that only through ongoing, long-term (at least 30 hours to achieve proficiency) training will we begin to see a difference in teachers' ability to effectively facilitate technology use.

The inaccessibility of technology during non-scholastic periods of time could possibly similarly affect students. In an informal study conducted by Dr. Dana Davidson at the University of Hawaii with six hundred of her undergraduate students, she found that 24% of her students did not have access to a computer at home.

A divide also exists in the resources available to students in various settings. Roblyer (2003) found that children in remedial programs "may have access to computers, but may use them mainly for remedial work rather than for e-mail and other personal empowerment activities" (p. 192). While students in non-remedial settings are offered

opportunities to learn strategies that will help them in the work force by learning to produce PowerPoint™ presentations, communicate via e-mail, and conduct informational searches, those who are not functioning at grade level will fall behind in yet another area so crucial to their future success. Furthermore, this accessibility also applies to the home. Parents realize that children in kindergarten through the second grade may be able to navigate through programs and Internet sites; however, the ramifications for independent unsupervised use can be instantaneous and damaging. Therefore, although young learners may have access to a computer at home, this does not necessarily translate to permission to use it independently, possession of software programs to promote learning, or use of the Internet. The number of minutes children have access to the computer at home is as vast a range as the time parents allow children to watch television.

Finally, there is another divide between home-and school-use of technology. Children often e-mail or IM (Instant Message) friends, create or view videos, and play computer games at home, but are expected to use technology for projects and formal writing at school. This is similar to telephone use in the work and home environment. While at work, the telephone is to be used as a means of communication between clients and employees with a prescribed etiquette throughout the conversation that is intended to promote customer satisfaction. The telephone is not intended for personal conversations that distract workers from tasks. Conversely, at home, it is a means of keeping in touch with family and friends, as well as making appointments and gathering information. A divide does exist between the two uses; however, each use adequately meets the needs of the user in their environment.

**Early Childhood Practice**

Jane Healy (1998), in *Failure to Connect*, wrote of her strong feelings toward the inclusion of computers in the early childhood environment. She believes that, when used inappropriately, "computer 'learning' for young children is far less brain-building than even such simple activities as spontaneous play or playing board games with an adult or older child" (p. 20). Healy suggests a practical, common sense approach toward the inclusion of technology with young learners to keep away from the negative implications that could result from disturbing the delicate balance between socialization and play with the use of machines.

Developmentally appropriate practice should remain the theoretical underpinning to developing any curriculum for young learners. It is our duty as educators to remember that we are encouraging the emotional, social, and cognitive growth of young children in the early childhood classroom – not just the cognitive. With the ideology understood, the next step is discerning which aspects of technology can and should be used to support reading acquisition. There are generally four phases of instruction which are prevalent regardless of the level of instruction: presenting information, guiding the learner, practicing, and assessing the learning (Alessi & Trollip, 2001; Morrison & Lowther, 2002). Ensuring that each of these components are present in the curriculum prior to implementation will further increase success. For a list of general principles, dos and don'ts, as well as guidelines for choosing software for early childhood learners, please refer to Appendices A and B.

**Tutorials and Practice**

During the early childhood years, when students are learning to read, computers can support instruction through "tutorials and practice on basic reading skills using examples and passages carefully controlled for reading difficulty" (Roblyer, 2003, p. 245). Tutorials offer both step-by-step instructions to allow students to independently master skills and infinite patience while presenting repeated review. There are many inexpensive programs, generally for fewer than $50, that are able to encourage students to associate phonemes with graphemes, match upper and lower case letters, find patterns in words, and find picture clues to complete a story. These leveled tutorial programs are best utilized when they are coupled with diagnosis that will ensure the accurate match of ability level and lessons to complete.

Many of these programs are written in a way that allows interaction and creativity. Children who have written a story can include graphics through kid-friendly programs such as *KidPix*™. These, and other programs like it, can enable children to comfortably learn and utilize components of the computer in a manner that is enjoyable.

In addition to drill and practice software, games are available for children to learn specific skills. The differences between regular drill and practice software and games are the inclusion of the concept of winning or losing, needing skills to play, and allowing multiple players. For those students who enjoy competition, this type of technology can be highly motivating and exciting.

Prior to investing educational funding and time away from other tasks, Healy (1998) warns that we should "temper our enchantment with a critical look at whether anything educational is really being accomplished" (p. 24). She believes that children are

often enjoying the activities, but are not actually learning desired skills during their play. Papert (1992), however, disagrees with the idea that computers should only be used for specific learning activities. He believes that although computers are most often used as an electric toy, this opportunity to play has "been the entryway for children into the world of computers. These toys are empowering children to test out ideas about working without fixed rules and structures in a way few other toys are capable of doing" (p. 4). For a list of guidelines to follow when choosing software for the early childhood learner, please refer to Appendix A.

**Talking Books**

Talking books are available on audiotape or computer software. Talking books using computer software, or electronic books, are equipped with digitized pronunciations of phonemes or entire words. "By accessing pronunciations of words that are unfamiliar in print, beginning readers should be able to negotiate text at or near their listening comprehension level. This benefit can only be realized when the process of accessing pronunciations is sufficiently unobtrusive" (McKenna, 1998, p.46). Furthermore, McKenna suggests that a child possess a minimal alphabetic knowledge and sight vocabulary prior to using talking books in order to adequately use them.

The opportunity to access phonemes and words ties in with Bruner's concept of scaffolded instruction, in which teachers provide students with the necessary assistance needed to reach goals. In addition to providing the immediate tutorial of unknown phonemes, when used as a read-aloud, talking books can support best practice in general education reading instruction by exposing students to read-alouds throughout the day. Through the use of reading software programs, students are not only able to listen to

stories read aloud, but they are able to vary the speed at which the words are read, dependent upon their individual reading rate. This reading will allow the student to hear the text read accurately at a speed that is appropriate for their learning. Bergman (1999) found that the narration rate of the read-aloud was directly related to the student's interest level, fluency development, and self-confidence as a reader. "When children cannot follow the narration, they are unable to make the connection between the graphemes they see and the phonemes they hear" (Bergman, 1999, ¶ 3). Therefore, when choosing to implement such programs in the classroom, teachers should ensure that the programs are able to vary the rate at which words are read.

Programs that provide such scaffolding allow students to work within Vygotsky's zone of proximal development when such technology includes Saloman, Globerson, and Guterman's recommendations of a) modeling, b) activation of relevant cognitive operations, and c) guidance (1989). Vygotsky (1978) believed that it is optimal for children to be in control of their learning. Talking books, theoretically speaking, are advantageous, as they continually allow a child to determine his level of required assistance. As a child's reading ability becomes increasingly proficient, his reliance on pronunciations will decrease. As the assistance is readily available, exploration of more challenging text will be permitted. However, the opposite effect could also take place. An over-reliance on technology to access phonemes could contribute to passive learning. I believe it is the teacher's responsibility to guard against such habits through careful monitoring.

DeJohn and Bus (2003) found that when children were able to listen to the oral text or click through the story to find hidden hotspots, they became distracted "[h]idden

hotspots in illustrations, to be found by moving the cursor over the illustrations, are assumed to distract children from the story especially when they are incongruent to the story" (p. 149). During their research, they found that "most children focused mainly on the iconic mode and activated hotspots and games. Even after six 15-minute sessions, only one of the four- to five-year-old participants had heard the entire text once in the correct order" (p. 149). However, they also found that when the text read continuously or "when stories are absorbing, children are inclined to follow routines very similar to the routines followed with adult-read books" (p. 149). Furthermore, when the children already possessed emergent reading skills, they "showed interest in playful interaction with the printed text by clicking on separate words or phrases. These children thus explored the relationship between the written and spoken words" (p. 150).

Tracking programs provide teachers with a visual representation of when and how often a child requests assistance. The teacher could then transfer this information to additional instruction. Horney and Anderson-Inman (1999), however, are concerned that the information presented could be inaccurate due to over- or under-accessing of information. They suggest that the use of voice-recognition software to track beginning readers' miscues will give teachers a more valid understanding of their instructional needs. Realistically, the time needed to train the computer to recognize each child's voice as well and the funding needed to purchase such software could be easily replaced by conducting a free, three-minute Miscue Analysis.

McKenna and Watkins carried out three studies between 1994 and 1996 that looked at the following variations of electronic texts: a) complete digitized oral reading, b) available pronunciations without analogies, and c) available pronunciations with

analogies. Not surprisingly, McKenna and Watkins (1998) found that the use of "pronunciations alone—without hints, analogies, and other embedded instructional information—may be the best approach" (p. 50).

McKenna (1998) believes that "the availability of digitized pronunciations is likely to discourage children from using context to help them identify unfamiliar words" (p. 51). Fluent readers have learned to use multiple strategies, including contextual clues, to access text. The debate as to whether talking books will allow children to skip this step to becoming fluent readers, as positive or negative, is yet to be determined. Perhaps this debate relies entirely on the extensiveness of the use of talking books to teach reading. As with any form of instruction, one must realize the intended goal of utilizing talking books in reading instruction and the possible pitfalls of such use prior to implementation in individual classrooms.

**Text-to-Speech**

Reading along is not limited to books that have been commercially prepared. Through the use of Text-to-Speech programs, or TTS, such as SimpleText by Apple Computer, Inc., which has been offered for over 15 years, students are able to hear what has been written – regardless of whether the author is an experienced writer or a first-grade student in the classroom.

Balajthy (2005) found that TTS is best suited for emergent or struggling readers who need additional time learning the phoneme-grapheme relationship. Those with higher capabilities were slowed down, became bored, and retained less information due to their distractibility with the program. Again, Balajthy (2005) suggests, as with best practices in regular education, that a clear understanding of student capabilities and needs

is imperative to the success of effective implementation of this type of technology. For a list of available TTS programs, please refer to Appendix C: Available Text-to-Speech Software.

With either Text-to-Speech software or Talking Books, teachers must be aware of the disconnection learners could possibly acquire with these types of literature. During traditional reading of printed text, children have been taught to mark up, circle, question, and discuss various points as they read. In order to ensure that we allow children to make deeper connections and cause their thinking to go beyond literal questioning, "we must make sure that computer use includes the important step of requiring children to 'elaborate' their knowledge—thinking aloud, questioning, communicating ideas, or creating some kind of original representation about with what they are learning" (Healy, 1998, p. 141).

**Hypermedia**

Another option for incorporating technology to support reading is the use of hypermedia. Hypermedia "represents the integration, extension, and improvement of books and other media (including photographs, video, and audio recording) in the electronic domain" (Alessi & Trollip, 2001, p. 140). In other words, hypermedia is electronic text with links to related information (Rozema, 2004). Hypermedia offers opportunities to provide background information to students. While students read a book or study a topic on the computer, they are able to click on words or pictures and be automatically linked to explanatory information. While this offers a wonderful opportunity to easily offer necessary background information, some students get lost in

the links and enjoy clicking around pages to see where it takes them without finishing requested tasks (Carroll, 2001).

The opportunities for extended learning are enormous. However, this is not to say that traditional book learning should be replaced with TTS or hypermedia. Drake (2001) wrote:

> Technologies of literacy are rapidly changing and children need to be prepared for more than book literacies in order to succeed in the 21st century workplace. New technologies will not replace books, but, teachers today must be prepared for the new literacies that go beyond book technologies (p. 17).

**Web-Based Communication**

Web-based communication is another mode of effective uses of technology. The terms Web and Internet are often used synonymously, when in actuality they are very different. Through networks, the Internet enables computers to communicate with each other. The Web is an application that uses the Internet as its network. This is similar to the way an automobile rides on the freeway. The freeway in this example would be the Internet, and the Web would be an automobile. The freeway and automobile don't affect one another directly. The car has no effect on the freeway (unless there is damage caused by an accident); however, the freeway's design (condition of road, safety of entry and exit points, speed limit, ability to accommodate multiple users) can have positive or negative effects on the automobile.

When discussing Web-based communication, reference is being made to electronic pages that can be accessed through an Internet connection. This also includes e-mail, chat rooms, and audio- and video-conferencing. It can be used to quickly and

efficiently send, retrieve, or post information. The implications for teaching are enormous and only limited by the teacher and students' imagination and technological proficiency in an environment that is open to exploration as a way to create new knowledge.

In El-Hindi's (1998) article *Beyond Classroom Boundaries*, she explores a U.S. kindergarten classroom that supports reading and writing with the Internet by sending messages to pen-pals in Japan. "Higher order thinking skill is developed through language. Social interaction, therefore, is essential to developing sophisticated thinking" (El-Hindi, 1998, p. 695). This type of instruction is not only cognitively stimulating while working through the writing process, but highly motivating as it "gives students a chance to display their work for the world to see; it is truly a unique opportunity for them to display their poetry, short stories, or artwork for an audience outside of the classroom" (Drake, 2001, p. 39). This type of activity is just one example that directly supports the theory of making learning purposeful and relevant as the students are reading and writing not to just complete an activity for its own sake, but for the intention of being able to communicate with others.

**Administering Assessments**

Finally, the use of technology to administer tests is an invaluable resource for educators. Tests can be commercially prepared by software companies or by teachers themselves. The flexibility and efficiency of the exams are able to not only save valuable time, but can create reports and specific lessons for children to complete to further their development as well. The implications for such use in the classroom include the ability of teachers to develop curriculum to specifically match the strengths and weaknesses of

each student. The amount of time saved in not only creating assessments, but then analyzing and interpreting the data, is quite impressive.

Assessment is not restricted to that created and analyzed by the teacher. Many progressive classrooms include student reflections. Recording reading sessions and then playing them back for the reader to follow allows them to deconstruct the way they read, discuss miscues, and devise ways to better future readings. This can be done simply through the use of tape-recording device or computer software, such as iMovie. The child is able to listen to his own reading and then see where he was struggling or soaring. This allows the child to personally assess his own ability and develop goals for improvement. At times, children who read laboriously don't realize how they sound. Those who are auditory learners will be able to listen to themselves reading and make further connections to print. This type of evaluative tool is one that follows the Piagetian epistemology theory, which is the study of how we process information.

Unfortunately, using a computer program to conduct an assessment, whether it was made by the teacher or is part of software, will not always be in the best interest of all learners, especially those who are not as familiar with word processing or typing, let alone the computer itself. Often, commercially prepared tests do not allow students to go back and make corrections, which can lead to negative ramifications and test anxiety, especially when completing higher-stakes tests (Alessi & Trollip, 2001). Many teachers, including myself, prefer to include pencil and paper exams, interviewing, or portfolio assessments as each allows teachers and students to track their process of writing, while also including technological prepared assessments when appropriate.

***Implications of Constructivist Model for this Study***

The constructivist model aligns most closely with the my ideology of developmentally appropriate practices in the early childhood setting as it allows students to learn in an environment that is open to exploration and free of unnecessary knowledge. Piaget believed that children learn best what they have had the opportunity to create and explore. Technology then, should be seen as a tool for accessing, developing, or sharing knowledge, not as the heart of a classroom, but rather one of the many veins that supply and carry needed information. The teachers observed in this study understand that technology is but one of the many necessary components of an effective environment, and allow ample time and opportunities to fully use technology and to effectively share information and answer questions.

# CHAPTER III

## METHODOLOGY

The purpose of this multiple case study was to examine effective teachers' use of technology to support emergent literacy in four early childhood (K – 2) settings. I believe that the observation of exemplary practices in these classrooms will allow the sharing of critical, useful, and pertinent information with teachers who would like to implement or enhance the use of technology in their classrooms.

This multiple case study consisted of personal interviews and five observations each of four private school kindergarten-through-grade-two teachers who were selected by administrators based on Pressley's (2000) effective teacher model. Participants were all licensed teachers with the State of Hawaii who were older than the legal age of consent (18). Each teacher took part in a semi-structured interview prior to classroom observations. Participation in the interview and classroom observations was voluntary. Responses and observations remain confidential. Participants received a consent form explaining the study and how their answers were to be used. The study was bounded by time (eight months of data collection), location (four elementary classrooms in two private schools on Oahu), and grade level of students (kindergarten through grade 2).

This study answered the following research questions:

1. How do effective K-2 teachers' pedagogical perspectives of reading acquisition influence their use of technology in the literacy curriculum?
2. How do effective K-2 teachers use technology to support emergent literacy? How is this technology use supported?

3. What are the similarities and differences in technology use among teachers in the study?

**Rationale for Using Multiple-Case Study Method**

Yin (2003) explains, and Stake (2003), Feagin (1991), Merriam (1998), and Davey (1991) agree, that "in general, case studies are the preferred strategy when "how" or "why" questions are being posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real-life context" (Yin, 2003, p. 1). Teachers benefit from multiple examples to further their understanding and develop a connection with their own environment. Multiple case studies are also referred to as cross-case, comparative, collective, multi-case, or multi-site. Regardless of their reference, they are independent studies carried out "in order to investigate a phenomenon, population, or general condition" (Denzin & Lincoln, 2003, p. 138). Yin (2003) claims that there is "no broad distinction . . . between the so-called classic (i.e.: single) case study and multiple-case studies" (p. 46). Merriam (1998) states, and Yin (2003) agrees, that multiple cases should be considered in order to enhance the "external validity or generalizability of your findings" (p. 40).

To carry out a multiple-case study, Stake (1995) suggests that researchers develop "an early commitment to common topics [in order to] facilitate later cross-site analysis" (p. 25). He believes that developing this commitment will allow the researcher to remain focused on specific attributes of the project. The challenge here is to stick to forming common topics while remaining open to unexpected situations and perspectives. Stake (1995) warned that "we do not study a case primarily to understand other cases. Our first

obligation is to understand this one case" (p. 4). In other words, one shouldn't neglect the responsibility to each case in order to gain the opportunity to make generalizations.

After determining common topics to observe, the multiple-case study resembles that of a single case. Data should be collected, coded, and understood singularly, again, focusing on the individual site prior to looking for similarities amongst sites. For example, when studying the uses of technology in the early childhood classroom to promote literacy, multiple classrooms would be studied individually. The data for each setting would be analyzed separately. Only after each case has been understood can the findings from each be cross-analyzed to ascertain if generalizations can be made.

Although Merriam (1998) believes that "the more cases, the more included in a study, the greater the variation across the cases, the more compelling an interpretation is likely to be" (p. 40), multiple-case studies are not always appropriate. When a case is exceptionally rare or individualistic, the goal of the study is often to gain an understanding and then share the experience with others, especially with those who find the situation to be conceptually foreign. In this situation, trying to form generalizations could negate the uniqueness of the case and disrespect the participant's individual experience.

Another disadvantage of multiple-case studies is the realization that the amount of time, expense, and size of the project is often more than a single researcher is able to handle. Single-case studies can be overwhelming; multiple-case studies compound the responsibility.

Before choosing to conduct a single- or multiple-case study, a careful review of research questions, availability of participants, uniqueness of the situation, and the

financial and time requirements should be made.

For my study, I followed an amalgamation of Yin's explanatory and Stake's collective case study, and Patton's models. The steps were: 1) create research design, 2) gather all data related to the study, 3) organize all data (coding), 4) validate findings with participants, 5) analyze the evidence, and 6) develop conclusion(s), recommendations, and implications.

Stake explained that although the researcher would still follow the same protocol as with individual cases, choosing to study several teachers, schools, or districts allows one to gain a greater understanding of the entire picture and eventually form generalizations. This format allowed me to effectively answer "how" and "why" questions. Additionally, this type of research will allow those outside the realm of the study to understand the specific phenomenon of the environment.

I agree with Stake's perspective on forming common topics to observe prior to entering sites. I feel that if a researcher is to later make generalizations about multiple sites, as both Yin and Merriam suggest, she must begin with an idea of what is to be observed, while trying to remain open to understanding what was not expected. I was interested in observing multiple sites to gain a broader understanding of how and why effective classrooms use technology.

The definition of effective teachers is taken from the Pressley, et al., 2001 study that found exemplary teachers' instructional practices to include the following:

- instructional balance (no dogmatism toward one method),
- instructional density (active classroom environment),
- scaffolding (mini-lessons to enable students to reach goals),

- encouragement of self-regulation,
- integration of reading and writing,
- high expectations, and
- good classroom management (consistent and fair).

Pressley's study also found that these exemplary teachers' classrooms were filled with various types of good literature; the letter-sound relationships, how to plan, draft, and revise writing were taught, and environments were highly motivating (Pressley et al., 2001).

Yin (2003) believes that although case study strategy is preferred when posing "how" and "why" questions, explanatory "what" questions are also appropriately addressed in case study research.

I studied each site in its naturally occurring environment without any control over the real-life events including curricular decisions or management of students. As the classrooms observed were multi-grade environments, I did not have control over which grade level would be seen at any given time as they were continually mixed together. I focused on what the singular teacher was able to provide based on the resources available to her, not the resources available, e.g., if a classroom did not have access to a SMARTBoard™ I focused on other ways teachers gained and disseminated information. (A SMARTBoard™ is an interactive white board that is connected to a computer and projector. Images can be not only be enlarged so they are easily viewed, but can also be altered and saved for later). Finally, I looked to outside variables to understand the availability of resources – did the administration allow for resources to be purchased, provide training, and support? Under these three conditions: a) naturally occurring

environment, b) no control over events, and c) comprehensive, a case study strategy was appropriate.

***The Unit of Analysis: Determining the Boundaries of the Case***

Stake (1988) explains that a case is a bounded system or a unit of analysis. He explains:

> "What is being studied is the case. The case is something deemed worthy of close watch. It has character, it has a totality, it has boundaries. It is not something we want to represent by a score. It is not something we want to represent by an array of scores. It is a complex, dynamic system. We want to understand its complexity . . . The case study tells a story about a bounded system" (Stake, 1988, p. 256).

This study consisted of five observations of literacy lessons at each of the two schools with two classes at each site. As each environment integrated literacy throughout the curriculum, the observations also included lessons that might traditionally be considered science, math, or art periods. My study was bounded by time (eight months of data collection), location (four elementary classrooms in two private schools on Oahu), and grade level of students (kindergarten through grade 2). The length of observation time changed as I adjusted my observations. Initially believing that the observations would take place concurrently, I afforded eight months of time; however as I completed them individually with very little overlap, the observations took place over twelve months.

***Case Selection***

Initially, the intended scope of the study included public and private school classrooms. Unfortunately, after a laborious process of miscommunication, misinformation from multiple offices, lost written requests, and amount of time lost while seeking to obtain initial approval to conduct research in the public school classrooms, I decided I would have to forgo those environments. Therefore, I contacted five private schools based on their reputation for excellence in education, developmentally appropriate practices, and commitment to continually seek methods to reach their student population.

One school's administration did not feel that they would be able to contribute much to the study, as they were not using technology in the early childhood setting. I met with the principals of the remaining four schools to discuss the scope of the study. Two of the schools principals authorized my study during our meetings; they did not need to seek approval from other school personnel. The remaining two principals forwarded my request to their research department for approval. Written approval was given within one week from both schools.

I gave the four principals a list of effective teacher criteria (Table3.1: Selection Process), and they identified the K-2 teachers who met the criteria. From that list, they identified the effective teachers who use technology in their classrooms. As the schools I was seeking participants from were private settings, the principals in each of the schools were able to carefully select teachers from a broad pool of highly qualified candidates. Many teachers seek employment in these environments as it is well known that the teachers in these schools are offered competitive salaries, excellent benefits (including

discounted or free tuition for their qualifying children), as well as work environments supported by administration and generous funding.

The total number of teachers in grades kindergarten through two who fulfilled the exemplary criteria in the five schools was 40. The number of teachers who also used technology in their classrooms was nine. Of those nine teachers, five were selected based on their openness to participating in research. Two teachers were from one school, two from another, and one teacher was from a third school. Each teacher selected agreed to participate in the study. The teacher from the third school chose to leave the study midway through observations for personal reasons. The remaining four cases were kindergarten-through-second-grade classrooms in two schools. All classrooms were in well-funded private school settings with teachers and curriculum that supported a child-centered, constructivist philosophy. Each of the classrooms followed the school's philosophy of teaching children to read through a balanced approach.

**Table 3.1**

**SELECTION PROCESS**

| Criteria | No | | | | | Yes |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| **Instructional Balance** | | | | | | |
| • Teacher does not show dogmatism toward one reading method | | | | | | |
| • Teacher uses multiple methods to facilitate reading | | | | | | |
| **Instructional Density** | | | | | | |
| • The teacher has created an active classroom environment with multiple opportunities to explore various skills or concepts to be learned | | | | | | |
| **Scaffolding** | | | | | | |
| • Teacher creates mini-lessons to enable students to reach goals | | | | | | |
| • Teacher re-teaches or offers multiple opportunities to learn lessons that were not mastered | | | | | | |
| **Encouragement of Self-Regulation** | | | | | | |
| • Teacher develops lessons and activities that encourage his/her students to self-regulate | | | | | | |
| • Teacher allows students to participate in the creation of rules and consequences for infractions | | | | | | |
| **Integration of Reading and Writing** | | | | | | |
| • Teacher combines reading and writing lessons with multiple subject areas | | | | | | |
| • Teacher creates lessons that encourage reading and writing for multiple purposes | | | | | | |
| **High Expectations** | | | | | | |
| • Teacher understands individual performance levels of his/her students and has high expectations for all learners | | | | | | |
| • Teacher creates and implements lessons that are correlated to state, federal, and/or school level standards | | | | | | |
| **Good Classroom Management** | | | | | | |
| • Teacher is able to facilitate learning in a classroom environment that is safe, inviting, and free from unnecessary distraction | | | | | | |
| • Teacher is able to maintain control of the classroom in a positive manner that allows students to learn from targeted and non-targeted behavior. | | | | | | |

***Hanele School's Philosophy and Make-Up***

The first school participating in this study will be referred to as Hanele School. Hanele was selected based on the reputation of the school, its teachers, and the administrator's ability to produce a quality educational experience for students. Individual classrooms were selected based on the teachers' expertise producing and carrying out effective language arts curricula in line with the requirements of this study.

Hanele is a college-preparatory school formed in 1908 through the amalgamation of an all-girls school (which originated in 1864) and an all-boys school which originated in 1892). Until four years ago, the school boarded students, who were predominantly from families living on neighbor islands and rural areas on Oahu, but also included students from Japan, the Philippines, China, Indonesia, Singapore, Israel, Australia, Fuji, Tahiti, Pohnpei, Chuuk, Samoa, New Zealand, and Canada, to name a few. The acceptance of international students creates a multi-cultural blend of social and learning opportunities.

Hanele's 146 faculty members currently educate 1,510 students in grades pre-kindergarten through twelve on their 36 acres of land in a lush valley in Honolulu. The elementary grades were added to the school in 2004, when an existing elementary school merged with Hanele; pre-K classrooms were added in 2005 to create a pre-K through 12$^{th}$ grade learning environment. A new state-of-the-art facility was built and pre-K and elementary students began receiving instruction on campus in 2005.

The middle and high school pay particular attention to the arts. Students are offered the option to participate in a rigorous Performing Arts program in theater, musical theater, dance, hula, instrumental music, visual arts, and media. The school is also well

known for its math, science, and technology center that rivals those on many college campuses, as well being the only high school in Hawaii with an International Baccalaureate Diploma program since 1960. To ensure that standards are met, samples of student work are mailed to international examiners throughout the world.

Hanele's campus also houses a pool, a football field, a gymnasium, baseball and softball fields, tennis courts, and three auditoriums as well as multiple dance pavilions, an art studio, and administration housing. Children attending Hanele are predominantly from middle and upper socio-economic families; however, 16.22% of the student population receives scholarships based on financial need and academic achievement, and 5% of the student population receives tuition waivers due to faculty benefits.

Hanele's elementary and pre-K school comprises 251 students taught by 26 teachers. Eighty-seven percent of the classroom teachers have Master's of Education degrees from universities such as Lesley, School of the Art Institute of Chicago, Stanford, Berkeley, University of Hawaii, and Chaminade University.

Technology permeates the elementary school's curriculum. Physical education projects have included creating songs in GarageBand™ to complement jump-rope routines. Music classes are able to log onto the computer after school to practice along with songs learned in class. Art pieces are photographed and displayed in progress portfolios and on class websites. Teachers in multiple venues work together to coordinate lessons: students studying Native American history in their regular classroom might: a) use the Internet to find examples of totem poles in art and then create their own; b) search the Internet for Native American children's games to play in P.E.; c) download Native American songs to sing in music; and d) discuss religious perspectives

in Christian Education. All learning is tied together in a cooperative environment allowing for individual growth of students.

Although other teachers at Hanele School met the criteria to participate in this study, two teachers were selected from multi-grade 1-2 environments.

**Environment A: Kim's Classroom**

Kim was a multi-grade (grades 1-2) teacher at Hanele School. Her classroom was composed of 19 students: 10 boys and 9 girls. The classroom seating was arranged around four round tables with four chairs each; one table had five seats. Markers (thin and bold-faced), colored pencils, pencils, and erasers were placed in the middle of each table. All supplies were provided by the school and replenished as needed.

The walls were decorated with colorfully painted self-portraits, author study notes, "What a good team member does (written by students)," editing checklists, Friendly Letter Form (components of a friendly letter: return address, greeting, body, complimentary closing), Story Problem Steps (process for answering math word problems), and an evacuation plan map. Each work area was fully stocked with supplies. For example, the math center was supplied with calculators, bear counters, playing cards, dominoes, stamp games, fraction blocks, ten-bars, and unit blocks. Additional centers included: Listening, Computer, Writing, and Library. Note: the elementary school did not yet have a central library; individual classrooms were abundantly supplied with books either selected by the teacher or administration, or donated by families to celebrate a child's birthday.

The computer area was supplied with five Macintosh desktop computers (all less than three years old), an inkjet printer, and a scanner (there are twenty additional laptop

computers for students to borrow in the computer lab, if needed). Two sides of the room were lined with large windows and exit doors. A SMARTBoard™ was located in the center of the front of the room with white and bulletin boards framing each side. Additionally, an iMac computer was connected to the SMARTBoard™ in the front of the room. The back of the room was supplied with a sink, various classroom supplies (stapler, hole punches, paper towels), and a door leading to another grade 1-2 classroom.

**Environment B: Emily's Classroom**

Emily was the second multi-grade 1-2 teacher at Hanele School to participate in this study. Emily's was a multi-grade (grades 1-2) classroom of 18 students: 10 boys and 8 girls. The classroom seating was arranged around four round tables and one kidney-shaped table with four or five chairs each. Markers (thin- and bold-faced), colored pencils, pencils, and erasers were placed in the middle of each table. All supplies were provided by the school and replenished as needed. Additional materials were also located in the back of the classroom.

The computer area was located in the front corner of the classroom. There were five iMac desktop computers in the center. A wireless connection was supplied to the scanner and printer that were also located in the same area. Twenty laptop computers were available in the computer lab.

Although there was a library center with books organized by genre and reading level, there were additional books available throughout the classroom. As mentioned previously, Hanele did not yet have a library for the elementary students; individual classrooms were generously supplied with books selected by the teacher or administration, and with donated birthday books.

Emily's walls were decorated with self-portraits, student projects, sound charts (graphic representation of sounds), and classroom rules. One bulletin board was decorated with children's photographs and stories they wrote about what it means to be a part of a community of learners.

The science and math centers were located against the side of the classroom. They were both well stocked with assortments of counters, balances, games, manipulatives, microscopes, and other opportunities to explore.

The back of the room housed a sink, teacher resources, student cubbies, teacher storage, a fish tank with live fish, and a caterpillar habitat occupied by a chrysalis. There was also a door leading to an adjacent multi-grade 1-2 classroom.

Students generally met as a group on a rectangular rug in the front of the classroom. They faced a large white dry-erase board and a SMARTBoard™, which was connected to an additional iMac desktop computer.

***Ulu Elementary School's Philosophy and Make-Up***

The second school participating in the study will be referred to as Ulu Elementary School. Ulu Elementary School was selected on the reputation of the school's, teachers', and administrator's ability to produce a quality educational experience for their students. Individual classrooms were selected based on the teachers' expertise in generating language arts environments in line with the requirements of the study.

Ulu Elementary School is nestled at the base of a lush, green mountain in Honolulu. The maximum student population was 206 children from grades pre-K through sixth. The pre-K and sixth grade are single-leveled classes, while the remaining are conducted in multi-age environments, combining grade kindergarten with grade 1,

grade 2 with grade 3, and grade 4 with grade 5. Each classroom comprises no more than 26 students. There are 11 classroom teachers and 11 specialists (art, band, French, library, music, physical education, physical world lab, strings/orchestra, technology, and auxiliary programs) led by their headmaster. Financial aid to assist in tuition payments is received by 19.9% of the students. A number of students suffer from allergies requiring attention. One student has diabetes, one has Crohn's disease, another uses a wheelchair, and multiple students have learning differences. All students are able to function well in the environment. When a child appears to be struggling to learn, the setting is no longer conducive to learning for the child. The family, a therapist, and administration meet to discuss possible ways to address learning difficulties. When those accommodations are not sufficient, an alternative environment may be suggested.

Ulu Elementary School was founded in 1918 on the educational philosophy of John Dewey and Francis Parker. The ideology continues on this path, but follows George Posner and Alan Rudnitsky's theoretical framework that distinguishes the differences among product, process, curriculum, and instruction. Understanding what is to be learned is agreed upon by all teachers and the administration; however the mode of accessing and mastering information is individualistized and tailored to the learning style of the child.

The school day begins each morning as the headmaster rings a familiar melodic bell, and the entire school gathers in the courtyard. Sixth grade students facilitate the meeting by leading the school in the Pledge of Allegiance and asking if there are any announcements. The librarian shares Birthday Books (student birthdays are celebrated by families purchasing a book for the school library in honor of their child's birth),

classrooms share projects, and daily special events are reported. After messages are completed, a designated classroom leads the school in a virtuous thought and song for the day. The students are then dismissed to begin learning in their classrooms.

Two multi-grade kindergarten and first grade classrooms were chosen for this study. Two head teachers facilitate each classroom, and all four fulfilled the requirements to be included in this study. For the purpose of the study, all of the teachers in the classrooms were a part of the discussions of the daily organization, curriculum planning, and decision-making process; however, all primary discussions and organization of visits between myself and classroom were directed through one teacher in each of the rooms.

Although other teachers at Ulu Elementary School met the criteria to participate in this study, two teachers were selected from multi-grade K-1 environments.

**Environment C: Grace's Classroom**

The first K-1 teacher at Ulu Elementary School will be referred to as Grace. Grace's classroom was a spacious room with multiple learning centers available for student use during the school day. Life science activities and observation opportunities were throughout the classroom; DASH (Developmentally Approaches in Science, Health and Technology) experiments and calendars were prominently displayed; and plants and live animals were kept in the middle of the room for visual examination. Multiple learning centers (writing, math, science, and art) were fully stocked to meet the needs of students. All of the supplies were provided by the school and replenished as necessary.

Student work areas were not assigned. Students choose where they would like to work each period; choices were made for the children when the child had made a poor choice and could not be productive.

The environment was extremely language rich. Labels were found throughout the room on pencils, centers, folders, shelves, cupboards, animal habitats, leveled books, and calendars, to name a few. Mutual agreements on classroom behavior were posted in two locations; weekly classroom responsibilities and classroom schedules were also prominently displayed. Grace said, "If we have it right where the children are, they can become more responsible for themselves. We just have to remind them where to look for the answer to their questions."

There were large doors on the side of the room leading to a picnic area where daily snacks were enjoyed overlooking the playground field, which included a large sand play area, a tree house, and a jungle-gym built upon foam protective matting.

**Environment D: Dinah's Classroom**

The second K-1 teacher at Ulu Elementary in this study will be referred to as Dinah. Dinah's classroom had multiple work areas. There were math, science, writing, reading, computer, art, and home centers. The math center was filled with building blocks, tangrams, links, and other manipulative materials. The science center was complete with balances, microscopes with readily available specimens, and opportunities to observe and create new experiments. The writing center was supplied with various types of paper, pens, pencils, crayons, markers, scissors, tape, and staplers. All supplies were provided by the school and replenished as necessary.

Everything seemed to be labeled. However, the labels in this room were generally accompanied by a photo of a child in the act of completing the activity. For example, Birthday Books were labeled as such, but also included a picture of a child on her birthday holding the book she donated to the class. Dinah said, "We have very different levels of readers in here. The pictures just offer another way to read."

Although books were primarily found in the reading center, they could be found throughout the room. This, along with identification cards posted just about everywhere, charts created by the children and teachers to specify community-chosen rules, jobs, and procedures, made the classroom a language-rich environment. Children's writing samples and artwork decorated the walls.

There were two main group areas: the front of the room and to the side. Each group area was supplied with chart paper, pens, and markers. The two stations allowed the children to split into groups based on interest or academic level. To the side of each group area, there were tables and chairs where children could work directly after their meeting.

The science area consisted of microscopes, experiments in progress, and opportunities to observe something new. A completed group activity called Germ Investigation was prominently displayed. The children conducted research on germs at school. Petri dishes with growing bacteria were photographed. Procedures and children's observations were typed and displayed on large chart paper and posted on the wall.

Dinah's classroom was unique in the placement of computers as they were positioned throughout the room, instead of grouped together in one space. Dinah stated this was done to allow more than one child to view the computer at a time:

> "It didn't matter if there was an open computer right next to them; they were all scrunched up around one watching each other work. Moving the computers around just gave them more room to be together without it getting crazy."

***Data Collection***

The collection of data highlighted Stake (1995, 2003), Yin (2003), and Patton's (2002) models, but was tailored to fit the needs of the proposed study and the comfort level of the participants (please refer to Appendix E or the section on Multiple-Case Study Research for further definition). Therefore, as the use of technology can enhance data collection, I used audiotape recorders for aiding in transcription accuracy. A digital camera was also used to aid in the transcription of the description of the classroom environment. Data was collected through direct observation (field visits), documents (letters, memos, newspaper articles that will aid in triangulation), and interviews (semi-structured question-answer sessions often to validate information or gain a deeper understanding of the case).

I agree with Stake's perspective of understanding cases individually first and became concerned with keeping data of each site separated early in the research. I assigned each site a different color: classroom 1, blue; classroom 2: black; classroom 3: orange; classroom 4: red. I then purchased multiple color-coded composition books for note-taking to ensure that information from one site would not be confused with another. I separated each visit with labeled plastic tabs (e.g., observation 1, interview, map, school

information). I also decided to focus on scheduling interviews and observations in one environment at a time. I felt that this would allow me to fully commit to each site without unintentionally looking for similarities among multiple sites.

**Interviews**

To gain a broader understanding of the four teachers' pedagogical perspectives of reading acquisition, I began conducting personal interviews with each teacher in January 2007. The meeting place of the individual interview depended on each teacher's schedule and preference. Two teachers preferred to not have a formal interview, but answer questions during open periods during the day (e.g., recess, before children arrived) as their schedules were quite full. I asked specific questions; however, I allowed opportunities to deviate and expand as they offered information not previously considered. Each teacher was given a set of questions prior to our interview to allow for reflection on answers. This allowed teachers to fully explore their ideas as they had the time and opportunity to reflect on their answers (for a list of the interview questions, please see Appendix F: Questions for Teacher Interview). Interview questions and responses were recorded using a MacIntosh PowerBook G4 laptop computer, a portable tape recorder, and paper and pencil for note taking. Each teacher was asked the same questions. When unexpected observations were made, e-mail correspondence between the teachers and myself aided in further verification and validation of information. Finally, as I visited each site a number of times and frequently e-mailed participants, informal conversational interviews were implemented when information gained was pertinent to the study.

**Direct Observations**

Stake (2003) wrote that "the whole story exceeds anyone's knowing, anyone's telling" (p.144). We will never be able to completely record the entire story – it cannot be told. The multiple perspectives and variables in a relatively simplistic case are still greater than our understanding. Our job as researchers, then, regardless of carrying out a single- or multiple-case study, should be to try to help others develop an awareness of a situation through our explanation of the participants' experiences.

Merriam (1998) explained that there are various types of observers. I followed the least participatory role, titled complete observer, and strove to be as unobtrusive as possible.

Days after each interview, I contacted the teachers through e-mail to set up observations during periods when technology would support literacy. I informed the teachers that I could adjust my schedule to be available any time they were open to having me there. Each observation ran approximately 45 minutes; however, some observations were longer due to the amount of time needed to complete the lesson. Although observations specifically noted schedules, habits, organization, classroom climate, social interactions, types of technology used, and the amount of time dedicated to using technology, I also remained open to recognizing other situations or variables that might contribute to the overall success of the environment.

As the selected teachers had already been determined to fulfill the criteria described by Pressley (2001), I remained cognizant of each teacher's use of any technology – regardless of its sophistication – used during language arts periods. Themes that arose were the amount of time the teacher and students were using the technology,

the degree the students were able to independently use the technology, the relationship between the technology and the lesson's objective, the degree and necessity of technology to support the learning, and the rationale for implementation. The information was classified, or coded, to identify the properties and dimensions of concepts discovered in the data.

**Documents Review**

Documentation can be pivotal to fully understanding a site. Letters, memos, newspaper articles, news stories, credentials, awards, and school documents not only aided in triangulation, but also allowed another vantage point to substantiate information collected by other means.

Therefore, prior to meeting with teachers or observing classrooms, I reviewed the school's Internet sites, school documents, newsletters, and accreditation information, and spoke with administration personnel to learn demographic background, including socio-economic background of the students, ethnicity of students and teachers, and vision and mission statements, as well as school and classroom budgets. I also looked for school and teacher accreditations, awards, and standards of curriculum (i.e., whether or not they were mandated to follow specific criteria set outside the environment).

**Survey**

Yin's (2003) *Case Study Research: Design and Methods*, maintains that researchers can utilize multiple strategies for any given study (p. 9). For instance, one could conduct a survey within a case study or a case study within a survey. To further validate the ability to form generalizations about the environments observed, I created the survey to overview uses and technology in the classroom. The questions evolved from

the teacher interview, but allowed respondents to choose pre-selected responses based on answers received from the interviews. Of the twenty-four questions, three were open-ended, four did not allow multiple responses (i.e., yes/no or specific number), and the remaining seventeen allowed for multiple responses as well as a comment box to include additional information.

I used a program called Survey Monkey that allows the researcher to develop surveys, distribute, and manage responses on the Internet. All responses were stored and could be easily disaggregated using multiple variables. Teachers commented on the ease of the survey, and two asked for help to create their own for future incoming student families. To review the survey questions, please refer to Appendix G: Survey Questions.

***Member Checking***

Stake (2003) suggests that findings be validated with the participants prior to analyzing the data. Allowing changes, when appropriate, empowers the participant and ensures accuracy. Gilgun (1994) advises that "case study researchers commonly have other researchers not involved in the project read their studies, which can enhance validity. Increasing the number of interpreters of the data aids in triangulation" (p. 376).

Therefore, all findings were validated with the participants prior to analyzing data to allow changes. Participants each offered suggestions or made clarifications on my interpretations. Finally, copies of the study were shared with colleagues and faculty advisors prior to completion.

***Triangulation***

Stake (2003), Yin (2003), Patton (2002), and Gilgun (1994), agree that case studies should be approached using triangulation. Triangulation is the process of looking

at a specific study from multiple perspectives – whether it be through data, investigators, theories, or methodology (Patton, 2002). If one is studying the effects of a school-wide behavior intervention program, triangulation would suggest studying the perspectives of the student, teacher, administrator, parent, and others involved with, or affected by, student behavior.

In my study, I employed methods of triangulation. I utilized various methods to collect data – direct observations, interviews, and document analysis – to allow multiple views of a single situation or event to support the theory of triangulation.

The data collected from multiple sources provided a distinguishing perspective from the classroom teacher. I found the school publications to be especially helpful in gaining background information on the school's philosophy and missions. Additionally, the administration and support staff at both schools openly shared information that could not be found through teacher interviews or school publications and website postings such as: number of students receiving financial aid, adaptations to the environment to support students with special needs, and demographic information.

The information gained through various sources confirmed the connection between the schools' and their teachers' philosophy on how young children learn best, the diverse population of students, and the justification for choosing the environments.

***Data Analysis***

Once data were collected, the analysis process began. Patton (2002) describes the classification or coding scheme to be the first step. Strauss (1998) defines coding to be "the analytic process through which concepts are identified and their properties and dimensions are discovered in data" (p. 101). Merriam (1998) contends that "the right

way to analyze data in a qualitative study is to do it *simultaneously* with data collection" (p. 162). Furthermore, Merriam urges researchers to devise a system for organizing information early on in the study so the information does not become overwhelming. At the onset of observations, I used an abbreviated version of Table 3.2: Table of Codes to manage my transcribed observations. These themes were taken from Pressley's model, best practices in technology use, as well as best practices in reading instruction. This enabled the "possible categories, patterns, and themes" (Patton, 2002, p. 453) to emerge. With knowledge gained, the table expanded to include more descriptors of teacher interaction and technology use. Patton (2002) wrote, "[c]onstant comparative analysis is a central analytical approach in grounded theory" (p. 56). As observations continued, and themes emerged, the original codes needed augmentation, and previously coded observations were revisited to fit the new system. Categories were then derived and centered on each research question to enable analysis.

## TABLE 3.2

## TABLE OF CODES

| Type | Code | T |
|---|---|---|
| **Interdependence of Reading and Writing** | **I** | |
| • Phonemic awareness | i.1 | |
| • Phonics | i.2 | |
| • Vocabulary | i.3 | |
| • Fluency | i.4 | |
| • Comprehension | i.5 | |
| • Word identification | i.6 | |
| • Rate and fluency | i.7 | |
| • Spelling | i.8 | |
| • Grammar | i.9 | |
| • Mechanics | i.10 | |
| • Writing | i.11 | |
| • Organization | i.12 | |
| • Voice | i.13 | |
| • Word choice | i.14 | |
| • Sentence fluency | i.15 | |
| • Conventions | i.16 | |
| **Read-aloud** | **RA** | |
| • Individual | ra.1 | |
| • Small group | ra.2 | |
| • Large group | ra.3 | |
| **Opportunity to read and write purposefully** | **O** | |
| • Reading material at appropriate level for reader | o.1 | |
| • Social writing opportunities | o.2 | |
| • Purposefulness | o.3 | |
| • Ownership of writing | o.4 | |
| • Listen and share | o.5 | |
| • Respond in writing | o.6 | |
| • Participate in instruction (mini-lessons, shared rdg, sm group) | o.7 | |
| • Information gathering | o.8 | |
| **High standards of success for all students** | **HS** | |
| • Teacher matches instruct. practices w/students needs | hs.1 | |
| • Reference to state or federal standards | hs.2 | |
| • Understanding of students ability level | hs.3 | |
| • Assessment of student's ability level | hs.4 | |
| • Goal setting – teacher | hs.5 | |
| • Goal setting – child | hs.6 | |
| **Sufficient time to read and write** | **T.1** | |

| Type | Code | T |
|---|---|---|
| **Firm foundation** | **F** | |
| • Skills taught | f.1 | |
| • Scaffolded | f.2 | |
| • Working w/peers based on ability to mentor, support, reinforce | f.3 | |
| **Frequent and valid assessment** | **VA** | |
| • Assessment is diagnostic and informative | va.1 | |
| • Assessment is authentic and related to what was learned | va.2 | |
| • Teacher assessed learning | va.3 | |
| **Inclusion of home support** | **H** | |
| • Access to information via website for families | h.1 | |
| • Website information contributed by teacher | h.2 | |
| • Website information contributed by students | h.3 | |
| • Parent volunteers during technology lessons | h.4 | |
| • Workshops for families | h.5 | |
| **Highly trained, motivated, committed to pedagogy** | **C** | |
| • Teacher's expectations of the learner achieving goal | c.1 | |
| • Teacher's self perception of technology use | c.2 | |
| • Teacher understood uses of technology | c.3 | |
| • Motivation | c.4 | |
| • Access to latest technology | c.5 | |
| • Access to latest information | c.6 | |
| • Support to learn technology | c.7 | |
| • Teacher understands process of reading | c.8 | |
| • Teacher searched for resources | c.9 | |
| **Technology Practice** | **TP** | |
| • Tutorial and Practice (skills drill – phonemic, phonetic, grammar, etc) | tp.1 | |
| • Problem solving | tp.2 | |
| • Talking Books | tp.3 | |
| • Text-to-Speech | tp.4 | |
| • Hypermedia | tp.5 | |
| • Web-Based Communication | tp.6 | |
| **Miscellaneous** | **M** | |
| • Lesson matched use of technology | m.1 | |
| • Technology enhanced the lesson | m.2 | |
| • Teacher provided support to learn tech – modeled | m.3 | |
| • Teacher provided support to learn tech – verbal | m.4 | |
| • Teacher completed task and child observed | m.5 | |

All information was organized systematically and separately by case. Information gained from each site was sorted to find patterns to aid in the dissemination and clarification. The same classification system was used at each of the sites to organize data and allow for future possible generalizations.

The data were validated with the participants prior to analyzing the data to allow changes, when appropriate, empower the participants, and ensure accuracy. Finally, the development of conclusions, recommendations, and implications brought the individual study to a close. After the data were collected, coded, and understood singularly, constant comparative analysis among sites began.

> "There is no equivalent of a statistical significance test or factor score to tell the analyst when results are important or what quotations fit together under the same theme. Finding a way to *creatively synthesize* and present findings is one of the challenges of qualitative analysis" (Patton, 2002, p. 57).

Cases were cross-analyzed by comparing the findings of each site. Both the appearance and absence of themes were sought to enable the response to the final research question regarding the similarities and differences in technology use among teachers in the study.

# CHAPTER IV

# FINDINGS

## *Environment A: Biographical Information*

Throughout this study, the first teacher observed will be referred to as Kim. Kim has been teaching since 1978. She earned a B. Ed. and M. Ed., both in Honolulu, and taught in general education classrooms as well as a language arts classroom at Chaminade University. When her own daughter was entering school 12 years ago, she decided to leave the university and return to the early childhood general education classroom. Her expertise in language arts enabled her to facilitate integrated language arts, math, science, and social studies lessons.

## *Environment A: Pedagogical Perspectives*

Kim shared her perspectives primarily during our interview as well as during classroom observations. She stated that she believed that her role as a multi-grade 1-2 educator at Hanele School was to provide numerous opportunities to learn in a social environment where students feel safe and accepted. Mutual respect was a priority in Kim's classroom. Both students and teacher spoke to each other in a manner that was agreeable: calm voices, no put-downs. Classroom rules were designed by students and displayed for all to refer to. Reminders on using various work areas and graphic organizers for writing were posted. Kim taught reading and writing skills directly in mini-lessons and in context, when appropriate. Her students were asked to choose "just-right" books that matched their ability to the reading they selected; when a mismatch occurred, Kim redirected the child to choose something more appropriate.

Kim wrote in a letter to her students' parents, "Both readers and writers generate ideas, organize, monitor, problem-solve, and revise. In both reading and writing, the goal is to construct meaning. Reading contributes to the students' writing development, and writing contributes to the students' reading development."

She also believed that students become more connected to their purposeful learning when they were responsible for what was learned. Kim provided the framework (overall themes and which skills were to be targeted), and students provided the subtopics (e.g., Kim chose to study animals found on various continents, the type of information students should seek, and the level of difficulty based on a student's ability, while the student determined the animal they would like to study). Furthermore, the information gained was then transferred to projects where knowledge was shared with classmates, families, and the school in classroom or assembly presentations.

Additionally, Kim offered a curriculum that had a broad background in multiple genres (balance between fantasy, fiction, non-fiction, environmental, social and emotional). She stated that she was continuously seeking new information to enable her to reach more students in various approaches. Finally, she sought a balance among teaching skills directly, facilitating information acquisition, and having information acquired independently by students. "Children learn so much just by watching each other. We [teachers] need to make sure that information is accurate, and be there when it isn't."

***Environment A: View of Technology***

Kim reported during our interview that she felt technology should be used in multiple settings in countless situations to support literacy in her grade 1-2 classroom.

She stated that she used books on tape to increase fluency and auditory comprehension (as students follow along with the tape, they were to turn off the recorder and check their own reading), and the SMARTBoard ™ allowed the entire class opportunities to read together, search for information, edit text, and share projects. She also shared that she believed that e-mail can offer children the ability to communicate with others quickly, regardless of where they live, and computer programs can be selected to help children learn in multiple subject areas.

When Kim was asked what the role of technology was in her classroom, she responded by saying:

> "It is important for children because it is in their life. It must become a communication tool. At this level we use computers to help us with writing and publishing. Visual learning is so important. The computer helps us with research projects. Maps and pictures are right there to explore. Math, geometry – we can manipulate shapes to be symmetrical. If I didn't use technology, I would not, not, not reach some children."

She then discussed the importance of monitoring children while they use the computer to make sure each lesson is meaningful and relevant. "Sometimes lessons can just be silly, but that's not a good use of time. Lessons that are just cute aren't a good use of time either."

When asked how the children respond to the use of technology, Kim stated that she often partnered children up and gives them roles to complete tasks.

> "Sometimes one will be the reader and the other will be the typer, and then they switch. If a child is just hunting and picking at the keyboard, they can take too

much time to complete their work. They can also get lost looking from the paper to the computer keyboard and screen. If they have a partner, they can stay on task longer."

Kim stated that she believed the best way to teach emergent writers remained with paper and pencil. She shared that children can become frustrated when information was lost in the process of trying to hunt and peck keys. She has found children at this level do better if they already have a completed edited draft in hand before going to the computer. "If they are using the spell check all the time, a lot would be lost. I wouldn't know where they are developmentally."

Kim was found to use traditional methods to introduce children to sound-letter relationships. She shared that computer programs can offer assistance to further master skills; however, the responsibility of teaching skills should remain with the teacher. During my visits, I did not observe the children using software programs to teach or reinforce phonemic or phonetic skills. All skills were intertwined within the writing and editing processes of their projects. Again, Kim referred to not knowing whether the children were attaching the appropriate sounds to letters if they were sitting with headphones in front of a computer. She would not have the opportunity to sit in front of them to assess their progress, and the children would not get to hear their own voices in relation to others if they followed a computerized program. Furthermore, she believed that retraining poorly learned skills is more taxing than spending the necessary time with children in the beginning.

Kim shared that she ensured the computer area is a quiet work area. Although they did have time where they can practice typing in a game-like manner (Sticky Bear

Typing), Kim said, "They can play computer games at home. We use the computer at school as a learning tool." She further shared that the students did not have a scheduled time when they met with a computer teacher, and were not mandated to work on the computer for a set amount of time. When asked about typing skills, Kim responded,

> "They can work on that as they get older. Right now they work much faster with a paper and pencil and are able to touch, erase, draw arrows, and move things around easily. We just stick to what works for them – they are still little guys."

Students were allowed to choose to work on the computer during activity time if they liked, or could make a "mindful choice" to use the computer during inquiry time. All of the children did have the opportunity to use various types of technology during free choice periods. However, when a child shied away from any type of use, Kim reported that she invites them to try something new.

***Environment A: Personal Use of Technology***

Kim reported that she used technology outside of the classroom to organize music and photos, communicate through e-mail, make purchases, conduct searches for information including medical information, and travel accommodations. Much of the skills necessary to use technology at home had either been self-taught or learned through sharing with family members. The desire stemmed from her need to either gain or share information. "We really teach each other. Sometimes my daughter knows how to do something and she teaches me, or the other way around. We really just explore and try to figure things out."

Kim became "excited about using it [technology] myself. I didn't want to get left behind, and I certainly didn't want the kids to fall behind because of me." She took a

class offered at another school, but when she joined the staff at her current school, she knew they were progressive and there would be a push from administration to move ahead. She remembered her administrator being "very deliberate" in choosing different types of technology based on the students' social, emotional, and developmental levels.

At school, Kim reported using technology to complete narratives of student assessment, communicate with parents, school-level and classroom blogs, and gather information.

***Environment A: Uses of Technology in the Classroom***

**Throughout the Curriculum**

Kim was observed using technology throughout the curriculum. Lessons were created and implemented to support multiple subject areas simultaneously. Kim was observed teaching skills within the context of writing. Students were given multiple opportunities to purposefully write, edit, and publish pieces. As formats were discussed, mini-lessons were provided to enable children to complete tasks successfully. Kim had multiple leveled books available. Students were given opportunities to choose books they felt matched their level of proficiency. They were also observed reading aloud to Kim. When a discrepancy between proficiency and ability occurred, Kim redirected the student to make a more appropriate choice.

Kim was observed offering extended periods of time to allow children to read and write. She shared her belief that children must have ample time to practice skills often if mastery is to be achieved. Kim's learning environment was not strictly broken into blocks of time when activities must be completed. Kim allowed multiple periods to complete tasks or projects. These work periods often included overlapping lessons in

math, science, and language arts, which permitted a flow of time from one task to the next. After one observation period, I asked Kim why she chose to incorporate writing sentences with an apparent math lesson. She responded, "Oh, we really try to tie everything together. It's not just math time or writing time. You have to have it all work together."

**Drills Software**

Kim stated that the only drill software she used in her classroom was *Stickybear Typing*. Following a classroom observation, Kim shared that she does not believe drills software to be the best use of time in the classroom. She preferred to have the children practice their skills during active reading and writing opportunities.

**Internet**

During our interview, Kim said that "the children use PBS sites and GoogleEarth independently. When we were talking about China – we were really able to find a lot of information on the Internet." Kim went on to say that children used the Internet to conduct other independent searches, however, she limited the sites for pre-selected search engines to those determined by the school. Information was gathered both in school and at home.

The Internet was also used to share information with her students' families. The school-wide website offered links to each teacher's classroom, including specialty teachers. The classroom site included upcoming events, photos of activities, and links to past postings. Kim uploaded newsletters, information about projects, classroom learning, and photos multiple times throughout the month. Parents were sent an e-mail with a link to the class site each time anything was uploaded to the site.

During my observations, the Internet was not used to play games or access talking book sites.

Finally, Kim stated during our interview that she and her colleagues "use the Internet to plan curriculum mapping." She felt that the "linear [organization] helps keep everything in place." This allowed Kim and her three multi-grade 1-2 colleagues to develop curriculum when it was convenient.

**Group Instruction**

In all of my observations of technology use during group instruction, the SMARTBoard™ was used. Please refer to the section titled SMARTBoard™ on page 83 for more information.

**Research Collection, Presentations, and Partnered and Group Assignments**

Kim reported during our interview that the children often determined how they would like to disseminate their learning to their classmates and family members. She stated that her students generally shared gained information in the form of a presentation. During an observation, Kim met with her multi-grade 1-2 class as a group in front of the SMARTBoard™ and discussed the upcoming activity, including expectations of learning outcomes, preceding dismissal. Each student, or group of students, checked in with the teacher to ensure they understood their responsibilities. Prior to sending children to work with their groups, she viewed their work folder and asked each child what their plan was for the next block of time. Children were not dismissed until they had a clear work plan.

Those children who were ready to type their notes and create slides sat at computers with their group members. Some children worked in pairs; one child took on the role of reader while the other typed. As mentioned earlier, Kim believed that this

allowed children to remain focused on typing without getting lost when looking between the keys, screen, and their handwritten draft.

During an observation, the first and second graders worked on an inquiry-based botany project. Each group developed five questions they would like answered about their specific plant. They found information in books, magazines, learning trips, and on-line websites pre-selected by the teacher. Children took notes, and color-coded for themes related to their previously determined questions. Children first coded their notes individually and then met as a group to compare notes. During group meetings, the teacher sat in to help organize notes. In their groups, children took turns reading their notes at a round table and later conferred with the teacher about the most important facts to include in their project. Once approved, the groups went to the computer to type out their notes into a written format that followed a logical and cohesive flow. Kim shared that she felt that students at this level needed to be assisted in choosing and organizing facts.

During this observation, the following types of technology were available for the students to use: computer (software and Internet), printer, headphones (attached to the computer to minimize classroom noise), and a tape recorder (in the listening center) for students who completed other tasks. Students were not required to use any form of technology during this observation. They could have chosen to present their findings in any medium of their choosing. However, all groups, with the exception of one, did choose to use the computer to create a KeyNote presentation. The one group that did not choose to make a slide show created a diorama. Two children, who had completed their

written work and were waiting for an available computer, visited the listening center to read along with tapes.

***Environment A: Equipment Used by Students***

**Computer**

The study found that Kim allotted ample time for her students to read and write. As for the use of technology to support writing, computers were used, but only after drafts were edited and approved for publishing. As mentioned previously, Kim shared in our interview that she believed the limited typing abilities of her young learners could slow children down to the point that they lost their thoughts. She felt that children were able to write more creatively when they used their time to write with a paper and pencil.

Kim was observed using technology to encourage the development of reading, but these opportunities were offered during "mindful-" or free-choice periods. During my observations, when children had a choice of reading a story on the computer or from a trade book, they chose to read from trade books. I did not observe any children reading along or listening to stories on the computer.

**SMARTBoard™**

During an observation, Kim asked the children to sit in a U-shaped formation in front of the SMARTBoard™. The lesson's objective was to further understand the concept of counting by groups.

The teacher first demonstrated counting by groups with counting bears. Next, she asked children to practice making groups of bears. After noting the students' success, she then went to the computer and accessed the already loaded *KidPix*™ program. She demonstrated how to use the stickers in *KidPix*™ to make arrays; she highlighted ways to

change shapes, colors, stamps, etc. After she made an array, she typed a sentence representing her array. Students were then called upon to come up in front of the group and complete the task. Once the group was able to accomplish the task to the teacher's satisfaction, she dismissed selected students to go to the computer, open *KidPix*™, create arrays, and write sentences that represented what they had created. Other students, who were less capable with this task, were asked to first create the array with counting bears and then transfer that to paper. The teacher could be heard questioning children, "Hmm, does that sentence match your array? Our writing needs to match your array." and, "Those sentences are true, but they don't match your array, do they?"

Kim stated she could have conducted the entire lesson without the use of the SMARTBoard™; however she believed that it allowed all children the opportunity to view the lesson at the same time as well as ask questions which might further aid others' learning.

**Microphone**

Although the use of a microphone was not observed during my visits, Kim stated that the students used a microphone when reading aloud to the class or presenting information. A microphone was used to allow all listeners to hear what was shared.

**Tape Player/Recorder**

Students were offered the experience of enjoying talking books on the computer. However, when children were found to be digressing from the intention of visually tracking the storyline and beginning to socialize with classmates, the option to use the tape recorder or computer was removed.

During an observation, students were individually reading stories to Kim, and then writing a reflection on their reading. They were asked to either transfer their writing to a document on the computer or re-write it in their neatest handwriting. Students who were done with their work were given the option to either read quietly or listen to a book on tape in the Listening Center. The Listening Center was supplied with a tape player, headphones, and dozens of plastic bags each encasing a single book and professionally narrated corresponding stories tape.

Two boys chose to visit the Listening Center; one was a student in the first grade, the other was in the second. The boys listened to different stories. As the first grade student followed along, he began reading aloud in a voice that could be heard by others. The second grade student tapped the student on the shoulder while holding his finger to his mouth. The first grade student then began reading along silently while mouthing the words.

**Software Programs**

During one observation, children worked in groups of 3 to 4 on continent projects that would be presented in a slide show. Although students were already familiar with the program, Kim began by saying, "We are all learning KeyNote together." She demonstrated how to use various components of the program and fielded any questions. Kim stated that she wanted her students to understand that learning is a continuous process that we are all a part of – no one is ever done learning.

The children had access to working in Microsoft *Word*, *Apple Works*, *KidPix*, and *Stickybear Typing* when appropriate.

**Printer/Scanner**

During an observation, a child completed his task of creating an array and typing a corresponding sentence in KidPix, and was ready to print and turn in his work. He was having difficulties printing and went to ask Kim for help. Kim realized that he hadn't selected a printer. First, she shared her findings and then modeled the process of choosing a specific printer. She did not complete the task, but left the computer in the same window it was upon her arrival and watched as the child independently followed her instructions.

Work was often printed and displayed around the classroom or placed in progress portfolios. Progress portfolios are a compilation of goals, work, and assessments that remains in the classroom throughout the year and goes home with the child at the end of the year. Children were able to print in color; however, prior to printing, Kim asked that children first clear their pieces in order to save resources.

Although a conversation between child and teacher about scanning a "Just-Right" book's cover for their progress portfolio was heard, I did not observe the use of the scanner.

**Headphones**

Children were observed using headphones in the computer and listening center. This allowed children to remain undisturbed while working or reading in and out of the computer and listening centers.

***Environment A: Supported Skills and Strategies***

**Grammar, Phonemics, and Phonics**

As stated previously, Kim did not use any form of technology to teach skills. The objectives of lessons that used technology were not to explicitly teach grammar, phonemics, or phonics. Practice of these previously learned skills were taught concurrently with active reading and writing. Many of these lessons were completed using one or more forms of technology that primarily consisted of the computer (through projects and writing assignments) and the tape player (to read and record stories).

**Fluency**

Kim used books on tape to encourage reading fluency. The stories consisted of professionally narrated recordings as well as readings recorded by students. She also displayed stories on the SMARTBoard™ to be read collectively as a group. Kim shared during our interview that "Technology is proactive. The children are able to follow along with expression and voice."

**Comprehension**

Comprehension was observed being taught during whole and small group instruction while students responded to questions about reading selections from the Internet on the SMARTBoard™. Students read the selection aloud, and Kim stopped periodically to check for understanding. Kim stated that this was a common activity.

Comprehension of information gained from Internet sites was observed during inquiry periods when students gathered important facts about their topics. Students were expected to read the sites and determine if the information was accurate, informative, and significant.

Additionally, comprehension was addressed during the sharing of *Keynote* presentations. Students in the audience were asked to respond to specific questions regarding what was learned from the presentations.

Finally, Kim shared that comprehension was not taught explicitly through any commercially prepared curriculum programs such as *Accelerated Reader*.

**Writing Strategies**

During our interview, Kim shared that she used "the computer in the publishing zone. Kids still need to practice handwriting and editing skills." Kim's writing projects offered the optimum opportunity to develop literacy as the child gathered information on topics of interest, determined and then listed important facts, organized information, and wrote and edited their paper. Following their prewritten text, the children transferred their writing to the computer prior to adding pictures or drawings to illustrate their point, all while having their teacher and peers available in a cooperative learning environment.

**Spelling and Vocabulary**

Observations of gaining new vocabulary through the use of technology occurred during inquiry project information-gathering periods. During this time, students collected information that was meaningful and relevant to their research questions, which often included learning new terms. These new words were then transferred to the students' individual spelling journal.

Kim taught spelling through target sounds and words used in their own environment. Each week, a different sound was targeted, and students practiced spelling words with the same sound (e.g., if the /o/ sound was targeted, chosen words could have been boat, tone, Joe, and door). The list of words was divided into three levels: One,

Two, and Challenge. Multi-syllable words as well as words used in current inquiry projects were added as "challenge words" (e.g., if they were studying the prehistoric period, "paleontologist" might appear as a challenge word). Children in grade 1 had to minimally study List One, and grade 2 student were required to study Lists One and Two, but all students were encouraged to study all three lists. Students whose skills were beyond those lists were given other words specifically targeted for their level.

Kim was observed utilizing spelling dictionaries in which children kept a list of words they would like to learn or had spelled incorrectly in their writing. These techniques allowed children the opportunity to learn words that were meaningful and relevant to their lives. The use of technology to support spelling was not observed.

**Typing**

Students had access to learn typing skills through a software program called *Stickybear Typing*. This opportunity was not available during my observations as they were considered work periods. Access to the typing program was only available during free choice periods, before school, and when all other work was completed.

***Environment A: Reason for Non-Inclusion***

**Inability To See Where Children Were Developmentally In Writing Pieces**

During our interview, Kim stated seven reasons why technology was or had been suppressed. First, as previously stated, Kim believed that she would not be able to have a clear picture of her students' reading abilities if they were doing all of their reading, writing, and assessment on the computer. She said,

> "Well, if they are using spell check all of the time, I wouldn't know a lot of what they are missing, what they don't know. You can't support a child if you don't

know where their strengths and weaknesses are. I think editing tools should be saved for older grades when the children already have a clear understanding of the writing process."

**Inability To Hear Sound/Letter Correlation While Reading**

Again, Kim believed that she would not be able to hear and adequately assess her students' reading abilities if they were doing all of their reading with the computer. She believed that her students needed to be guided to promote healthy habits at a young age.

**Typing Ability Slows Down Thought Process**

As stated previously, Kim believed that typing slowed down her readers. She felt that students at this young level were still hunting and pecking at the keyboard, which slowed down their thought process.

**Time**

Kim informally shared during an observation that she believed the lack of practice time limited the level and frequency of technology used in the classroom. Kim believed that finding time to incorporate technology into the curriculum, personal training, and practice time to master its use are inhibitors to using technology.

The students were not scheduled for a pull-out period of time to work with a technology teacher nor were they required to spend a minimum amount of time on the computer; that remained voluntary. Kim shared, "I make sure everyone chooses some of the time. But, I don't have a schedule where I make them check off to make sure they spend so much time on the computer." Even though Kim felt that the amount of practice time was limited, she would not want to have the children pulled out to work with a technology teacher. She said, "Oh, no, that would be worse!" Kim believes that

curriculum should flow into connected pieces of information, and technology should remain a support tool.

**Appropriate Internet Sites**

Kim shared she was "interested in finding more appropriate sites for kids." The school sponsored a search engine that allowed access to links that were rated by reading level. The rating level was not the only issue; safety of young learners was of utmost importance. Although the school did have safety features limiting the navigation of Internet sites, worrying about children accessing inappropriate site was still on Kim's mind. "We have to be so careful that the children aren't exposed to anything bad or information that isn't correct. You really have to preview what they are doing to make sure the site is okay." She shared that she goes over the different types of sites, but encouraged her students to find the same facts in more than one site before committing it as truth.

**Personal Knowledge**

Kim was a proficient user of technology. However, when asked about barriers that inhibit technology use in her classroom, Kim replied, "My own knowledge and experience. We are given the tools – very generously – the only barrier is how much I know." She shared that she had the opportunity to do anything; she just needed to learn how to do it.

**Technical Difficulties**

Kim shared that "servers are a part of the benefit of having technology, but there are always problems, too. Sometimes we are ready for a lesson, and the server is down.

We can't access the Internet or upload our work to the server." She was then forced to quickly change direction before losing the attention of her students.

***Environment A: Reason for Inclusion***

Kim shared four main reasons for the inclusion of technology to support her curriculum: communication tool, visual learning, different types and strategies of learning, and technology use in her students' lives.

**Communication Tool**

The study found Kim to frequently include families in the process of educating their children. Each week a newsletter was posted on the classroom website listing spelling words, class events, and projects. Photographs of activities were also posted on the website and could be downloaded to families interested in making their own copies.

Kim also communicated through telephone, e-mail, and handwritten letters to inform families of changes in behavior or temperament, or social problems and celebrations.

**Reaching Different Types And Stages Of Learning**

The study found Kim to masterfully match students' needs to instructional practices. She believed that all students were able to learn, but often at different rates and with diverse interests. Kim was responsible for assigning inquiry projects; however, it was the individual students who determined what they were interested in studying within selected parameters. Kim might first select the topic of animals and design to follow: habitat, lifestyle, physical characteristics, interesting facts. Then, students selected specific animals of interest to them. It was often observed that Kim generated groups based on the group's ability to support each other. More proficient technology users or

readers might be paired with those who were less proficient to provide modeling opportunities and support. Additionally, the level of information necessary to complete projects was adjusted based on the students' abilities.

Kim was observed providing high standards of success for all students. She presented challenging curriculum while offering assistance to those in need via peer and teacher interactions. As the environment was multi-grade, the curriculum was prepared for students of multiple ages and abilities. Kim offered a higher level of success to children than they would be able to accomplish individually. Vygotsky's (1978) zone of proximal development, the range where children are able to solve tasks at a higher level, based on the assistance received from an adult, than they are independently, was extended from working with an adult to working with proficient peers. This was observed on numerous occasions during inquiry projects. Students were given rubrics to follow as they completed both independent and group portions of assignments. The opportunity to use technology to encourage high standards to be met was offered through computer programs and stories in the listening center.

After an observation, I asked Kim why some of the children did not use the computer after a lesson. She stated that, "It just wasn't right for them for this lesson. They needed more hands-on with the manipulatives to develop their understanding. If they were just at the computer, they might not get it."

**Technology In Students' Lives**

During our interview, Kim shared that she feels technology "is important because it is in their lives." Furthermore, she believed it was her responsibility to help them

develop a strong foundation and interest in the use of technology to help them answer questions and communicate with others.

***Enabling Factors***

Kim said that the administration has provided opportunities, both mandatory and optional, for teachers to learn more about technology currently in place. A technology coordinator was available for the elementary school, but the middle and high school coordinators could also be solicited for help, if needed. Kim shared that other teachers were very open to sharing what they knew and had done in their classrooms. "Initially, Mrs. X [principal] was the driving force – now it is just the mindset. Most of the teachers here look for ways to include technology."

The following table is a compilation of Kim's biographical background and reported classroom uses of technology gained through our interview, observations, discussions, and survey questions.

**TABLE 4.1**
**ENVIRONMENT A: KIM – HANELE ELEMENTARY SCHOOL, GRADES 1-2**

| Teacher | School | Grade | Years of Exper | Level of Tech Use* | Classroom Use of Technology | Equipment Used by Students | Skills/strategies Supported | Reason for Non-Inclusion of Technology | Reason for Inclusion |
|---|---|---|---|---|---|---|---|---|---|
| Kim | Hanele | 1-2 | 25+ | ++++ | • Throughout curriculum<br>• Drills software<br>• Internet<br>• Group instruction<br>• Presentation<br>• Collect research<br>• Partnered and group assignments | • Computer<br>• SMARTBoard™<br>• Microphone<br>• Tape recorder<br>• Software programs: *KeyNote*, MS *Word*, *Stickybear Typing*, *Apple Works*, *KidPix*<br>• Books on tape<br>• Printer<br>• Scanner<br>• Headphones | • Phonemics<br>• Phonics<br>• Fluency<br>• Comprehension<br>• Writing strategies<br>• Vocabulary<br>• Typing | • Inability to see where children are developmental -ly in writing drafts<br>• Not hearing sound-letter relationship while practicing reading/drills<br>• Typing ability slows down thought process while writing<br>• Practice time<br>• Appropriate Internet sites for students<br>• Personal knowledge | • Communication tool<br>• Visual learning<br>• Researching tool<br>• Different types of learners |

* Level of Technology Use – four-point system based on comparison of teachers in the study

***Environment B: Biographical Information***

A second multi-grade 1-2 teacher at Hanele School was included in this study. She will be referred to as Emily. Emily attended a college-preparatory school from kindergarten through the twelfth grade. She went on to receive a Bachelor's degree from Stanford University and her Master's in Education at Chaminade University in Honolulu. Although this was her first year teaching in a multi-grade 1-2 classroom, she had also taught preschool and kindergarten. She displayed all of the characteristics of Pressley's model of an exemplary teacher.

***Environment B: Pedagogical Perspectives***

Emily believed in a multi-sensory, multi-modality approach to learning that included audio, visual and kinesthetic senses. Learning was strongly attached to the social Deweyian style, where learning takes place in a hands-on atmosphere. She believed this must be done through an environment that ensures respect for others, where every child is honored and heard.

Emily firmly believed a "strong connection between parents, teachers, and student was crucial to the overall academic, social, and emotional development of students." At least once a week, Emily uploaded pictures, discussions, classroom news, and upcoming events to her classroom website.

She stated that she adhered to the concept of "structuring students for success." When speaking with Emily about this structuring process, it sounded more like structuring *her* teaching and understanding about how children learn rather than compiling a to-do list for children to follow. She believed this was done through offering a broad background in multiple genres while providing students and herself with multiple

opportunities to seek new information and learn purposefully. Emily's background in Orton-Gillingham provided the structure for teaching phonics, and her commitment to authentic literature drove her desire to create a balanced approach to teaching reading and writing with purpose.

***Environment B: View of Technology***

Emily is from a generation that grew up with technology, not just in her classroom but in her home as well. Computers and the Internet were a part of everyday school life, not a tool to be considered or feared. I asked Emily if she could imagine her life without technology, she responded by saying,

> "I *can* imagine my life without technology, but not as a fully functioning person in today's world . . . e-mail is my preferred form of communication now. When the telephone rings, I cringe because I have to talk to someone, but e-mail can sit quietly until I am ready to respond . . . I can't imagine teaching without technology. Yes, it is totally possible, but once you know what you've got [technology] I would have trouble teaching without it."

***Environment B: Personal Use of Technology***

Throughout our interview, Emily shared that she personally used technology daily to communicate with others through e-mail, organize photos and conduct informational searches as well as for entertainment. "I am an e-mail junky. I'm always checking for messages from parents, friends, and other teachers." When asked if e-mail can be distracting for teaching, she responded,

> "You know, it really could be, but there's just so much going on in the classroom that I wouldn't even have time for it. I check all the time, but am not always able

to respond. It's kind of like the telephone. If it rings during class, you know they'll leave a message and you can get back to it when you have time. You pick and choose when you are going to respond."

Emily also personally used chat rooms to communicate, make purchases online, and writes letters on a weekly basis. She also used the computer to organize music about once a month and used the Internet to play games very infrequently (less than once a month). At school, Emily reported in the survey that she used the computer to communicate with parents through e-mail, organize lessons, prepare narratives of student assessment, gather information, and obtain curriculum ideas daily. She also stated that she communicated through school level and student blogs, managed her website, and organized grades more than once a week.

Much of the technology Emily used had been self-taught. She infrequently depended on the use of software tutorials, support staff, or friends or family members to help her with the use of a new program or type of equipment. She said that she will most often "play around with it until I figure it out."

***Environment B: Uses of Technology in the Classroom***

**Throughout the Curriculum**

Emily believed that technology should be used throughout her multi-grade 1-2 curriculum to support not only literacy, but all aspects of a child's education: math, science, art, music, social studies, and communication. She believed that these subjects complement each other and can be taught concurrently. During an e-mail communication, Emily wrote:

"We don't just do math or science or reading. Sometimes we use the SMARTBoard™ to manipulate tangrams and then we talk and write about what we've done. Or we do research on animals and look at artwork on the Internet. It's all connected."

Emily went on to say that they do not have time for "fluff." The students worked with a purpose; they were not permitted to enter the computer area without a task at hand. Students were not permitted to play games. They could, however, use the computer independently for educational games such as *Stickybear Typing* or phonics reinforcement, as needed.

**Drills Software**

Emily reported using *Stickybear Typing* to encourage her students' ability to type correctly. She discussed the differences in opinions teachers hold on the appropriateness of keyboarding skills with young children. "We discussed keyboarding skills at a faculty meeting, and some teachers said that the children's hands are too small to teach proper typing. However, I disagree. Children play the piano just like adults. They can learn proper keyboarding." She went on to discuss laying down a good foundation of skills. She believed that proper keyboarding skills are similar to holding a pencil correctly. Unlearning bad habits iss much more difficult than learning properly from the beginning.

Emily shared after an observation that she was seeking appropriately leveled phonics and phonemic software programs. She was not using them frequently to support her curriculum as she had not found one that fit her criteria.

**Internet**

The Internet was used throughout the day in Emily's classroom by Emily and the students to gather information, upload information to the classroom website, and work on websites with talking books. Students were able to independently log on to the Internet with no assistance from classmates or their teacher. Access was limited to school-sponsored and teacher pre-viewed sites.

**Group Instruction**

Emily used large and small group instruction daily. During each observation, group instruction took place in conjunction with the use of the SMARTBoard™. Please refer to the SMARTBoard™ section on page 103 for information on specific uses of technology during group instruction.

**Research Collection, Presentations, and Partnered and Group Assignments**

Emily stated that the most frequent use of technology to support literacy in the early childhood setting was to gather information. Gathering information was done daily, and often throughout the day. On one particular visit, the classroom was learning how to collect and review information from the Internet. The lesson began with Emily saying, "Today we are using the Internet to learn information about Moon Jellyfish. We are going to learn about an animal together so we will know what to do when we are working on our own animal." She then went on to ask her students what they already knew about Moon Jellyfish. Students responded with multiple answers and were met with positive reinforcement from their teacher. Next, she asked the children to remember a school-wide picnic they attended at the end of the previous school year. She logged on to Google Earth and showed them the exact location. Then, she moved the focus of the

window to a location next to the picnic area and said, "This is where I caught our lovely invertebrate friend yesterday while kayaking." Emily unveiled a plastic tank with a Moon Jellyfish swimming around. After all of the children had a moment to view the jellyfish and were able to share comments based on their observations, Emily placed the jellyfish out of sight, and focused the children on the SMARTBoard™, where she had pre-selected a site for the children to gain information on Moon Jellyfish. The children read together as a group while Emily moved the mouse in tandem. Each time a new or interesting word was read, Emily stopped and asked for clarification.

"Oh, this says they are *fragile*. What does that mean?"

"Glass is fragile," a student responded.

"Oh, yes, glass is fragile because it can break easily. What else?"

"A window," another child replied.

"Yes, what about the opposite to fragile?

"Sturdy," said a boy raising his hand.

"Brilliant. Sturdy is the opposite of fragile."

The group continued reading and pausing when appropriate. When they read that jellyfish swim with pulsating action, Emily asked the children to pretend they were jellyfish and show what their hands would look like if they were pulsating. After reading about lingering dangers of being stung by dead jellyfish, a child raised his hand and said, "If you chop off its head, it won't sting you."

"How did you learn that?" Emily replied.

"I just did," responded the child.

"How do we know that the head won't hurt you? How do we know if this information is correct?"

"We can do research in books and on the Internet to find out," another child answered.

"You are right. We can do research to find out if our information is correct," Emily replied.

This lesson supported uses of technology, vocabulary, reading fluency, comprehension, creative movement, and information gathering, as well as phonic and phonemic awareness in the context of active reading. Furthermore, it was an active modeling experience for the students to use while working on their own animal research project. Emily reported frequently using this type of modeling activity prior to children's independent and group work.

***Environment B: Equipment Used by Students***

**Computer**

Emily's students used the computer daily to complete independent and group lessons. She reported that students used the computer daily to gather information and for shared and guided reading. Her students accessed software for tutorials and drills weekly, and wrote projects, shared information, and did read alouds more than once a week.

After one visit, the children left the room, and Emily and I had a moment to talk. I noticed that she did not have a listening center in her room and inquired why she chose to exclude one. At first, Emily didn't understand my question, and said,

"What do you mean? They follow stories on the computer."

I replied, "Do you mean through Talking Books?"

"No, I just download stories to iTunes and the kids log on."

"Wow, so you've cut out the necessity to allocate more space in your room by having another use for the computer."

"I didn't even think of having a separate center. I could set one up, but I think tapes are kind of outdated, don't you? Nobody buys tapes anymore, and then you have to keep track of everything."

Emily encouraged her students to use the computer for multiple purposes throughout the day. As it was connected to the SMARTBoard™, it was used frequently. Independent computers were used by students to gather information, publish final drafts, share information, and for shared and guided reading.

**SMARTBoard™**

Each of the five observations made in Emily's classroom began with the children sitting on a rectangular rug in front of the SMARTBoard™.

> "Even having the use of the SMARTBoard™ has totally changed the way I introduce students to something new. It also makes us a 'spontaneous' class because as questions arise, the World Wide Web can take us to an answer right away. Instead of saying, 'I'll get back to you,' I turn on the SMARTBoard™ and the children jump aboard the learning train into cyberspace. They become the researchers *with* me, and we investigate an idea or question together."

During a visit, Emily asked the children to meet on the carpet in front of the room as she logged onto a program called *Power Polygons*. The program allowed the

manipulation of shapes to create a picture. Emily ensured that the children used the proper terminology of each shape and action.

Emily began the lesson by informing the children of the rationalization for the upcoming activity and future uses.

"Last time we did it with tangrams. Shall we try it with *Power Polygons*? We are going to do this as a group. Next week we will have this on all of our computers, and we can practice on our own computers, and we can practice on our own."

She continued to go through the program but did not make any moves without explicit directions from her students. The students walked her step by step through the process of completing the desired shapes. Emily asked, "What do I do?"

Multiple children raised their hands. Emily called on a student who responded, "Open it."

"Open it? How do I do open this?" she replied.

"You have to move the arrow to the program and click on it two times," she said.

"Oh, like this?"

"Yes."

While this continued, some children were not able to express themselves verbally to the point that their instructions were clear. At times they would come up to the SMARTBoard™ and point to what needed to be done. Emily then reiterated their instructions verbally in question form (e.g., "You want me to click on the orange rectangle and move it next to the purple octagon?").

At one point, a child gave Emily incorrect instructions. Emily continued to follow the instructions and let the child realize the mistake. She then asked how they

could solve the problem. The children offered various responses, and each was tried until a solution was found. This was followed by a discussion of the necessary action needed to rectify the problem.

After the children were able to give directions with confidence, Emily asked them to come up to the board individually to solve another problem. While children worked with the SMARTBoard™, they also were given a set of manipulatives to complete the task in front of them. This continued until the students were asked to go to their desks and write about their activity.

In an e-mail, I asked Emily how she learned to use the SMARTBoard™. Emily responded:

> "I just started playing around with it. I still am not using the SMARTBoard™ to its full potential (there are some awesome applications that go along with it). Just last week I discovered these dice that roll when you click on them. My first graders are having a blast touching the screen to make the two or three dice roll and then doing the addition ad subtraction problems . . . my mom also uses a SMARTBoard™ for her high school math classes, so she tells me about some of the things she's doing with it."

**Software Programs**

Emily shared during our interview that she used the following software programs to support literacy: *KeyNote*, Microsoft *Word*, *Apple Works*, *KidPix*, and *iTunes*. She also used *Stickybear Typing* to encourage the development of typing skills.

*KeyNote*, *Apple's* version of Microsoft's *PowerPoint*, was used to present information in a digital format to share with classmates and family members. The

presentations included pictures taken by the children using a digital camera, recordings or student voices, and information about specific topics learned during inquiry process. Microsoft *Word* and *Apple Works* were used in the final stages of writing to type drafts for publishing and to complete assignments. *KidPix* was used to create images in support of written text, and *iTunes* was used to read along with narrated stories.

Emily shared her disappointment with some software programs that teachers were not able to "dismantle pop-ups within the story." She limited the use of many programs as she felt that they could pose a distraction and her students could easily get lost in the game aspects of the lesson.

**Printer/Scanner**

Children in Emily's classroom had access and were allowed to use the classroom's printer and scanner. Students printed writing projects, relevant information found on the Internet, and completed work. The scanner was used to copy and store handwritten work, pictures, paintings, and covers of books to include in the student's assessment portfolio.

**Headphones**

Students used headphones to minimize the classroom noise level and allow students in and out of the computer area to concentrate on their work.

**Digital Camera**

Emily reported using the digital camera daily to record classroom activities and student work. Various photos were displayed in the classroom, posted on the classroom website, used in *KeyNote* presentations, and inserted as documentation of learning in their assessment portfolios.

***Environment B: Supported Skills and Strategies***

**Grammar, Phonemics, and Phonics**

Emily used phonemic and phonetic software, read along books, and Internet sites once a week to support the development of grammar, phonemics, and phonics. She did not use any of the software of Internet sites to introduce skills or concepts. Grammar, phonemics and phonics were primarily taught during active reading and writing, small and large group activities, and individual activities.

**Fluency**

The use of technology to support fluency was done through active reading during group lessons as well as through individual time using *iTunes*. When students used *iTunes,* they listened to narrated stories stored in *iTunes* and followed along with classroom copies of corresponding trade books. This use of technology served the same purpose as traditional listening centers.

**Comprehension**

Emily taught comprehension through active reading and writing. Observations of student discussion during whole group inquiry based research searches were made. Emily frequently stopped the reading to highlight, clarify, and review information throughout readings. Students did not participate in any form of technology to administer commercially prepared comprehension assessments. Please refer to the Research Collection, Presentations, and Partnered and Group Assignments section on page 100 for an observation of Emily teaching comprehension strategies in whole group instruction.

**Writing Strategies**

Emily stated that she used technology for writing projects that included multiple subject areas. During an observation, Emily began her lesson by inviting the children to sit together on the floor in front of the SMARTBoard™. She told them that they were going to be getting ready for a learning trip to the Academy of Arts. She then reviewed information gained from a classroom guest from Museum-in-a-Box. Museum in a Box is an outreach program of the Academy of Arts that takes art pieces and artifacts to the classroom for observation and discussion. Emily continued her lesson by saying, "I found some neat websites that have to do with animals in pictures. We get to put together a story based on what we think the pictures are showing." The children read the website pages as a group and then were asked specific questions based on the artwork. The story changed depending on the group's choice. Emily found that the website was reading aloud at a rate that was too fast, so she turned off the volume and read with the children at a pace that matched her students' ability level.

Next, the children were shown a picture of Pablo Picasso's *Goat* sculpture. They were asked various questions about the size, shape, and temperament of the animal. Finally, they were asked to view Henri Rousseau's *The Sleeping Gypsy* and respond, in writing, what they believed the artist was trying to say. This writing took place in their Writing Journal. The Writing Journal was a lined composition book – thick lines for grade 1, thinner lines for grade 2 – which housed writing drafts.

All of the children's ideas were accepted, as long as the child was able to reasonably make a connection between their thought, the piece, and what they wrote. Students were encouraged to go back and correct spelling and grammatical errors as well

as include more information when necessary. These writing pieces did not go through the publication process during my visit.

**Spelling and Vocabulary**

As illustrated in the previous section, spelling and vocabulary were taught in the context of active reading, writing, and investigating. Terms found are highlighted and then written in spelling journals and project information sheets. As Emily's curriculum was experiential and lessons were directly related to units of study, spelling and vocabulary software programs were not used.

**Typing**

Please refer to the section on software programs on page 105 for specific information on Emily's use of technology to teach typing.

***Environment B: Reason for Non-Inclusion***

During our interview and through e-mail conversations, Emily shared the following two reasons for not including more technology in her classroom: time and additional software options. However, Emily clearly stated that neither of these were foremost issues that restricted her from using technology.

**Time**

When asked which factors inhibited Emily from progressing now, she believed that time was the biggest block to using more technology. "Our days are just so full, it's hard to find time to do everything I want." She also indicated that it was challenging finding the time necessary to not only find additional resources, but learn to use them well enough to implement in her classroom

### Additional Software Options Appropriately Matched to Students' Level

Emily also believed that having more equipment and additional software matching her students' level would be helpful. There were six desktop computers in her classroom, and twenty laptop computers were also available in the technology center. Emily stated that the resources she currently had are sufficient. However, she stated that the older grades tended to receive the latest resources before the younger grades.

Emily stated that she continued to search for software that was appropriately leveled for her young learners and was in line with her perspectives on teaching. "There is so much out there, I just have to weed through it to find out what is going to work with these guys." Again, Emily believed that the software available in her classroom was sufficient to carry out her curriculum and did not inhibit her from teaching or her students from learning.

## ***Environment B: Reason for Inclusion***

During our interview as well as e-mail conversations, Emily stated three reasons for including technology in her curriculum: technology was a part of her students' lives, children enjoy using technology, and the ability to reach different types of learners.

### Technology in Students' Lives

Emily shared, "Children are growing up practically typing and surfing the web before they can walk and talk. 'Computerese' is essentially a language; we have a new generation of bilingual children."

"Emily discussed her observations of the role of children in the family:

> I think about how parenting and teaching are a bit different these days because the younger generation has the power of knowing how to use the technology.

Parents, with many exceptions, rely on their children to teach them how to use computers, cell phones, etc. Interesting power dynamics when technology is involved."

Emily believed that the inclusion of technology will prepare her students for the future. This came from a pedagogical perspective that teachers are to look at the world around their students and encourage their growth and development so they will become productive members of society.

**Children Enjoyment; Incentive to Work**

Emily wrote in an e-mail conversation that "students love typing, researching on the computer, creating presentations – it's incentive to work." She shared that she was able to use free time on the computer, *iTunes* dance periods (when students have an especially good week, they are rewarded with a dance period on Friday afternoon), and videos as student rewards for hard work.

**Reaching Different Types and Stages of Learning**

Emily shared that although her school is selective during the admissions process, there were multiple learning styles and needs in her classroom. "I have some first graders who are reading beyond some of my second graders, and a few second graders reading at the level of my lower first graders." Multi-grade curriculum allowed for the broad learning range in the classroom, but Emily was cognizant of the challenges her older students would have next year if their needs were not met.

Emily allowed her struggling students to work at their current level, but consistently pushed them to strive for the level of their peers. Through information-gathering sites targeted to specific reading levels, technology enabled Emily to prepare

and implement curriculum that was at her students' independent and assisted learning levels.

Furthermore, Emily believed that children have multiple learning styles. The use of technology was able to open doors to visual learners that traditional resources would not have allowed.

***Enabling Factors***

When asked about support systems currently in place at school, Emily responded that the administration played a very active role in scheduling workshops, ensuring that adequate funding for technology equipment and support staff were in place, and that the administration communicated daily through e-mail or blogs.

When speaking of support systems for students, she believed that the administrator not only ensured adequate help for teachers but also for the students themselves, that the use of technology and all its components was supported by having adequate staffing. Class sizes were small enough that students' needs were met, and there was time to work with those who needed extra help. She also believed that peer tutoring was successful in helping reach more learners. "The way our classrooms are set up with multi-age environments, the olders teach the youngers." Furthermore, Emily stated that, "Teachers and older students modeling technology use and encouraging technology use was awesome at our school. We are always there for each other."

Always being there for each other did not necessarily mean physically. Teachers communicated on a daily basis through e-mail and blogs, and at weekly faculty meetings. The administrator ensured that the discussions that took place during the meetings were

ones that would challenge the pedagogical perspectives of teachers and not merely "housekeeping"-type dialogue.

Emily did not have a "disconnect" between personal and professional uses of technology; she utilized the same forms of technology in her personal and professional life. She not only used her iPod to organize her personal music to enjoy while exercising, spending time with friends, or relaxing, she also organized music for her classroom and encouraged all students to complete their work in a timely manner so they could have a dance party at the end of the week. Emily commemorates events with digital pictures both at home and at school and shared them with others electronically and through websites. The question was not whether Emily would use technology; it was when and how it would be used.

Finally, Emily was observed as being a clearly proficient user of technology who did not shy away form technical difficulties. Emily was cognizant of inevitable problems when using technology, and used the quandaries as opportunities to teach the trouble-shooting process. When problems arose during observations, Emily remained calm and began clicking around the screen to try various options to rectify the matter.

The following table is a compilation of Emily's biographical background and reported classroom uses of technology gained through our interview, observations, discussions, and survey questions.

**TABLE 4.2**
**ENVIRONMENT B: EMILY – HANELE ELEMENTARY SCHOOL, GRADES 1-2**

| Teacher | School | Grade | Years of Exper | Level of Tech Use* | Classroom Use of Technology | Equipment Used by Students | Skills/strategies Supported | Reason for Non-Inclusion of Technology | Reason for Inclusion |
|---|---|---|---|---|---|---|---|---|---|
| Emily | Hanele | 1-2 | 6 | ++++ | • Throughout curriculum<br>• Gather information<br>• Drills software<br>• Internet<br>• Group instruction<br>• Presentation<br>• Collect research<br>• Partnered and group assignments | • Computer<br>• SMARTBoard™<br>• Microphone<br>• Software programs: *KeyNote*, MS *Word*, *Stickybear Typing*, *Apple Works*, *KidPix*, *iTunes*, , *Reader Rabbit*, *Word Muncher Deluxe*, *Read, Write, and Type*<br>• Printer<br>• Scanner<br>• Headphones<br>• Digital camera | • Phonemics<br>• Phonics<br>• Fluency<br>• Comprehension<br>• Writing strategies<br>• Vocabulary<br>• Typing | • Time**<br>• Additional software options appropriately matched to students' level** | • A part of children's lives<br>• Children enjoy using technology, incentive for children to work<br>• Reaching different types of learners |

* Level of Technology Use – four-point system based on comparison of teachers in the study
**Emily reported that neither time nor the availability of additional software inhibit her from carrying out her objectives.

***Environment C: Biographical Information***

Grace attended the University of Hawai'i at Manoa and received her Master's degree, also from the University of Hawaii at Manoa, 28 years later. She has been teaching for over 25 years at Ulu Elementary. Prior to Ulu Elementary, she taught at Atherton Preschool and in Santa Barbara, California. Grace was also certified in Early Childhood Education, Orton Gillingham, DASH, and Math Their Way.

***Environment C: Pedagogical Perspectives***

Grace believed her kindergarten and grade one students learned best using a hands-on, multi-sensory approach to learning. Her perspective was based on the philosophy that children learn well in a safe, loving, open environment where opportunities are given and children are taught to be responsible for their learning. Grace believed in creating a learning environment that incorporated subject areas simultaneously. Therefore, the class might make observations of the weather using their senses, they could write their observations on a daily calendar, and calculate the number of days particular weather was observed in a given period of time in a chart. They could also write about events that did or did not take place as a result of the weather, and share the information with the rest of their school during the school-wide morning meeting.

Grace believed in constantly seeking new ways to reach her students. Although she was a master teacher and usually had university students conducting observations in her classroom. she continued to attend workshops, read journals, and seek discussions with others to help her reach the different learning styles of her students. When asked if having outsiders in her room ever bothered her, she responded with a smile,

"Oh, no. I get so much from them, too. They are the ones learning all the new stuff at the university, so I get to hear about it through them or when they do their lessons with the kids. I'm still learning, too, you know."

Grace's background in multiple theories of learning enabled her to create a balanced approach to reading. She did not teach reading skills out of context. All skills were taught in mini-lessons throughout the day using student- or teacher-created pieces and during individual or small group reading and writing lessons between either Grace or her partner and the student(s). Students gained fluency through exposure to appropriately leveled books. Grace shared the following about how she believes young children learn to read:

"Much has been researched and written about 'the way' to teach children how to read. Personally I believe that learning to read is not as natural as speaking and listening and that reading must be taught directly to many children. After all, having well-developed reading skills prepares children to take full advantage of learning in school and indeed assures success in school. My approach to teaching reading is necessarily eclectic, acknowledging that children learn to read in different ways. It has taken me years to develop a repertoire of ways to help children to learn to read."

***Environment C: View of Technology***

Grace viewed technology to be an important aspect of the community. However, she did not stress the use in her multi-age K-1 classroom.

"They are still little guys. They need to figure out where they are in a group so they can work together. If they are on the computer, they'll just be playing by themselves, and that's not what we want or they need right now."

When asked for further clarification, Grace affirmed that technology can be used with young learners, but the time and use must be chosen carefully, based on need, availability of other resources, and appropriateness of the technology for the learner. "When we first opened up the computer center, it got crazy. The kids who really needed the socialization were the ones spending all of their free-choice time there."

Grace shared, "First and foremost is providing a safe learning environment where children feel they can take risks with their learning." Grace also shared that the children will have multiple opportunities to use and master technology in the future. At this point in their lives, she believed, it was essential for them to develop meaningful relationships with their peers. Grace's partner added, "They *will* get it, when it is the right time."

***Environment C: Personal Use of Technology***

Grace shared that she personally used technology to communicate through e-mail daily, and regularly used the Internet to gather information. She also organized photos and music, made on-line purchases, and wrote letters about once per month. She infrequently watch a movie or used the computer for entertainment purposes. To learn to use these types of technology, she most often requested help from friends or family members, attended school-sponsored workshops, or used software tutorials that came with the program. She did not use on-line classes, tutorials or attend university classes.

While at school, Grace used the computer and communicated daily via e-mail with teachers and staff. She will also responded to e-mails from parents daily, and

generally gathered information from the Internet about once a month. Grace did not use blogs, manage websites, organize lessons, or collect curriculum ideas from the Internet.

***Environment C: Uses of Technology in the Classroom***

**Throughout the Curriculum**

Grace incorporated technology throughout her curriculum. Students were offered opportunities to use various forms of technology, sometimes through apparatuses they had created themselves. During one visit, a group of five students worked with rain catchers – one professionally made, and four others made by students. The creation of the rain catcher's process took place with the help of investigating various types of rain catchers – some investigations were shared from previous experience, others through research or an idea that a child thought would be particularly useful. Rain samples were collected over time, recorded in charts, and used to make observations about the rain and the efficacy of their devices. During one of my visits, a girl approached Grace's partner and said, "It was raining really hard at my house when I was trying to sleep last night. I was awake so late because I kept hearing the thunder."

Grace's partner replied, "I did hear the rain and thunder last night. It was really coming down by my house, too." Children nearby responded affirmatively, and Grace's partner suggested going outside to check their rain catchers. Five children excitedly joined him as they retrieved the rain catchers and recorded their observations. Grace shared, "They really get to see the whole process with this. They see how their ideas work and what works best."

Grace's classroom was a highly social learning environment. Students actively created, shared, and supported each others ideas. Although Grace reported using

technology infrequently, she modeled technology use often as she created assignments with the assistance of the computer, recorded classroom events on digital and video cameras, and encouraged her students to create tools that would enable them to answer their questions.

**Read-Along Stories and Talking Books**

Students were invited to access pre-selected Internet sites for interactive read-along stories. Log-in procedures were displayed in front of the computers for quick reference. It was not mandatory for students to visit the computer center, but they were scheduled for two days each week. During my five classroom observations, only four children chose to access these stories. The remaining students who chose to read did so with trade books.

**Drills Software**

Grace shared that students have access to a software program, *Earobics*, that provides explicit phonemic and phonetic skills practice for young learners. For an observation of its use, please refer to section: Reaching Different Types and Stages of Learnering on page 125.

***Environment C: Equipment Used by Students***

**Computer**

Although it was not a requirement, Grace encouraged her students to use the computer twice a week. Time in the computer center was scheduled during free-choice periods. Students were able to independently open and navigate through pre-selected programs and sponsored websites. Log-in procedures were posted in the computer center

for the students' reference. Those needing assistance raised their hand, and a teacher came to help.

Computers were not independently used by students to gather information, create projects, communicate with others, or publish work. All observations of computer use, as well as conversations about computer use with Grace, were focused on using the computer to practice previously learned skills.

When asked why only a limited number of students were given access to the computer each day, Grace replied, "We want to ensure that the children try many different areas in the room – many of which offer more social development opportunities."

**Microphone**

Grace shared that her students infrequently used a microphone. Microphones had been primarily used when presenting information to larger groups of students or parents. Grace reported that her students needed very little, if any, assistance.

**Software Programs**

Students were observed using the following software programs: *Earobics*, *Stickybear Typing*, and *PidPix*. During each observation, students were able to independently log-in and open the programs, or were able to solicit help from either a peer or adult.

During one observation, a girl checked the posted schedule for the date and her name. She saw her name listed (children were only invited to the computer center on specific days), walked to her cubby, and retrieved her headphones. She then sat down but

wasn't able to accomplish getting started. She stayed in her seat and raised her hand. Grace came over and said, "What's going on, X?"

"I think it's broken."

"Oh, let's see." Grace noticed that the computer was in sleep mode and said, "Oh, we have to wake it up, don't we? Remember, the computer goes to sleep when we haven't used it for a while. That's all." She moved the mouse on the pad and reactivated the computer.

**Printer**

Students were permitted to print materials from the computer such as achievement or completion reports from the software programs used. The printer was stored in the classroom and offered black- and white- or colored prints.

**Headphones**

Students were encouraged to use their personal headphones while visiting the computer center. The headphones were relatively inexpensive (the type you would receive on an airplane). Students were responsible for retrieving and replacing their headphones, which were stored in a zippered plastic bag in their cubby. For hygienic purposes, students were not permitted to share headphones.

**Video Camera**

During a visit to Classroom C, a pulmonary-disease specialist visited the class as a guest speaker to discuss the effects of sleep patterns on developing healthy bodies. The doctor chose a volunteer from the class and demonstrated the use of electrodes when connected to a computer to generate a graphic representation of sleep patterns. The guest brought posters and charts to show the children deep- sleep patterns. He then correlated

these deep sleep patterns to growth. He explained that when we don't get enough sleep, we won't grow to our potential. The doctor asked the children what kinds of things they could do to have good sleep habits. Throughout the visit, Grace wrote down questions and responses by children while her partner videotaped and took still pictures. At one point, the school's technology coordinator also joined the class to videotape sections of the visit.

When the guest finished sharing, the children thanked him for coming and went to recess. Grace sat down at the computer and typed up a worksheet for the children to complete based on their guest's visit. When the children returned to class, they were asked to respond to the prompt: Dr. X talked today about the importance of sleep. What can you do to get a good night's sleep?

The teacher met with five children who needed additional support. As children answered the question verbally, the teacher wrote down their response while audibly segmenting each phoneme on a small piece of scratch paper. The children then took those scraps and copied the writing on their own paper. One child used a cardboard screen to keep focused on his work area. When other children noticed this, they also requested and received a screen.

When asked what would become of the videotape, the teacher responded that it would be saved and reviewed with the students later. On a later visit, the photos and captions from the visit were displayed on the board.

**Digital Camera**

A noteworthy visit took place when the teachers shared an upcoming event. A large section of the school would soon be under construction. The library and offices

would look very different during and after the two-year reconstruction project. The teachers and technology coordinator worked in conjunction with the students to record the construction process.

The children first visited all of the spaces that would be altered, then drew out and labeled all current spaces on large butcher paper. Next, the children were asked to take pictures of the current areas. Grace said that the pictures were taken from the children's perspective, not an adult's. The children were comfortable using the cameras as Grace reported that they use them at least once a week to record events in the classroom. She and her colleagues believed that permitting the children to express their viewpoint would further encourage their understanding of the reconstruction process as well as allow them the opportunity to fully comprehend the transformation, so they can share it with others.

As the construction continues, children will make changes to their posters. All of the children's current posters were exhibited in the library for the entire school to view.

***Environment C: Supported Skills and Strategies***

**Phonemics, Phonics, Fluency, Comprehension, and Vocabulary**

The students were free to choose the program they were interested in unless the teacher made specific recommendations due to their academic progress. Practicing reading skills using technology was done via the following programs: *KidPix*, *Earobics*, *Stickybear Typing*, and Internet accessed read along stories. Grace did not log the programs children chose nor their amount of time at the center, but noticed who chose to visit the center and occasionally invited those who did not.

An interesting observation made throughout each of the visitations was the number of children who visited the computer center. Although the center was available

to students and one teacher was often preparing a lesson or keeping a record of student learning using the computer, during all visits combined, only four children visited the center, one girl and three boys. The children chose activities that included working with other children such as games, art projects, and writing letters to friends.

**Typing**

Grace also encouraged her students to practice their typing skills during their visits to the computer center using *Stickybear Typing*. Again, two weekly scheduled visits were allowed; however, they were during free-choice periods and were not mandatory.

***Environment C: Reason for Non-Inclusion***

**Developmental Level of Learners**

When asked if there were any barriers that inhibited her from using more technology in the classroom, she did not mention any of the factors generally listed by others, e.g., insufficient time to implement, outdated or insufficient equipment, insufficient funding, administrative decisions, or even personal limitations. She simply responded that the only barrier to inclusion was the developmental level of the students. Grace believed that her students' developmental stage should be supported through hands-on, multi-sensory activities that offered multiple socialization opportunities. Grace shared that her classroom experiences with technology had shown her that her students tended to socialize less and focus more on using the technology. After one of my observations, Grace said, "We really have to watch the amount of time they are in there . . . the ones who spend the most time there are usually the ones who need the most time with the other kids."

***Environment C: Reason for Inclusion***

**Reaching Different Types and Stages of Learning**

"One of our students has really come a long way, but he struggles with hearing individual sounds in words, so one thing we do with him is have him work with a program called *Earobics*. It's really helped him." *Earobics* is a computer program designed to provide explicit phonological awareness, listening, and introductory phonics skills.

On one visit to Classroom C, the observation began while the children worked during a free-choice work period. All centers were open, including reading, writing, art, science, math, and the computer centers. Seven children, two groups of two and another of three, chose to work with Math games; three boys used stencils to create an animal scene; two girls wrote a letter to their teacher on decorated stationery; one boy wrote out math problems on a sheet of paper, and then answered the problem with counting blocks; three boys "cooked dinner" in the home center; five children (two boys and one girl) drew pictures; and the remaining children worked with Grace's partner on rain projects. While children worked, Grace invited a student who was challenged with hearing individual sounds in words to the computer center. For the purpose of this example, the student will be referred to as Jack. Grace did not run the *Earobics* program until Jack sat down with his headphones. Although Jack had previously worked with the program, Grace walked through the process of finding and opening the program with him.

As Grace and Jack sat together, they took turns answering the questions. Grace patiently prompted Jack to hear individual sounds in two phoneme words. Each time a

correct answer was made, Grace responded with comments such as: "Way to go!" "You've got it!" and "Oh, this is really helping you, isn't it?"

After Jack successfully completed a number of questions, Grace allowed him to work independently while she checked in with other students. Jack remained focused for the next two minutes while working on words with two sounds, and then he transferred to three-sound words. A few minutes later, he walked up to Grace and asked for help. Grace stopped what she was doing and went with Jack to the computer area. "Wow! You got three sounds! That's great!" She sat next to Jack as he demonstrated his ability to continue the lesson. As he faltered, Grace gently whispered, "Oh, pay attention this time. There's the first [sound], now the second, listen for the third." Jack continued working while Grace returned to check on other students.

The lesson Jack was working on allowed him multiple opportunities to find targeted sounds. The lesson could continue or the child could stop at any point. Jack chose to work for another few minutes and then independently shut down the program and returned his earphones to his cubby. When Grace saw that Jack was putting his headphones away, she walked up to him. "I tried it two times, and I stopped it because I won" Jack said.

Grace responded with, "Oh, we need to practice every day. It's not winning or losing – this will really help us become better readers and writers."

**Additional Practice of Previously Learned Skills**

Although Grace believed that the external programs were not suitable for teaching children new skills, she did share that she felt they wouldoffer learners the opportunity to practice previously learned skills in an alternative format.

***Enabling Factors***

Grace said that the administration played an active role in the inclusion of technology in the classroom by scheduling workshops, and ensuring there was adequate funding for technology and support staff (technology coordinator). She also stated that when students were in need of help beyond her understanding or availability, they were able to turn to the technology coordinator or peers for help.

The following table is a compilation of Grace's biographical background and reported classroom uses of technology gained through our interview, observations, discussions, and survey questions:

**TABLE 4.3**
**ENVIRONMENT C: GRACE – ULU ELEMENTARY SCHOOL, GRADES K-1**

| Teacher | School | Grade | Years of Exper | Level of Tech Use | Classroom Use of Technology | Equipment Used by Students | Skills/strategies Supported | Reason for Non-Inclusion of Technology | Reason for Inclusion |
|---|---|---|---|---|---|---|---|---|---|
| Grace | Ulu | K-1 | 25+ | ++ | • Read-along stories<br>• Drills software | • Computer<br>• Microphone<br>• Software programs: *Stickybear Typing*, *KidPix*, *Earobics*<br>• Printer<br>• Headphones | • Phonemic awareness<br>• Phonics<br>• Comprehension<br>• Fluency<br>• Vocabulary<br>• Typing | • Developmental level of students | • Reaching different types of learners<br>• Additional practice of previously learned skills |

* Level of Technology Use – four-point system based on comparison of teachers in the study

***Environment D: Biographical Information***

Dinah attended a college-preparatory private school from kindergarten through the twelfth grade before moving on to Stanford University for her undergraduate work in education. After graduating, she moved on to Wheelock College in Boston, where she earned a Master's of Science in Teaching Young Children with Special Needs. She then returned to the islands and earned a second Master's Degree, in Elementary Education focusing on Language Arts. Dinah was certified in Early Childhood Education, and has also taken courses in American Sign Language, Math Their Way, and Slingerland, as well as courses with Dr. Mel Levine's *Schools Attuned.*

***Environment D: Pedagogical Perspectives***

Dinah followed the Deweyian theory in which children were encouraged to learn from each other and the world around them. She believed strongly in the inclusion of the child's family in her curriculum. "The family is the child's first and foremost educator, so I allow families to be involved in whatever way they can." Parents were welcome to join in during the day or on learning trips, and they were encouraged to share information with the teachers that offered a different perspective of their child as a learner and social being. Parents were kept informed through daily homework folders that included a reading log and any assignments to be completed at home.

Dinah designed her multi-age K-1 classroom to be eclectic. She believed that "children learn through direct experience – doing"; she and her partner offered multiple opportunities to learn the same information. For example, one child might learn patterns by coloring in boxes in a worksheet, another by playing with colored blocks with a partner, and another by creating patterns with plastic links with a group of friends.

"Children learn from each other and benefit from being in environments with children at different ages and stages; that really helps the learning from each other!"

Dinah explained why her classroom was set up in an open format:

> "There is a wide range of language arts learning opportunities, many very open-ended and others more structured . . . We respond to children's learning needs differently. For one, we might encourage him to sit at a desk on his own because he is able to complete his writing when he sits alone. For others, we may sit them next to certain people to watch or work with."

Dinah believes that the multi-grade environment provided abundant opportunities for children to learn from one another. Dinah was confident that the K-1 multi-grade classroom allowed children to work at their individual academic and social levels. The design of the multi-grade classroom was less separation by age than by proficiency level. Those more proficient became the leaders and role models to others who were less proficient. Furthermore, multi-grade environments allowed children less proficient in one area, whether it be academic, social, or developmental, the time and support to continue progressing.

Finally, as with Environment C, the classroom was not set up in blocks of time dedicated only to Language Arts or Math. Mini-lessons were given on reading and writing strategies with authentic children- or teacher-prepared pieces. Skills were taught when and as needed in a balanced approach to reading. Lessons took place in large, small, and individualized sessions, based on student need.

The school day was purposefully free-flowing; children were given tasks and encouraged to complete them in a given time period. This was not to say that the

children did not participate in group activities in which all students were completing the same task at the same time. There were occasions when this was the case, when it was deemed appropriate for the type of instruction given. However, in this environment, the children were often given the opportunity to complete lessons at their own pace throughout the day.

***Environment D: View of Technology***

Dinah viewed technology as a significant component of a child's education. Her partner summed up their view of technology by saying, "Technology for literacy? No, it's for life!" Understanding the connection between technology and their students' future was apparent as they continually looked for opportunities to incorporate its use.

As Dinah strived to produce curriculum that was individualist and therefore grounded in the specific level of her students, she continued to provide opportunities to those who were ready. "Technology is one way to reach our students, but they have to be ready for it developmentally."

***Environment D: Personal Use of Technology***

Dinah used technology daily to access e-mail. She also conducted Internet searches more than once a week, and organized or used the computer to enjoy music. Monthly, Dinah made online purchases or wrote letters. She infrequently took or organized photos, created or edited movies, or used the Internet for entertainment purposes. She did not chat on-line or play games.

Dinah most often sought help from friends or family members to help her understand new technology. Otherwise, she usually learned on her own. She

infrequently solicited help from on-line sources, used software tutorials, or took on-line classes to gain information about using new forms of technology.

While at school, Dinah used e-mail and took photographs with a digital camera daily. She also communicated with parents, created and organized lessons, gathered information, viewed learning videos/DVDs on the television, played CDs, and acquired curriculum ideas from the Internet more than once a week. She infrequently, less than once a month, used a video camera. She contributed to her classroom blog and organized grades monthly.

Dinah appreciated using the computer to organize her grades and write student narratives. Ulu School's assessments were shared with parents through a descriptive narrative of students' growth and development. Dinah kept "running records on what the children do or say for our records and ongoing assessment of the teaching and learning process."

Dinah primarily learned to use the technology at school through faculty sharing or through friends and family. Otherwise, the information was usually self-taught. Dinah occasionally used software tutorials or school-supported coursework to learn information. She had not ever taken an on-line or university course to learn to use the technology at school.

***Environment D: Uses of Technology in the Classroom***

**Throughout the Curriculum**

Dinah's classroom was very active. Children moved throughout the room busily completing assignments, creating art projects, playing math games, writing, reading, or conducting science experiments.

When a familiar bell rang, teachers, children, and lingering family members gathered in the courtyard to listen to messages, hear an inspirational thought for the day, and sing a song as an entire school before beginning their lessons.

Children returned to their classroom to begin their morning activities. Many had already stored their bags and put their homework folders in the correct bin before the school bell rang and were ready to get started. Children began morning jobs, which consisted of assignments given based on individual needs. For example, each child had a writing assignment; however the content and extent of the expectations varried from child to child.

Six children worked on a calendar worksheet using coin stamps to represent the day of the month, four children completed their writing homework assignment, two girls worked together and one boy worked by himself with tangram puzzles, a group of five children created a chain of colored links, three children worked on a writing assignment near their teacher, and three children enjoyed reading books.

In another area of the room, a group of five children worked on patterns using colored, plastic chain links. They had successfully created a chain over fifteen feet long when they decided to ask Dinah to take a picture. Dinah retrieved a camera and said, "Boys and girls, are you ready? How do you want to do this picture?" The children stood as a group, holding the long pattern chain. "Oh, we have a problem. We can't see how long it is." The group worked together to spread out the chain to make one long line. When they were done, they requested that the picture be taken again. As with the tangrams episode on a previous day, the photo was printed and placed with the plastic

links. Dinah also shared that these photos are saved and considered as entries for their newsletter.

**Read-Along Stories and Talking Books**

During another visit, a child began working at a computer twenty minutes after the start of the work period. He independently retrieved his headphones and booted up the desired read-aloud program on the Internet. Procedures and passwords were readily available to view in multiple locations. As he worked independently, reading a story that was suggested at an earlier time by his teacher, his friend came up and asked which program he was working on. After the child responded, the friend stayed and watched the story's progress. The two began to read the storyline together and looked to each other for the answers to prompts. After the story was complete, the second child booted-up the same program on a nearby computer. The two boys loaded identical stories, and worked on different computers, but they continued to discuss aspects of the story together. When they missed information, weren't able to answer specific questions, or thought something was interesting, they would replay those sections. The first child said, "This is really interesting."

The second responded with, "I don't have this at home."

"Me either," the first child replied.

"This has lots of information."

**Drills Software**

Dinah shared that her students have access to *Stickybear Typing*, *Reader Rabbit,* and *KidPix*. *Reader Rabbit* imparts practice opportunities with phonemic and phonic skills. *Stickybear Typing* presents beginning typists' basic skills in placement of hands,

key location, and practice. *KidPix* offers both text and pictures in the same frame. Children were able to narrate artwork created in the programs, save it for the future, or print projects.

**Internet**

Students used the Internet to access interactive talking books through *Brainpop* and to collect information from sites previously selected by Dinah and her partner. *Brainpop* is a subscribed website composed of narrated movie clips. Students were able to independently log on to sites and manipulate through windows. Children needing assistance first looked to classmates and then to teachers.

**Gather Information**

Dinah used technology to gather information from the Internet, as well as collect and store information gained through observations and experiments. When children had a query, they were encouraged to use school-selected sites to gather information.

During an observation, as children went from one activity to another, they visited a station with a large poster board. A few days earlier, the children went on a learning trip and personally took pictures of observations they had made. Many of those pictures were glued onto the poster board with captions and a thank-you message from the class; the children each signed their name around pictures. Some chose to write a personal thank-you.

***Environment D: Equipment Used by Students***

**Computer**

Students independently accessed the computer. When problems arose, they first asked classmates for help, and then if necessary, asked a teacher. In an e-mail exchange,

I asked Dinah about the sense of community in her classroom. "Children benefit from being in environments with children at different ages and stages, that really helps the learning from each other!" This was evident in the number of observations of children assisting each other.

Children in Dinah's class completed projects, enjoyed talking books, played learning games, drilled previously learned skills, and uploaded pictures on the computer. They did not use the computer to write papers or learn new skills.

Dinah shared that their technology coordinator formatted their computer to be in "teacher-mode and student-mode." Dinah said, "Students know that they have to be in the boring blue screen. They want to be in there because there are fun things to do."

Dinah did not allow her students to use word-processing programs to write stories. Although more than one method was used to complete an assignment, all writing was done with paper and pencil. In a project displayed on the bulletin board, students took pictures around the campus of their favorites places at Ulu Elementary. The photos were downloaded and printed on a sheet of unlined paper. Students handwrote narrations below the pictures using conventional and invented spelling, "I liked other pktures but I liked this pkture best" and "I realy like this pisher because it has evewan in the pisher."

**Software Programs**

The programs available to Dinah's students to further their development of various skills were *Stickybear Typing*, *Reader Rabbit,* and *KidPix*. Students had access to the programs multiple times throughout the day. Students were observed easily manipulating through the programs with little or no assistance from others.

**Printer**

Students were able to independently print completed work, colored pictures, and information from the computer.

**Headphones**

Students used headphones while in the computer areas to minimize distraction to themselves and those in surrounding work areas. Students each had their own headphones which were stored in their cubbies in zippered plastic bags for hygienic reasons.

**Digital Camera**

The two children who were reading chose a book that the class had created using photographs; a different child created each page. Children were given a letter and asked to think of ways they could represent that sound in a book. They went home and planned their page, took photographs, and then brought them in to be edited with the teacher. "At the beginning of the year, we had to sit with them and show them how to soften edges and cut shapes. The children are now able to take the pictures and crop them by themselves." Numerous books created by this and past years' students were available for the children to enjoy.

During another visit, a boy, who shall be referred to as Trevor, sat on the rug concentrating intensely on filling in an eight-inch hexagon-shaped area with multiple colored tangrams. Tangrams are geometrical shaped tiles, originating in China, that were designed to create patterns using seven tiles. Today, many teachers use the tiles to encourage children to find relationships between shapes, regardless of the number of tiles used.

When Trevor finished his pattern, he approached the teacher smiling and said, "I'm done!"

"Wow! That looks great! What are you going to do now?" Dinah replied.

"Can we take a picture?" Trevor asked.

"Sure. How do you want to do it? Do you want to take the picture, or be in it?"

"I want to be in it."

"Okay, I'll get the camera."

While taking the picture, other children approached the boy and commended his efforts with comments such as: "Cool," "Nice job!" and "Did you do it all by yourself?" After taking the child's picture, Dinah immediately went to the computer to download the picture; Trevor then printed it out. He cut out the picture and placed it in the basket with other patterns for the children to follow if they wished. Another child, who watched the process of taking a picture, printing it, and placing it in the basket, wanted to create a new shape with the same materials. Trevor wasn't bothered that another child was going to dismantle his hard work. The picture served as a memory. Four other children, two girls and two boys, began working on tangram patterns.

Another observation was made when Dinah led a discussion about favorite aspects of their school. Ideas were written on large chart paper, and then the technology teacher helped the children use the digital camera with an eye for sharing information. The children were to focus on making sure their picture was able to send a message to others – they needed to make sure the lighting was correct and all important factors were represented in the picture. Then they were to download and print their picture, and finally handwrite their description.

The children visited various locations around the school to find their desired one. Various selections included the fishpond, plumeria trees, other trees, friends, and drinking fountains. Once the projects were completed, they were pinned to a bulletin board entitled "We are Learning About Taking Pictures Using the Digital Camera with Ms. XX."

***Environment D: Supported Skills and Strategies***

**Phonemics, Phonics, Fluency, Comprehension, and Vocabulary**

Dinah's use of technology to support emergent reading skills was done through the use of commercially prepared phonemic and phonics games, read-along stories, and talking books. The programs were used not to introduce but to support previously learned skills.

During an observation, a boy went to a nearby computer and began playing a phonics game. He was able to independently log onto the Internet using the posted site address and type in the security code. As he was working, three other boys came up behind him and started interacting with the game. Their voices began to rise a bit, and they would occasionally all laugh together. Dinah looked at the group, surveyed the situation to see that they were talking about the game, and allowed the children to continue. Although there were four other computers available, the four boys stayed in the same area. After a few moments, Trevor allowed another child to have a turn at the mouse, but remained with the group and encouraged his classmates.

**Typing**

Students were able to practice typing skills through a commercially prepared program called *Stickybear Typing*. During my visits, I did not observe students using this program to further their typing abilities.

***Environment D: Reason for Non-Inclusion***

**Developmental Level of Students**

Dinah carefully selected the inclusion of technology so it allowed for social interaction and peer mentoring. In the past, Dinah's students were able to complete numerous projects with the assistance of technology. The group she was working with during this study was less mature and required more teacher-student interaction than previous groups, so she chose to reduce the opportunities to include technology, as it was not conducive to learning. Dinah's ability to correlate her students' ability with her pedagogical perspectives and adjust her teaching style and resources to meet the needs of her students enabled them to succeed.

> "In the past, we've been able to do so much more . . . the developmental level of this particular group is the biggest inhibition. They are a young bunch! So, we are finding that we need to provide more individual guidance than before."

Dinah shared her disappointment with not being able to move forward as quickly as she would have liked with this group, but realized that skipping fundamental behavioral and social development issues would inhibit future progress.

***Environment D: Reason for Inclusion***

**Reaching Different Types and Styles of Learning**

Dinah's background in special education made her especially cognizant of the learning differences in her students. During our e-mail correspondence she wrote, "What changes mostly are our expectations, not necessarily what we introduce . . . we shift, the program shifts." Dinah shared that she felt that various form of technology could help students express themselves and respond to learning in ways that conventional methods could not.

**Additional Practice of Previously Learned Skills**

Dinah believes that children should continue to practice skills to develop mastery. Furthermore, she felt that computer software programs allow children repeated practice of previously learned skills.

**Building Skills for the Future**

Dinah stated that the administration generously supplied the classroom with desired technology. "When we first got digital cameras, we [the teachers] took the pictures because we only had one camera. Now that they are less expensive, we have more, and they do it all."

Dinah felt that having computers and digital cameras available to students all day allowed them to develop an awareness and comfort level that would be disjointed otherwise. "The children can use the camera to take pictures of math patterns or science experiments. There isn't a time or day that we set up to take pictures and that's it. It comes from them." This integration of technology throughout the day allowed children

to become proficient with the technology and enabled them to use it in multiple subject areas.

***Enabling Factors***

Dinah believed Ulu's administration plays an active role in supporting technology. The administration schedules workshops, provides adequate funding for technology and support, and communicates frequently through blogs and e-mails.

Ulu's principal also provided teachers and students the opportunity to work with a full-time technology coordinator. The coordinator worked directly with the teacher to develop an educational plan based on the curriculum and direction of the classroom. Students were not pulled out of their regular learning environment to complete lessons or projects unrelated to the classroom learning, but given opportunities to further their understanding of the curriculum chosen by their classroom teacher through the use of technology.

Dinah believed that having the computer set up in two environments: "teacher mode" and "child mode," allowed her to be in control of what her students had access to while being freed from the worry that they would be able to vary files or enter inappropriate websites. "They know they have to be in the boring blue [screen]. They want to be in there because there are fun things to do."

The following table is a compilation of Dinah's biographical background and reported classroom uses of technology gained through our interview, observations, discussions, and survey questions.

**TABLE 4.4**
**ENVIRONMENT D: DINAH – ULU ELEMENTARY SCHOOL, GRADES K-1**

| Teacher | School | Grade | Years of Exper | Level of Tech Use | Classroom Use of Technology | Equipment Used by Students | Skills/strategies Supported | Reason for Non-Inclusion of Technology | Reason for Inclusion |
|---|---|---|---|---|---|---|---|---|---|
| Dinah | Ulu | K-1 | 25+ | +++ | • Throughout curriculum<br>• Read along stories<br>• Drills software<br>• Internet<br>• Projects<br>• Gather information | • Computer<br>• Digital camera<br>• Headphones<br>• Software/Internet programs: *Stickybear*™ *Typing, KidPix, Reader Rabbit, Brainpop.com*<br>• Printer | • Phonemics<br>• Phonics<br>• Fluency<br>• Comprehension<br>• Vocabulary | • Developmental level of students | • Reaching different types of learners<br>• Additional practice of previously learned skills<br>• Building skills for the future |

* Level of Technology Use – four-point system based on comparison of teachers in the study

***Summary of Research Findings***

This research was a qualitative multiple case study of two multi-grade K-1 teachers' and two multi-grade 1-2 teachers' use of technology to support literacy in Honolulu, Hawaii. It investigated how teachers used technology to support emergent literacy, how technology use was supported at two schools, differences and similarities among the participants, and how pedagogical perspectives influenced technology use. Two participants, Kim and Emily, were both multi-grade 1-2 teachers from Hanele School. The other two participants, Grace and Dinah, were multi-grade K-1 teachers from Ulu Elementary School.

The findings were categorized and disaggregated according to the research questions. Please refer to Table 4.5: Coding Categories

**TABLE 4.5**

**CODING - CATEGORIES**

| Research Question | Categories |
|---|---|
| 1. How do effective K-2 teachers' pedagogical perspectives of reading acquisition influence their use of technology in the literacy curriculum? | high standards of success for all students, teacher matches instructional practices with students needs, understanding of students ability level, assessment of student's ability, goal setting, skills taught, scaffolded, working with peers based on ability to mentor, support, reinforce, assessment is diagnostic and informative, assessment is authentic and related to what was learned, teacher's expectations of the learner achieving goal, teacher's self perception of technology use, teacher understood uses of technology, motivation |
| 2a. How do effective K-2 teachers use technology to support emergent literacy? | phonemic awareness, phonics, vocabulary, fluency, comprehension, word identification, rate and fluency, spelling, grammar, mechanics, organization, voice, word choice, sentence fluency, conventions, read-aloud, purposeful reading and writing, appropriated leveled materials, social writing opportunities, listen and share, response writing, information gathering, sufficient time to read and write, tutorials and practice (skills), problem solving, talking books, text-to-speech, hypermedia, web-based communication, teacher understood the process of reading, teacher searched for resources |
| 2b: How is this technology use supported? | access to information via website for families, website information contributed by teacher, website information contributed by students, parent volunteers during technology lessons, workshops for families, lesson matched use of technology, technology enhanced the lesson, teacher provided support through modeling, teacher provided support through verbal instructions, teacher completed task and child observed, access to latest technology, access to latest information, support to learn technology |

# CHAPTER V

# CONCLUSIONS AND IMPLICATIONS

In this concluding chapter, I will summarize the research findings, and discuss the limitations of the study as well as the implications for the present study on early childhood education. I will conclude with suggestions for future research in the early childhood setting.

## ***How Do Effective K-2 Teachers' Pedagogical Perspectives of Reading Instruction Influence the Use of Technology in the Classroom?***

The first research question addressed how effective K-2 teachers' pedagogical perspective of reading instruction influenced the use of technology in the classroom.

### Early Childhood Specialization

Kim, Emily, Grace, and Dinah each hold a specialization in early childhood education, have additional training in specific reading methods, such as Orton-Gillingham, and have clearly defined perspectives of how young children develop, and therefore should be taught, in order to complement and further their students' growth and development. They each followed a social constructivist learning theory in which children learn from each other in a safe, nurturing environment that is matched to their cognitive, physical, social, and emotional health (Piaget, 1950). This perspective was the core of each teacher's decision to include, or exclude, the use of technology to support emergent literacy. Additionally, all of the participants in this study used a balanced approach to teaching reading paired with books suitably leveled to their students. Each of the teachers in this study integrated phonemic and phonic instruction through active reading and writing, and created their own literature-based curriculum based on the needs

of their students. The use of technology (e.g., read-alouds, talking books, project sharing, and information gathering) supported the system already in place. Collaboration between practice and developmental levels is consistent with Katz's (1995) belief of developmentally appropriate practice where needs and curriculum align.

**Balanced Instructional Approach**

Kim, Emily, Grace, and Dinah believed in the interdependency of reading and writing, and encouraged children to write and read books appropriately matched to their level daily. They all believed that their students needed extended periods of time to practice reading and writing if mastery was to be achieved. This practice of allowing sufficient time to develop writing assignments supports The Center for the Improvement of Early Reading Achievement's findings on the correlation between successful readers and writers and the time provided to read and write in school (Taylor, Pearson, Clark, & Walpole, 1999).

**Paper and Pencil First**

The teachers each shared their thoughts on computer use during the early stages of writing. They all emphatically believed that students should continue to use pencils and paper to write assignments prior to visiting the computer. Grace and Dinah did not have the students use the computer to create writing projects, they only used paper and pencil. Emily and Kim both ensured that student work was completed before typing. Beginning with paper and pencil allows the teacher, students, and family the opportunity to witness the progression of writing proficiency. Kim simply stated the feelings of the other participants when she spoke of using grammar tools within word processing programs, "I wouldn't know where they are developmentally."

### Developmentally Appropriate Practice in Social Settings

Finally, each teacher's classroom was a multi-grade environment that encouraged the growth and development of learners based on their current academic level, not their chronological age. Students were given multiple opportunities to work with peers, more proficient learners, and the teacher to complete projects. This also offered students the prospect of being the most proficient learner and sharing knowledge with others. Regardless of whether they were the most or least proficient learner in the class, working with others at various levels of development encouraged growth both socially and cognitively. The relationships built among learners in these environments allowed them to depend on each other for assistance, whether they were at the computer, using the SMARTBoard™, or sitting at their desks. It was the integration of technology throughout the day that allowed children to become proficient technology users and problem solvers. Kress (2000) believed important aspects of education should include the "the identities and personal dispositions that will be most highly valued, and most essential, will be those of flexibility, creativity and innovation" (p. 14). Piaget (1950) believed that children working in cooperative learning environments such as these have multiple opportunities to learn to work together to complete tasks and solve problems.

## ***How Do Effective K-2 Teachers Use Technology to Support Emergent Literacy?***

### Reinforcement of Previously Learned Skills

The next research question answered how effective K-2 teachers used technology to support emergent literacy. Kim, Emily, Grace and Dinah all used technology to support phonemic awareness, phonics, vocabulary, fluency, comprehension, and writing skills, but the degree to which it was used varied. In each of the classrooms, technology

was used to reinforce previously learned skills with tutorials and drills, for gathering information, for read-alouds, and for creating projects in line with the teacher created curriculum specifically designed for their current group of students. This is in alignment with Morrow, Barhart, and Rooyakker's (2002) suggestion that technology should be used to reinforce, not introduce, previously learned skills.

Each teacher believed in introducing skills within purposeful reading and writing activities. They followed the National Association for the Education of Young Children's concept of developmentally appropriate practice that asserts educators should start with individual learners, understand their strengths and weaknesses, and introduce knowledge that will be meaningful and appropriate (1997). Thus, the teachers each encouraged the development of reading and writing skills during active reading and writing. The Center for the Improvement of Early Reading Achievement found that primary teachers who offered multiple reading experiences of authentic text throughout the day were higher achieving than those offering less (most effective schools spent 134 minutes a day on reading) (Taylor, Pearson, Clark, & Walpole, 1999). The four participants employed multiple reading and writing opportunities throughout the school day.

**Skills Taught Prior to Technology Use**

None of the teachers in this study used technology to introduce reading and writing skills. All teachers presented sound-letter relationships in mini-lessons and through small and large group work. Only after a skill was learned were children invited to explore skills practice software and website tutorials. These tutorial practice sessions generally took place during free-choice opportunities that included a variety of phonemic

and phonetic drills practice through programs such as Reader Rabbit, fluency through read aloud books on the Internet or on tape, writing and drawing in KidPix, and development of typing skills through Sticky-Bear Typing™. The limited use of drills practice in these environments follow Howard Gardner's (1999) perspective; he reminds us that our goal is not to produce children who are able to recall individual skills, but students who can use the skills they have been taught to solve problems.

**Modeling Appropriate Uses**

Each of the teachers was observed clearly explaining the necessary steps to take in order to complete tasks using technology prior to students' independent use. This was done through modeling and was often accompanied with checklists of the procedure. For example, Grace sat with a child needing one-to-one instruction in working with a software program to further develop his phonemic awareness. Each step was modeled and practiced prior to having the child work independently. This followed Vygotsky's (1978) perspective of teaching children within the zone of proximal development. The child was able to complete more than he would have been able to without the teacher's direct instruction, modeling, and practice.

**Restricted, Monitored Internet Use**

***Information Gathering***

The teachers also allowed restricted, monitored Internet use, and taught their students how to access appropriate websites and perform simple trouble-shooting techniques. The teachers posted website addresses and passwords in the computer area for their students to quickly refer to when needed. The Internet was used to gather

information for inquiry projects and to access school-sponsored talking story and drill practice sites.

**Share Information Learned in the Classroom**

Another similarity among participants was the use of technology to share information learned in the classroom. Digital cameras were used in each environment to give an account of classroom activities, document learning trips, and aid writers in recording information. All teachers indicated that they use the digital camera as a means to record and share information. Those images were then downloaded, printed, and used to illustrate writing.

Projects were also created and presented through the use of technology in each environment. As with the introduction of software tutorials, the pre-writing, writing, and editing skills were first learned or completed through drafts, and then supported with the use of technology. Again, the degree to which students completed tasks independently varied from one environment to the next. These differences will be discussed later in this chapter.

**Support Social Interactions**

The computer, along with other forms of technology, was used in environments that were open to social interactions. In each of the environments, students generally completed tasks with assistance from peers. The study found that although students sat at different computers, they often collaborated with each other on their current task – some children simply asked, or told, another child what they were doing, and then returned to work. This freedom to quickly divert their attention from the screen and then return to

work allowed both the break and social interaction many young children need to remain focused.

**Throughout the Curriculum**

All teachers used technology to support literacy throughout the curriculum, not just during language arts. Furthermore, emergent literacy was encouraged through the use of software and Internet programs to practice phonemic/phonetic drills, for read aloud/along stories, and for writing projects. Best reading practice tells us that there are five essential components to effective reading instruction: phonemic awareness, phonics, vocabulary, fluency, and comprehension (Drake, 2001; Pressley et al., 2001; Slaughter, 1988). The teachers incorporated technology with each of these components.

**Meaningful and Relevant Curriculum**

***Student Interests***

An additional note on the similarities among teachers: each teacher developed a curriculum that was meaningful and relevant to learners. Projects stemming from children's interests drove their connection to the activity and increased productivity. Dinah spoke for all the teachers when she discussed time frames for using the digital camera to record something interesting to her students. "The children can use the camera to take pictures of math patterns or science experiments. There isn't a time or day that we set up to take pictures and that's it. It comes from them." This was in alignment with Dewey (1896), when he challenged teachers to first examine the nature of the learner and the surrounding environment. He believed, as did Vygotsky (1962) and later Piaget (1978), that a productive, naturalistic approach to learning should begin with an understanding of how learners interact and respond to their environment. Allowing

children access to technology throughout the day, regardless of subject matter, enabled the children to use it thoroughly.

***Child-Centered***

Finally, each of the teachers began by designing curriculum that was filled with child-centered, hands-on, social, and experiential activities first, keeping the learner in the forefront, and disseminating information based on the child. Then, when appropriate, technology was added to support these lessons. This use is in agreement with what the National Association for the Education of Young Children's (1997) believes about early childhood developmentally appropriate practices.

**No Commercially Prepared Assessment Curriculum**

None of the teachers in this study used commercially prepared computer programs to assess or evaluate the reading, writing, or comprehension level of their students. Cobb (2003) discussed the differences between assessment and evaluation. Evaluation was tied to the completion of a unit of study, and assessment was diagnostic and formative. The teachers used the computer to aid in the recording of scores and for writing narratives based on their students' development; however these activities were done without the students.

***How Is This Technology Use Supported?***

The findings show six enabling factors that allowed each of the teachers to carry out their curricula.

**High Level of Commitment from Administration**

First, there was a high level of commitment from the administrations of both Hanele and Ulu schools to not only provide the latest resources available, high-speed Internet access, a wireless environment, multiple laptop computers, scanners, color printers, high-tech microscopes, and up-to-date software, but the training and support needed to effectively use technology as well. Interviews revealed that both administrations offered multiple opportunities to learn various uses of technology. Classes and workshops were offered, some mandatory, some optional, on a regular basis. Hanele School posted notes from workshops in a private location for teachers on the school website, which allowed re-visitation as necessary.

**Full-time Support Staff On Site**

Second, support staff was available full-time. All of the teachers in this study were offered the opportunity to discuss matters, ask for personal assistance, or ask for assistance presenting information to students at the school every day. They did not need to schedule calls around mainland hours, wait for e-mail responses, or schedule appointments with external support persons. The support staff was available daily.

**Community of Help**

Third, all of the teachers in this study had a community of help available from other teachers at the school and older students in the classroom. They all believed that the open sharing of information and offer-to-assist were phenomenal. The school climate was agreeable and professional, and teachers were comfortable expressing their ideas and concerns.

**Teachers Were Technology Users**

Fourth, all of the teachers demonstrated that they were technology users. When children see that their teachers value reading and writing in their personal lives, they learn to appreciate and hopefully value those activities as well. I believe the same is true for technology. When children see teachers using technology to solve problems, complete tasks, and communicate, they will as well. This is reflective of Morrow and his colleagues' (2002) belief that the teacher must first see the importance of technology as a tool in their own lives prior to implementation in the classroom.

Emily's experience with technology was unique among the teachers in that she was able to trouble-shoot problems with relatively little fear. As technology was second nature to her, she was open to trying new programs and equipment independently, whereas the others were often more comfortable waiting for training or using accompanying literature.

**Technology Use Respected**

Finally, the teachers in this study did not allow any form of technology to be used for non-educational play games. At Hanele, the SMARTBoard™ was used to help gain and disseminate information, and in all environments computers were used with specific tasks in mind prior to entering the computer area. The idea that technology was to be respected and used as a mode of creating something tangible to share with others was prevalent in all classrooms.

***What are the Differences in Technology Use among Teachers in the Study?***

**Amount of Technology Use**

All of the teachers in this study shared very similar pedagogical perspectives; each believed children learn best in a social-constructivist environment. The older the students became, the more technology was used. Furthermore, as the students' age increased, the teachers' lessons included more specific tasks using technology.

Kim and Emily strongly connected technology to learning throughout the entire day, regardless of the targeted subject area. During the writing process, their grades 1-2 children continuously read and checked written work to ensure accuracy. Final drafts of writing projects were often shared with classmates and family members through letters, reports, posters, class websites, and various genres of presentations created by the children. Children took pictures of each other for "author's interviews," researched animal characteristics on the Internet for science, and used math programs to support classroom learning of geometric shapes. Children were comfortable using the technology because it was always available to them. Drake (2001) believed that early emphasis on technology use in the elementary grades not only supports literacy, but secondary studies as well.

**Type of Technology Used**

Kim and Emily very frequently used the SMARTBoard™ the way others would collectively use a chalkboard, overhead projector, and computer. Morning messages were edited, daily plans were posted, and information was gathered and shared multiple times throughout the day. Although the use of technology did permeate the curriculum, technology use was not the fulcrum for creating curriculum. This is in alignment with

Morrow, Barnhart, and Rooyaker's (2002) belief that technology should support, not supplant, the teacher or good, sound curriculum.

**Pedagogical Perspectives**

Grace's pedagogical perspective of teaching strongly influenced her decision to limit the amount of technology used by her grades K-1 students to support not just literacy, but all subject areas. Although she adhered to the notion that technology was an important factor of a child's education, she did not believe that it should occupy large periods of her students' day. She believed that the skills needed to use technology will be addressed in higher grades, and the emphasis of her K-1 classroom should remain with socialization and mastery of emergent skills. This limited use is in alignment with Healy's (1998) position that young children learn more through playing with adults or other children than they do with computers. Grace believed that using time to support social interactions was more valuable to her students' growth and development at this stage in their lives. Vygotsky (1962) and Piaget (1978) were both strong proponents for social development of young children. The argument exists that social opportunities can exist within the context of technology use, and those opportunities were observed during this study. It is the careful determination of when, how, and to what extended the individual teacher is comfortable with technology in order to successfully implement it in her curricula.

**How the Technology Was Used**

Grace generally supported the use of computers twice per week per student, and Dinah offered the use daily during free-choice periods. Students were allowed to choose from a pre-selected list of programs or Internet sites. During these free-choice times,

multiple learning and social opportunities were available, which may or may not include any form of technology. Grace's and Dinah's curriculum also included projects that incorporated technology throughout the school year.

Although all four teachers monitored the programs and sites used, as well as the length of time children spent on the computer, there was a notable difference in the amount of structured activities connected to this time. Each of the teachers allowed children to choose the programs and sites they would like to explore during free choice periods; however, in addition to this time, Kim and Emily often asked children to use the computer with specific tasks in mind. Typing final copies of writing pieces, creating a Keynote presentation, or gathering information were just a few of the tasks requested by the teachers. Papert (1992) did not believe that computer time should always be occupied with specific learning tasks. He felt that playing with the computer offered an "entryway for children into the world of computers . . . without fixed rules and structures in a way few other toys are capable of doing" (Papert, 1992, p. 4).

**Possible Reasons for Differences**

***More Access to Various Types of Technology***

The first possible reason for the higher level of this technology used by Kim and Emily was that the multi-grade 1-2 teachers at Hanele School had more access to technology than those in multi-grade K-1 at Ulu Elementary. The SMARTBoard™ technology, laptop availability, integration of technology with all specialty teachers (art, music, and physical education) and continual access to workshops was apparent. This access does not necessarily produce better readers or writers; the scope of this study did not include projections of student aptitude. Each of the teachers in the study

demonstrated superior abilities to carry out curriculum in alignment with best reading practices that were developmentally appropriate to their learners, regardless of the use of technology (National, 1997).

### *Correlation Between Age and Socialization*

Another explanation for the limited use of technology was the correlation between age and necessity for socialization opportunities. Grace and Dinah repeatedly discussed the importance of keeping the social and emotional needs of their grades K-1 students at the forefront of their curricula. Grace believed that the only reason she limited the amount of technology in the classroom was because of her students' developmental level. Dinah also stated, "In the past, we've been able to do so much more . . . the developmental level of this particular group was the biggest inhibition. They are a young bunch!" The difference between the use of technology and the need to offer social learning opportunities was in alignment with Piaget's (1950) stages of moral development. Children in grades K-1 are generally between five and six years old, which would place them in Piaget's preoperational stage where the connection to fantasy and egocentrism are higher than they are in the concrete stage, which generally begins around the age of six to seven (grades 1-2). Children in the preoperational stage generally have lower reading abilities than those in Piaget's concrete stage, and are challenged to cognitively differentiate between factual and fictional information on the Internet and make appropriate uses of time.

## Implications of the Study

The findings from this study yielded a number of implications for the early childhood teacher. Prior to working with children, each teacher in this study began

designing their curricula based on the social and cognitive levels of their students. The strong pedagogical basis for curricular decisions encouraged the multi-grade K-1 teachers in this study to use less technology and offer more social opportunities for growth than the multi-grade 1-2 teachers. Teachers used technology to support reading skills already in place, to gain and share information with others, and keep loved ones in touch with classroom events at a level appropriate to their development. Furthermore, administrative funding of workshops, full-time support staff, philosophical discussions on appropriate use, and the latest technology available supported the teachers at Ulu Elementary and Hanele School.

Therefore, I suggest that teachers begin with their pedagogical perspective of reading acquisition prior to determining whether technology would benefit learning. Second, I propose that technology that will support current practices be dispersed throughout the curriculum. Third, I recommend that administration provide the necessary support for teachers to adequately use resources.

***Pedagogical Perspectives of Reading Acquisition***

A Chinese proverb says, *"If you don't know where you are going, any map will do."* Software engineer Watts Humphrey added, *"If you don't know where you are, a map won't help."* Beginning with a clear understanding of how children learn is the first essential component in developing curriculum that will support a child's growth and development. Katz (1995) wrote:

> "In a developmental approach to curriculum design . . . what should be learned and how it would best be learned depend on what we know of the learner's

developmental status and our understanding of the relationships between early experience and subsequent development (p. 109)."

It is particularly important for educators to dedicate a sufficient amount of time acquiring a strong philosophical understanding of how children learn in order to determine what types of curriculum will meet the needs of their students. Building this foundation will enable educators the fundamental knowledge necessary to determine whether support systems will help or hinder practices currently in place.

Developing a strong pedagogical understanding generally requires years of education, multiple discussions with colleagues, and time to practice teaching methods in line with current research-based philosophies. I believe that teacher education programs must persist in requiring that graduates have a strong theoretical base along with multiple opportunities to explore various methods in order for them to make wise curricular choices. Teachers already practicing who do not have a firm understanding of how children learn to read must dedicate their time to gaining that knowledge.

The importance of developing a sound pedagogical perspective cannot be overemphasized. Teachers in successful schools were found to be articulate and knowledgeable about their curricula (Mosenthal, Lipson, Torncello, Russ, & Mekkelsen, 2004). Understanding the complex relationship between the teacher and learner is critical to the learning environment. Matching a child's cognitive level of development with curriculum is essential to optimal growth.

***Introduction of Technology Throughout Curriculum That Supports Current Practices***

Throughout the study, teachers discussed their connection between pedagogy and practice. This remained at the forefront of all their curricular decisions. Technology was introduced as a supportive measure after a sound reading program had been established.

Teachers should remain cognizant of current available resources for the specific needs of their students. This can be accomplished through coursework, online or in-person discussion groups, and subscriptions to various educational journals that support apposite use of technology in the early childhood setting. Visiting other successful early childhood settings is an effective way to observe the uses of technology to support literacy and could possibly allow the opportunity for teaming with other educators to reflect on appropriate practices.

Drake (2001) described technology best practices to be "identified, successful, education practices which utilize technology to support literacy learning and create an objective measure for achieving improved performance goals" (p. 12). Furthermore, Gordon (2002) adheres to the belief that technology should match a student's age and ability levels in order to be developmentally appropriate. In order for technology to be used in a way that will be meaningful and relevant to learning already taking place in a social environment that addresses standards, it is essential that it is age appropriate and lessons match that of the ability of the learner. Labbo (2003) adds that "technology should add substantively to your literacy curriculum and not be used merely for its own sake" (p. 301). Using technology for the sake of using technology would not follow best practice.

Additionally, Morrow, Barnhart, and Rooyakkers (2002) warn that computer technology should supplement and not supplant the teacher. I also believe that it should not overshadow or distract students from current curriculum practices in place. Teachers can easily become distracted with technology trends and administrative push for inclusion. However, teachers must remain aware of the capabilities of current technology and determine if its use would benefit their learners (Kozma, 1994). Alessi and Trollip (2001) suggest that teachers find opportunities where technology can assist in supporting instructional practices already in place. Therefore, computers and other forms of technology should not be the cornerstone of a learning environment but an addition to what already exists.

As similarly noted in best practices of reading acquisition, the most efficient blend of technology use with literacy was in environments where technology was integrated into multiple subjects. Teachers find that this allows children to fully develop their skills to the point that they are able to independently suggest a form of technology to gain or share information.

Finally, the understanding that pedagogy and practice should align prior to implementation of technology is clear. However, I would also recommend that the teachers be proficient users of the technology prior to its introduction. This is not to say that teachers should be technological gurus prior to use, but rather to keep in mind that young learners can quickly become disinterested by the user's inability to navigate a program or recall how to operate a device. Therefore, just as an educator would prepare for teaching a lesson, so too should practice time be set aside to be able to adequately use the tool.

***Administrative Support***

This research suggests the need for administrators to provide the necessary support for teachers to adequately use resources. The participants in this study believed that the support from their administration enabled them to adequately carry out their curricular choices. Each participant worked with an administrator who was very active in determining the inclusion of technology in the classroom.

First, discussion opportunities should be scheduled for teachers to share their philosophical understandings of technology and ways to incorporate it in their curricula to support learning. Ulu Elementary and Hanele School shared that their administrator used after-school faculty meetings and resource days to discuss the perspectives of multiple pedagogical issues, including the use of technology with learners at various levels of development. Furthermore, the administration encouraged teacher-teacher interaction and sharing. Teachers were encouraged to work together to develop plans to effectively implement technology.

Second, not only should funding for resources be provided, so should adequate training to use the technology in place. There is often a push to raise funds to purchase items such as digital cameras, computers, scanners, and SMARTBoards™, but not the funding to cover expenses for training. Without allocating time to adequately learn to use technology, funds are squandered. Even very proficient technology users believe that the equipment they use most likely is able to do more than it currently does but theu do not have the training to take advantage of these uses.

Third, the participants of this study found that proficient full-time support staff enables them the freedom to confidently implement various technologies in their

curricula. Once, while Emily was going through a program on the Internet with her students, she was unable to navigate the environment the way she wanted. She told the class, "I'm not sure about this. I'm going to have to ask Mr. X about this one." She was secure in the knowledge that help was just a few moments away without her having to spend hours on the phone trying to explain her problem. Support staff was on-site as well as willing and able to help.

***Limitations of the Study***

The study aimed to understand how effective K-2 teachers use technology to support literacy. The four teachers chosen were from two private schools in Honolulu that represent the ideal situation: matching perspectives of education between the administration and teachers as well as adequate resources and support. As the environments were ideal, this offered a most fortuitous opportunity to observe exemplary examples. However, this does not reflect how exemplary teachers in environments without similar pedagogical perspectives and support use technology to promote literacy.

The second perceived weakness of this study was related to interpretation bias. Having previously worked with two of the teachers chosen for this study, I was already aware of their teaching abilities, comfortable with their teaching styles, and appreciative of their perspectives. This feeling of familiarity could have influenced me to look for various events to occur or to miss something I wasn't expecting.

***Suggestions for Future Research***

Merriam (1998) believes that "the more cases, the more included in a study, the greater the variation across the cases, the more compelling an interpretation is likely to be" (p. 40). With this in mind, this study recognizes several areas for further research.

The first is single or multi-grade classrooms with similar pedagogical perspectives on reading acquisition from public schools or other private schools without generous financial support. The schools observed in this study were both private schools supported with generous funding to allow teachers to carry out their curricular decisions. Observing classrooms from other environments with similar pedagogical perspectives of reading acquisition might offer a broader understanding based on the resources and administrative support available to them.

Another research opportunity would be to include international sites. The United States is considered to be technologically advanced. However, other technologically advanced nations may have a different perspective when it comes to the education of young children.

Finally, technology use has become quite prevalent in the United States. I think it would be interesting to develop a study on the impact of children's level of familiarity with technology on teachers' decisions to include it in their curricula. As noted by Emily, multi-grade1-2 teacher at Hanele School, children are coming to school with abilities to use various forms of technology that exceed many adults'. This higher ability level might encourage teachers to look for opportunities to include technology based on student interest rather than pedagogical perspectives.

***Conclusion***

This study investigated two kindergarten-grade one and two grade 1-2 classrooms in private schools in Honolulu, Hawaii. It examined how effective K-2 teachers use technology to support emergent literacy. The investigation found that the teachers in this study all used technology to support literacy throughout the curriculum, but the degree to

which it was used varied. Each environment kept the learners in the forefront as the teachers created curriculum that was meaningful and relevant to their students. They used technology to aid in gaining and disseminating information and to create projects and presentations. Although the amount of independent use varied from one environment to the next, teachers in each environment clearly explained and modeled steps to take in order to complete tasks using technology prior to students' independent use. None of the teachers in this study used technology to teach skills not already introduced or used commercially prepared materials to assess or evaluate reading, writing, or comprehension levels, or allowed any form of technology to be used as a means of play.

The study also examined how technology use is supported in each environment. The investigation found that both schools benefited from administrators who displayed a high level of commitment to the inclusion of technology when and where it is appropriate to young learners. This was done through frequent discussions among colleagues on appropriate and successful uses of technology. Teachers reported a sense of community among the faculty, as they were readily open to share information with others. Additionally, workshops on uses of technology already in place were offered to all teachers, some mandatory, some voluntary. Full-time support staff was available at both schools every day throughout the school year to answer questions, trouble-shoot, teach lessons, and offer additional support. Finally, the teachers in this study were proficient users of technology in their personal lives. Again, as with uses of technology, this degree of proficiency and use varied from one teacher to another.

One of the greatest differences among teachers was the level and frequency of use of technology used to support literacy. Although two teachers demonstrated a stronger

connection to technology use, they were also offered more types of technology than the other two teachers. This access does not necessarily produce better readers or writers; the scope of this study did not include projections of student aptitude.

Next, the difference in age of the students in the K-1 setting compared to the 1-2 setting influenced the amount of technology used. The average age of students in the K-1 setting was reflected in their maturity level and the necessity to offer activities appropriate to them.

Another difference between teachers in the two schools was the way information was disseminated to families; one school used technology, and the other did not.

Finally, the study also investigated the influence pedagogical perspectives of reading had on the use of technology in the classroom. The data showed the pedagogical perspectives of the teacher strongly influenced their decision to include the use of technology to support literacy. All teachers believed that paper and pencil tasks must first be completed prior to transferring information to computers. Each teacher believed in the benefits of reading aloud to children, and offered listening centers and books on tape, CD, or iTunes for children to follow along. Finally, all the teachers believed that children should first learn skills before practicing them with the aid of technology.

Excellent teachers know their material, understand the needs of their students, and are able to motivate and encourage children to learn. In turn, excellent curriculum supports learning and allows opportunities for children to gain relevant and meaningful knowledge at a level that is appropriate for them. Having each component work simultaneously is the foundation for excellent reading instruction. The decision to

include technology to support this structure must be based on opportunities where it will enhance instruction and further the growth and development of young learners.

The teachers in this study were exemplary models who benefited from clear pedagogical perspectives, superior administrative support, and the latest technology. Their strong connection to their beliefs on how children learn best did not sway them to frivolously implement technology to succumb to parents', students', or community pressure. The participants continually reiterated the need to keep students' first. Therefore, their students thrived in an environment where learning was designed specifically with their individual learning styles and cognitive development as the foundation of all curricular decisions. When pedagogy and practice are in harmony, a melodic tune plays, children begin to dance, and the possibilities for success are immeasurable.

# APPENDIX A

## GUIDELINES FOR CHOOSING EARLY CHILDHOOD SOFTWARE

- Is the child in control, an "actor not a reactor?"
- Does the child set the pace of the activity?
- Are instructions clear?
- Does it teach powerful ideas, not just trivia?
- Can the child operate it independently?
- Does it feature discovery learning, not skill drilling?
- Does it capitalize on the child's intrinsic motivation rather than using external rewards?
- Is process more important than product?
- Does it reflect the child's experience in the real world?
- Are technical features well designed (e.g., runs quickly, saves child's work, has uncluttered graphics)?
- Does it display gender and role equity?

Taken from Healy's *Failure to Connect*, page 239

## APPENDIX B

## HEALY'S GENERAL PRINCIPLES FOR MEANINGFUL TECHNOLOGY USE

1. Fit the activity to students' level of maturation and cognitive development.
2. Make the activity meaningful by linking it with students' interests and experiences.
3. Start with hands-on and interpersonal activities (e.g., practicing face-to-face interviewing skills before questioning "experts" on-line; building a classroom replica of the rain forest while participating in a simulated adventure in Central America).
4. Set clear outcomes and standards for learning. Help students evaluate when and how well these goals have been reached.
5. Ask for student self-reflection –preferably in writing—on work habits and process as well as on the outcome.
6. Plan for a meaningful and useful way for students to "show off" what they have earned (e.g., a multimedia demonstration about planets in the solar system; an explanatory guide to local historic spots; a virtual tour of Shakespeare's England; a musical performance incorporating original digital composition; an essay or letter to the editor expressing the student's point of view on a topic studied).
7. Don't be seduced by technical effects. Be sure technology use is always cloaked in understanding (e.g., require the child to explain the meaning of the data and to justify the formats chosen to present the project).
8. "Support" the organization and quality of long-term projects with clear written directions and expectations, checklists, and checkpoints for each step. Elementary-age children especially need adult supervision in planning and completing each step.
9. If students work in groups, make sure all share in total workload and various types of tasks (e.g., all have experience with designing graphics, and all must do some reading and writing). Acknowledge that some students are better at some types of tasks, and encourage all to enjoy exercising their talents as they also improve less-favored skills.
10. Encourage integration of understanding across modalities (e.g., prepare an original—written—script about something viewed; represent historical information in dance; draw illustrations for mathematical data in a spreadsheet; compare and contrast emotional response and learning from reading a book vs. seeing it in a video).

Taken from Healy's *Failure to Connect*, page 246-247

# APPENDIX C

## AVAILABLE TTS (TEXT-TO-SPEECH) SOFTWARE

| Name | Format | | 1. Price |
|---|---|---|---|
| | PC | Mac | |
| CAST eReader | ✓ | ✓ | $200 (not-for-profit organization) |
| CoolSpeech 5.0 | ✓ | ✓ | $29.95 |
| HelpRead | ✓ | ✓ | Free download |
| Kurzweil 3000 | ✓ | ✓ | $1000 |
| Microsoft Reader | ✓ | | Free download |
| PDF Aloud | ✓ | ✓ | $110 |
| Read Genius | ✓ | | $29.95 |
| ReadPlease 2003 | ✓ | ✓ | Free download |
| TextSound 2.0 | ✓ | ✓ | $29.95 |
| WordSmith | ✓ | ✓ | $495 |
| Zero2000 | ✓ | ✓ | $39.95 |

# APPENDIX D

## SAFE SEARCH ENGINES FOR KIDS

| Name of Site | Description | URL |
|---|---|---|
| AOL Search for Kids | Safe, age-appropriate environment for kids in a manner appealing to both kids and parents, addressing primary industry and consumer concerns. | www.aol.com/netfind/kids |
| Ask Jeeves for Kids | Fast, easy, safe way for children to find answers to their questions on the Internet | www.ajkids.com |
| Awesome Library | Organizes the Web with 15,000 carefully reviewed resources, including the top 5 percent in education | www.awesomelibrary.org |
| Children's Literature Web Guide Search | Attempt to gather together and categorize the growing number of Internet resources related to books for Children and Young Adults | www.ucalgary.ca/cgi-bin/userindex.pl/~dkbrown/myindex.swish |
| KidsClick! | Web Guide and search tool for kids by librarians | http://sunsite.berkeley.edu/KidsClick!/ |
| OneKey | Kid-safe search engine sponsored by Google | www.onekey.com |

## APPENDIX E

## TYPES OF CASE STUDIES

| Source | Type | Description | Purpose | Strength | Limitation |
|---|---|---|---|---|---|
| Davey (1991) | 1. Illustrative Case Study | Descriptive, uses two or more instances to show what a situation is like | To make the unfamiliar familiar | Good method to use if the readers are unfamiliar with the topic or program | Requires in-depth information of each illustration, time required |
| | 2. Exploratory Case Study | Condensed case study | Carry out prior to large-scale investigation | Good safeguard to implement prior to large-scale investigations | Preliminary findings can lead to inappropriate conclusions |
| | 3. Critical Instance Case Study | One or a few sites for one or more purposes | Look at unique situations to determine cause and effect | Good for determining cause and effect | Little or no interest in generalizability |
| | 4. Program Implementation Case Study | Multiple sites focusing on implementation | To understand if implementation and intent are aligned | Useful when there is concern about implementation | Multiple sites and lengthy training |
| | 5. Program Effects Case Study | Single or multiple site focusing on program efficacy | Determine the impact of programs | Provides reasons for success or failure | Researchers should use other methods first |
| | 6. Cumulative Case Study | Combined information from several sites at different times | Longer-term, broad look | Can be done about past, present or future | Problems verifying the quality of the original data and analyses |

## APPENDIX E

## TYPES OF CASE STUDIES (CONTINUED)

| Source | Type | Description | Purpose | Strength | Limitation |
|---|---|---|---|---|---|
| Stake (2004)<br><br>Stake forms three categories of case studies, but feels that at times, studies might not fit neatly into a single category. | 1. Intrinsic Case Study | Researchers have an intrinsic interest in the case | To learn about a specific case (i.e.: why a child's behavior is taking place in a particular situation and not others) | Good for understanding a particular case (not necessarily interested in other cases) | Not for forming generalizations about other cases |
| | 2. Instrumental Case Study | Looking at one situation to understand another | i.e.: studying a teacher but paying close attention to her grading techniques to see if it affects her teaching | Finding hidden effects of case | Difficult to weed out other variables to form conclusions |
| | 3. Collective Case Study | Each case is important to understand the greater picture | Choosing to study several teachers, schools, or districts instead of just one | Forming generalizations | Time requirements |
| Yin (2003) | 1. Exploratory | Condensed case study, could be a pilot study. | Determining if a full project should be undertaken | Answering questions, forming an initial understanding | Researchers can be quick to form conclusions |
| | 2. Descriptive | Covers the depth and scope of study | Multiple studies to find patterns | Seeking pattern | Heavy |

## APPENDIX E

## TYPES OF CASE STUDIES (CONTINUED)

| Source | Type | Description | Purpose | Strength | Limitation |
|---|---|---|---|---|---|
| Yin (continued) | 3.Explanatory | In-depth look at a specific case or cases | Describe the context of an event or environment. Allows those outside the realm of the study to understand a specific phenomenon. | Casual studies. Can be used for multiple cases. Allows for the possibility of forming generalizations. | One can never really understand the entire case |
| Merriam (1998) | 1. Descriptive | Presents a detailed account of the phenomenon under study | To provide useful information about areas where little research has taken place. | Describes and shares innovative programs or practices. | Are often costly, time consuming, product too lengthy, too detailed, too involved for policy makers and teacher to read and use. |
| | 2. Interpretive | Contain a thick, rich description of a phenomenon. | To gain as much information possible with the intent of analyzing and interpreting the data to be able to form theories on the phenomenon. | Allows further investigation of previously unknown or misunderstood phenomenon. | |
| | 3. Evaluative | Provides description, explanation, and judgment. | To evaluate a, or a number of, specific situation(s) | Lifelike, simplifies data, illuminates meanings, and forms judgments. | |

# APPENDIX F

## QUESTIONS FOR TEACHER INTERVIEW

1. How do you personally use the computer away from school? (i.e., e-mail, purchases, movie listings, basic searches)
2. How did you learn to use the technology that you do in your personal life?
3. How do you personally use the computer at school?
4. What is the role of technology in your classroom?
5. Which types of technology do you use?
6. How did you learn to use this technology?
7. Which types of technology do your students use?
8. Are children scheduled for computer time?
9. Must children spend a minimum amount of time on the computer?
10. Why are you deciding to include technology? What or who influenced your decision?
11. How do you use technology to support emergent reading?
12. What barriers do you experience that inhibit technology use in your classroom?
13. What support systems are in place for you to use technology at school?
14. What support systems are in place for your students to use technology at school?
15. Where do you see your next steps in technology use in the classroom?
16. What is inhibiting you from doing it now?
17. What role does the administration play in the inclusion/exclusion of technology?
18. Is there anything else you would like to share?

# APPENDIX G

## SURVEY QUESTIONS

### 1. Educational Background and Grades Taught

Please tell us about your educational background and the grade(s) you've taught.

**1. How many years have you been teaching?**

- 0 - 5 years
- 6 - 10 years
- 11 - 15 years
- 16 - 25 years
- more than 25 years

**2. What is your level of education?**

- Bachelor's Degree
- Some Graduate Courses
- Professional Diploma
- Master's Degree
- PhD

**3. Are you certified in Early Childhood? (Did you major/minor in Early Childhood Education?)**

- Yes
- No

**4. What grade level are you currently teaching?**

- K
- K-1
- 1
- 1-2
- 2
- 2-3
- 3

Other (please specify)

**5. How many years have you been teaching this grade?**

# APPENDIX G

## SURVEY QUESTIONS (CONTINUED)

**6. Which other grades have you taught?**

- [ ] Preschool
- [ ] K
- [ ] K-1
- [ ] 1
- [ ] 1-2
- [ ] 2
- [ ] 2-3

## 2. Personal Use of Technology

The following questions pertain to your personal uses of technology.

**1. How do you personally use the computer away from school?**

| | Daily | More than once per week | Weekly | Monthly | Infrequently | Never |
|---|---|---|---|---|---|---|
| Email | ○ | ○ | ○ | ○ | ○ | ○ |
| Chat | ○ | ○ | ○ | ○ | ○ | ○ |
| Photos | ○ | ○ | ○ | ○ | ○ | ○ |
| Music | ○ | ○ | ○ | ○ | ○ | ○ |
| Movies (create/edit) | ○ | ○ | ○ | ○ | ○ | ○ |
| Online purchases | ○ | ○ | ○ | ○ | ○ | ○ |
| Letter writing | ○ | ○ | ○ | ○ | ○ | ○ |
| Entertainment | ○ | ○ | ○ | ○ | ○ | ○ |
| Games | ○ | ○ | ○ | ○ | ○ | ○ |
| Information search | ○ | ○ | ○ | ○ | ○ | ○ |

Other (please specify)

# APPENDIX G

## SURVEY QUESTIONS (CONTINUED)

**2. How did you usually learn to use the technology that you do in your personal life?**

| | Most often | Most often | Usually | Not often | Never |
|---|---|---|---|---|---|
| Self taught | ○ | ○ | ○ | ○ | ○ |
| On-line classes/tutorials | ○ | ○ | ○ | ○ | ○ |
| Software tutorials (information that came with the program) | ○ | ○ | ○ | ○ | ○ |
| University course(s) | ○ | ○ | ○ | ○ | ○ |
| Friends/family | ○ | ○ | ○ | ○ | ○ |

Other (please specify)

**3. Personal Uses of Technology at School**

Please respond to the following questions about your personal uses of technology at school.

**1. How do you personally use technology at school?**

| | Daily | More than once per week | Weekly | Monthly | Infrequently | Never |
|---|---|---|---|---|---|---|
| Email | ○ | ○ | ○ | ○ | ○ | ○ |
| Blogs - school level | ○ | ○ | ○ | ○ | ○ | ○ |
| Blogs - student/family | ○ | ○ | ○ | ○ | ○ | ○ |
| Communicate with parents | ○ | ○ | ○ | ○ | ○ | ○ |
| Manage website(s) | ○ | ○ | ○ | ○ | ○ | ○ |
| Organize grades | ○ | ○ | ○ | ○ | ○ | ○ |
| Organize lessons | ○ | ○ | ○ | ○ | ○ | ○ |
| Create lessons | ○ | ○ | ○ | ○ | ○ | ○ |
| Gather information | ○ | ○ | ○ | ○ | ○ | ○ |
| Curriculum idea | ○ | ○ | ○ | ○ | ○ | ○ |

Other (please specify type and level of use)

**2. What role does technology play in your classroom?**

- ○ Imperative (I couldn't imagine teaching without technology)
- ○ Very important
- ○ Somewhat important
- ○ Not very important
- ○ Not important
- ○ I don't use technology with my students

# APPENDIX G

## SURVEY QUESTIONS (CONTINUED)

**3. Which types of technology do you use?**

| | Daily | More than once per week | Weekly | Monthly | Infrequently | Never |
|---|---|---|---|---|---|---|
| Computer | ○ | ○ | ○ | ○ | ○ | ○ |
| Digital camera | ○ | ○ | ○ | ○ | ○ | ○ |
| Video camera | ○ | ○ | ○ | ○ | ○ | ○ |
| Overhead projector | ○ | ○ | ○ | ○ | ○ | ○ |
| SmartBoard | ○ | ○ | ○ | ○ | ○ | ○ |
| Tape recorder | ○ | ○ | ○ | ○ | ○ | ○ |

Other (please specify type and frequency of use)

**4. How did you learn to use this technology?**

| | Most often | Usually | Sometimes | Never |
|---|---|---|---|---|
| Self-taught | ○ | ○ | ○ | ○ |
| On-line classes/tutorials | ○ | ○ | ○ | ○ |
| Software tutorials (information that came with the program) | ○ | ○ | ○ | ○ |
| University course(s) | ○ | ○ | ○ | ○ |
| School supported course (structured) | ○ | ○ | ○ | ○ |
| Faculty sharing (colleagues sharing) | ○ | ○ | ○ | ○ |
| Friends/family | ○ | ○ | ○ | ○ |

Other (please specify)

**4. Student Uses of Technology**

Please respond to the following questions about the way your students use technology in the classroom.

# APPENDIX G

## SURVEY QUESTIONS (CONTINUED)

**1. Which types of technology do your students use? Please indicate the level of independence based on their developmental capabilities.**

| | Independent | Needs very little assistance | Needs assistance | Assistance mandatory | Does not use |
|---|---|---|---|---|---|
| Computer | ○ | ○ | ○ | ○ | ○ |
| SmartBoard | ○ | ○ | ○ | ○ | ○ |
| Tape recorder/player | ○ | ○ | ○ | ○ | ○ |
| Overhead projector | ○ | ○ | ○ | ○ | ○ |
| Digital camera | ○ | ○ | ○ | ○ | ○ |
| DLR camera (film) | ○ | ○ | ○ | ○ | ○ |
| Video camera | ○ | ○ | ○ | ○ | ○ |
| Typewriter | ○ | ○ | ○ | ○ | ○ |
| Microphone | ○ | ○ | ○ | ○ | ○ |

Other (please specify type of technology and level of independence)

**2. Of these types of technology, how often do the students use them?**

| | Daily | More than once per week | Weekly | Monthly | Infrequently | Never |
|---|---|---|---|---|---|---|
| Computer | ○ | ○ | ○ | ○ | ○ | ○ |
| SmartBoard | ○ | ○ | ○ | ○ | ○ | ○ |
| Tape recorder/player | ○ | ○ | ○ | ○ | ○ | ○ |
| Overhead projector | ○ | ○ | ○ | ○ | ○ | ○ |
| Digital camera | ○ | ○ | ○ | ○ | ○ | ○ |
| DLR camera (film) | ○ | ○ | ○ | ○ | ○ | ○ |
| Video camera | ○ | ○ | ○ | ○ | ○ | ○ |
| Typewriter | ○ | ○ | ○ | ○ | ○ | ○ |
| Microphone | ○ | ○ | ○ | ○ | ○ | ○ |

Other (please specify)

**3. Are students scheduled for computer time?**

○ Yes
○ No

# APPENDIX G

## SURVEY QUESTIONS (CONTINUED)

**4. Are children required to spend a minimum amount of time on the computer?**

- ◯ Yes
- ◯ No

If yes, how many minutes per week?

## 5. Professional Choices of Inclusion/Exclusion of Technology

The following questions pertain to your professional choice to include/exclude technology to support learning in your classroom.

**1. Why are you deciding to include technology in your classroom? (choose all that apply)**

- ☐ Mandatory administrative decision
- ☐ Suggested administrative decision
- ☐ Collaborative faculty decision
- ☐ Personal decision (I personally like/dislike technology)
- ☐ Pedagogical perspective (professional decision based on developmental appropriateness)

**2. How do you use technology to support emergent reading?**

| | Daily | More than once per week | Weekly | Monthly | Infrequently | Never |
|---|---|---|---|---|---|---|
| Computer software (tutorials/drills) | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| Writing projects | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| Information gathering | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| Information sharing (i.e.: projects, slide show, reports) | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| Read aloud | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| Other | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |

Other (please specify)

# APPENDIX G

## SURVEY QUESTIONS (CONTINUED)

**3. What barriers do you experience that inhibit technology use in your classroom?**

| | Strongly Agree | Agree | Agree Somewhat | Disagree | Strongly Disagree | N/A |
|---|---|---|---|---|---|---|
| Insufficient time to implement | ○ | ○ | ○ | ○ | ○ | ○ |
| Not enough equipment | ○ | ○ | ○ | ○ | ○ | ○ |
| Outdated equipment | ○ | ○ | ○ | ○ | ○ | ○ |
| Insufficient software for their needs | ○ | ○ | ○ | ○ | ○ | ○ |
| Insufficient funding | ○ | ○ | ○ | ○ | ○ | ○ |
| Administrative decisions | ○ | ○ | ○ | ○ | ○ | ○ |
| Personal limitations/expertise | ○ | ○ | ○ | ○ | ○ | ○ |
| Developmental level of students | ○ | ○ | ○ | ○ | ○ | ○ |
| Other | ○ | ○ | ○ | ○ | ○ | ○ |

Other (please specify)

**4. What role does the administration play in the inclusion of technology? (choose one)**

- ○ Active role (schedules workshops, ensures adequate funding for technology and support, communicates through blog/email)
- ○ Adequate role (occasional workshops, some funding and support)
- ○ Limited role (would like you to use technology, but does not sufficiently fund devises, offers limited help)
- ○ Passive role (does not get involved - you are on your own)

Additional thoughts

**5. What support systems are currently in place for you to use technology at school? (choose all that apply)**

- ☐ Administration
- ☐ Support staff (i.e.: technology coordinator)
- ☐ Online support contracts
- ☐ Other (please specify)

# APPENDIX G

## SURVEY QUESTIONS (CONTINUED)

**6. What types of support systems are in place for your students to use technology at school?**

- [ ] Administration
- [ ] Support staff (i.e.: technology coordinator, technology teacher)
- [ ] Peer tutoring
- [ ] Posted steps for device use
- [ ] Other (please specify)

### 6. Next Steps

You are almost done :) Please answer these last few questions on future uses of technology.

**1. Where do you see your next steps in technology use in the classroom?**

**2. What is inhibiting you from doing it now?**

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