The Relationship Between 21st Century Literacy and Technology:

A Comparison of Perceptions

A Dissertation Submitted to the Graduate School in Partial Fulfillment of the
Requirements for the Degree of Doctor of Education

by

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Dedication

I dedicate this work to my husband Jerry and my children, Christopher and Sara. Jerry, nine years ago when I started this journey, you did not hesitate to say “Go for it!” When circumstances reprioritized our lives and the completion of this project, you told me, “It will get done.” When I was convinced I could not complete this huge task, you said, “Sure you can.” Quitting was not an option, and you reminded me of that often. I am grateful for your unconditional encouragement and support. This degree is as much yours as it is mine. Thank you for being the incredible person you are.

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This study analyzed three different groups’ perceptions of 21st Century literacy and technology. The three groups were juniors and seniors at two large urban high schools, juniors and seniors in teacher education programs from four mid-west post-secondary schools, and the four deans of education at four post-secondary schools. A mixed methods research design was used including a survey of student groups and interviews of all four deans and representatives of each of the schools. Findings included differences in perceptions of each of the groups as well as differences in access and use of technology. The implications for teacher education and future research in the area of 21st Century literacy are included.
Chapter One

A primary ideal of American democracy is that every citizen becomes literate. Since their inception, schools in the United States have been charged with the responsibility of developing a literate electorate. Throughout the history of American education, beliefs about what it means to be literate and beliefs about literacy instruction have been defined by the socio-political and cultural context of any given time history (Alexander & Fox, 2005). The definition of literacy has ranged from being able to read and write to more advanced conceptions of being able to read, write, discern valid resources, and analyze and synthesize what was read. No matter the definition of literacy, meaning was considered to be derived through the interaction between the individual and text print. Until most recently, little has changed in the ways in which literacy is defined.

Technology has also been integral to societal influences throughout history. Often technological developments have occurred as the result of societal needs, and innovations in the areas of science and industry have been the focus of past attention. Many advancements have been viewed in terms of implements or tools rather than as extensions of the process of making meaning. In the 21st Century, success or failure of technological advancements occurs within a complex interaction of social, cultural, and...
economic factors. No matter what the technological development, technology does not succeed or fail on its own merits (Volti, 2006).

Technology and literacy have been intertwined since the advent of written language. Both are integral to any given social context, and it is impossible to extract either in isolation from that context. Rapidly increasing developments in the form of digital communication connects technology and literacy in the 21st Century as new literacies. Twenty-first Century literacy gains deeper meaning within the wider socio-economic and cultural context that includes digital communications and globalization via the Internet. As literacy becomes re-conceptualized, the educational community must consider reforming traditional schooling and concepts of what it means to be literate. Kleibard (2002) reminds us that “Reform movements…find strength or weakness depending on their compatibility with the tenor of the times.”

One example of the tenor of the times is the way in which technology now permeates daily life. Digital communication increases the connectedness of millions of people around the globe. E-mail, cell phones, instant messaging, and text messaging, as well as video e-mail, exemplify popular modes of communication, most of which are not utilized in schools.

In addition, the current educational tenor in the United States is to set standards and require assessments to measure success in meeting them. The federal government, through the No Child Left Behind Act of 2002, has set the bar for every child to be technologically literate by eighth grade. At the same time, standards developed by the United States Department of Education and the International Society for Technology in Education (Appendix A) have added to other and sometimes contradictory imperatives.
All this has led to an increasing societal context of disequilibrium where schools are expected to meet the requirements of the law, and to also meet the demands of the times.

Yet another factor is the very disruptive nature of rapid change. Increasing connections of the global community are the catalyst for necessary pedagogical reform (Christensen, 2008). Schools must change. Twenty-first Century literacy is developing in relation to technological advances. The educational reform that must occur to prepare students for the future requires understanding of literacy and technology within the complex socio-political and cultural context of the present.

Rapid change in technological advancements distinguishes the start of the 21st Century. The world is connected in ways never before imagined, as evidenced by how people communicate, do business, and think. As an implement for communication, design, and creation, technology changes people’s roles as consumers. Technology as catalyst can change the way people think about their world and of themselves. The ways in which people think of or perceive their world relates to how each navigates daily life. Perceptions as mental models are constructs to be utilized or applied in situated contexts (Gee, 2004). With the onset of the knowledge society and increased global connection through the Internet, innovation and change are no longer waves of the future. They are the present. Literacy continues to be defined and redefined through technological innovations and change. One of the most predominant examples of the influence of technology on literacy is development of web 2.0, which provides an interactive Internet environment. In this new environment previously linear connections of reader with text print now become multimodal interactions where the individual is creator and designer as well as reader. A growing number of academicians across disciplines are questioning
the impact and consequences of changing patterns of communication, ways of conducting research and development, and ways of doing business.

Research related to the impact that technology now has on literacy has spawned the study of new literacy or 21st Century literacy. Rapid technological change resulting in on-going differences in the ways people communicate is forcing differences in the way literacy is defined. “Literacy is defined by change” (Leu, Kinzer, Coiro, Cammack, 2004).

What it means to be literate now is vastly different than in the past. Knowledge and learning are no longer the sole domain of schools according to Gilbert (2006). Anyone who has access to the Internet has access to more information and knowledge than any other period in time. No longer is access to information limited to libraries full of text print books. With this explosion of access to information has come growing concerns about the quality of information on the Internet and the ways in which people in general, students specifically, discern what constitutes valid information. What it means to be literate is changing as fast as the technology itself, and with that change emerges many questions that are yet unanswered. Those questions include how best to discern what is valid and what is not in addition to how literacy will be defined in the 21st Century.

This vastly different meaning of literacy as “a total paradigm shift: a radical break with the past that requires us to stop and completely rethink much of what we do” (Gilbert, 2006 p.10) is most significant to those who are directly involved with education. Those who help to set policy, those who are preparing to teach, and students are significant groups in education. Understanding the perceptions of higher education
faculty, emerging teachers, and students in the K-12 setting, as related to the ways in which literacy and technology are intertwined, will lead to understanding how each group will then act on or use those perceptions in situated action (Gee, 2004). A comparison of each group leads to better understanding the enactment of 21st Century literacy within a context of an educational system that has not changed significantly since its inception.

The American K-12 educational system is designed to teach students uni-modal print literacy. Joseph, Bravmann, Windschitl, Mikel, & Green (2000) detail curriculum perceived as cultures. One curriculum culture orientation is Connecting to the Cannon, and within this classical humanist orientation teachers are viewed as “elders and masters” (p. 59). This orientation originated with Socrates when teachers were storytellers or performers “leading students to meaningful answers and affirmation of values” (p. 60). Until recently, teachers have been considered the dispensers of knowledge, and childhood has been defined by school (Des Dixon, 2000). Now, the gap widens between the students who use technology in multimodal ways and the teachers who do not (Prensky, 2005). The teacher is still considered the elder and the master in many classrooms, and overall, public schools’ use of technology is narrow in focus and as controlled as the instructional discourse that goes on between teachers and students. Even though much has been invested in infrastructure at the local level, technology is still not as extensively integrated instructionally in order to prepare students for the future (Maximizing the impact: The pivotal role of technology in a 21st century education system, 2007). Increasingly, students come to school with technological skills that far exceed the limited and controlled technological opportunities that exist in many schools.
The educational implications for higher education are at least as significant because all roads lead back to the academy. Higher education largely determines the state of education in the country at all levels (Sanyal, 2001). The students who are preparing to be teachers and the faculty who teach them often represent a technology dichotomy of status quo and change much like what is seen in K-12 schooling. The digital divide that exists in higher education is the chasm existing between faculty members who are unfamiliar with digital screen language and students who are well versed in digital fluency (Bleed, 2005). More importantly schools of higher education as research communities lack capacity to provide a strong research base to inform educational instruction. A very small percentage of post-doctoral candidates in education actually are involved in research. In addition, the research that exists provides very little insight into literacy that involves technology (National Research Council, 1999, 2000, 2002). The result is that the educational community, K to post-secondary, is being pressed for systemic change. At the same time it remains resistant to change and devoid of a substantial research base to verify what it means to be literate in the 21st Century.

The evolution of new literacies within the context of the 21st Century and increasing developments of technology have created a climate that emphasizes there is no one exact definition of literacy. According to Williams (2007) “there is no absolute definition of literacy: it will vary amongst individuals, societies, regions and nations, and also over time” (p.10). Literacy is contextual. It is defined by who a person is, framed by social class, job, and geographic area. Literacy is a “dynamic construct that one is always developing towards and never achieving” (p. 10). Because literacy continues to be defined and redefined through the lens of constant change, there is little in the research
literature that inspires consensus (p.10). The lack of consensus of how 21st Century literacy is defined suggests there are a variety of ways in which the integration of technology and literacy is perceived.

**Statement of the Problem**

Historically, educators have always been charged with preparing students for the future. Today all educators find themselves preparing students for a future of increasingly rapid change, and few would argue that preparing students for the future must have much to do with the ability to utilize current innovations in technology. The problem is that the educators who are preparing students for the future may not have the same perceptions of literacy and technology as the students who they are teaching. Increased access to the interactive web, social networking technologies, and information has served to peak interest in analyzing and researching what is coming to be known as new literacies, or 21st Century literacies. Often the meaning of these terms is best understood in relation to the users of technology. Prensky (2001a) refers to the difference between today’s students, under the age of 35, and those who are older as digital natives and digital immigrants. The student who has grown up immersed in technology as in TV, cell phones, computers, video games, and the Internet knows how to speak and comprehend digital language. They are the digital natives. “Today’s students are no longer the people our educational system was designed to teach” (Prensky, 2001b, p. 1). Those who have not grown up with web-based technology are digital immigrants. According to Prensky(a), digital immigrants are best distinguished by the fact that they print out e-mail to read and do not know the digital language in the same way that digital
natives do. Put simply, digital immigrants are teaching digital natives, and to a great extent they may not be speaking the same language. The author makes reference to very real differences. Natives are used to receiving information very fast. They like to multi-task, and they do it very well. Natives want graphics before text when reading and prefer random access as in hypertext. They prefer networking and collaboration, and they prefer games over traditional work. According to Prensky, digital immigrants find the behaviors of natives distracted, and they prefer to teach in linear, step-by-step ways – slowly. Prensky’s reference to difference between today’s students and the current educational system suggests some very real differences that are not limited to attitudes, behaviors, and experiences.

The aforementioned behaviors reveal significant differences in perceptions of technology and its use in relation to literacy in general. If the differences are as vast as Prensky (2001a) describes, the impact on K-12 and post-secondary education is undoubtedly significant, especially in relation to those who oversee educational policy and programming, those who are studying to be teachers, and students.

**Purpose**

The purpose of this research project was to identify the similarities and differences in the frequency and type of use of technology and perceptions about 21st Century literacy of deans of education, emerging teachers, and high school juniors and seniors. In addition, the study was conducted to further inform the literacy community, both researchers and practitioners, of perceptions of new literacy held by deans of education, emerging teachers, and high school students. Finally, this study also helps to
further clarify and define new literacy within the context of the beginning of the 21st Century as it related to further research.

**Significance of the Study**

The significance of this study rests in the ways that the data can be utilized to make programmatic changes in teacher education programs. The ways in which overseers of policy and program, emerging teachers, and students perceive and define new literacy impact the ways in which literacy is taught and learned. Lack of congruence between perceptions of literacy in the 21st Century and the ways in which emerging teachers are taught to implement literacy instruction could have significant impact on meeting the needs of students in the 21st Century. Research in the area of 21st Century literacy is relatively new. Representative studies have been related to the perception of leadership in technology implementation, teaching techniques, and the amount of use of technology (Bagwell, 2008; Keenwge, 2007; Oliver, 2003; Rogers, 2000; Sanny, 2005; Savery, 2002).

Also significant is further definition of new literacy through the perceptions of leaders, teachers, and students. Being aware of similarities and differences in perceptions that impact the way people interact in situated contexts also aids further development of programming and pedagogy for future teachers. If in fact change is the status quo, further research may show that what it means to be literate will need to be as adaptive as are the technological developments.
21ST CENTURY LITERACY AND TECHNOLOGY: PERCEPTIONS

Research Questions

1. With what frequency do deans of education, emerging teachers, and high school students use technology?

2. In what ways do deans of education, emerging teachers, and high school students use technology?

3. What are the perceptions of deans of education, emerging teachers, and high school students about 21st Century literacy and technology?

4. What similarities or differences exist between the frequency of use and type of use of technology of deans of education, emerging teachers, and high school students?

5. What similarities or differences exist between the perceptions of deans of education, emerging teachers, and high school students relative to 21st Century literacy and technology?

Definitions of Terms

EMERGING TEACHER: The student who is in a teacher preparation program. For the purpose of this study, this would be the student in the final two years of study specific to qualifying for teaching certification.

DEANS OF EDUCATION: Those department leaders who are in charge of overseeing policy and program development at the university / college level.

ACADEMIC INSTITUTIONS: Institutions of higher learning. Post K-12 schools. For the purpose of this study – Ball State University, Bethel College, Goshen College, Indiana University at South Bend.

HIGH SCHOOL STUDENT: For the purpose of this study, high school students were identified in their junior or senior year of high school.
LITERACY: In the traditional sense, literacy is defined as text print decoding, comprehension, and writing. For the purpose of this study literacy also includes analysis and synthesis of text print.

21ST CENTURY LITERACY / NEW LITERACY These terms are used interchangeably throughout the study. They are defined as comprehension, analysis, and synthesis of digital, multi-modal, collaborative communication. Included is text print, in addition to multi-media formats of sound and movement and ways in which any given person is able to discern the validity of what is being read.

WEB 2.0: Software that allows for users to read, compose, and edit other’s writing on the web. Often referred to as the interactive web.

DISCOURSE: The socio-political and cultural contexts to which each person belongs as a member of society. Each person belongs to several discourses in their life as they have a variety of roles in life.

SITUATED ACTION: Actions of a person within the context of a person’s life. Action that is determined by the context of a person’s life.

UNI-MODAL LITERACY: One mode of literacy that involves the individual and text print either reading or writing.

MULTI-MODAL LITERACY: Multiple modes of literacy that involves sound and movement as well as text print.

VISUAL LITERACY: Literacy that involves that which can be interpreted visually rather than involving sound. An example would be interpretation of text print in conjunction with pictorial representation.

INFORMATION LITERACY: Literacy that involves interpretation of varied amounts of information and the analysis of its validity. An example would be the process of analysis and interpretation of a variety of web sites to determine valid sources.

MEDIA LITERACY: Literacy that utilizes interpretation of forms of media often used simultaneously to communicate. An example would be interpretation of multimedia as in pictures, sounds, movement to determine meaning.

PERCEPTION: Utilized throughout this study as the way in which a person “sees” their world. Perceptions are like lenses. A person interprets daily situations through the perceptions held of those daily events. Perceptions are utilized to create mental models by which a person acts and reacts in their social context.
MENTAL MODELS: Structures of the mind to scaffold our thinking (Gilbert, 2005, p. 68). Mental models are developed through the context of a person’s life, and they are useful to everyday thinking.

Delimitations

1. Subjects for both emerging teachers and high school students were limited to students who were in their junior and senior year of a teaching program and a high school program.
2. No limitation was put on the years of experience for the deans of education.
3. The study was limited to four academies in Indiana. Generalization of results will be limited.
4. The group of only four deans did not lend itself to quantitative comparison to the larger groups of emerging teachers and the group of high school juniors and seniors.
5. High school language arts teachers proctored the survey administration to high school students in computer labs. Although the teachers were given very specific instructions to not provide any assistance or editorial comments to students during administration unless there was an equipment failure, this was an area of administration the primary researcher had less control over.

Summary

Change is the status quo of the 21st Century. Rapid change distinguishes the technological advances that are now shaping the world. The impact on K-12 education and higher education is still to be determined. What is known is that many current students have been surrounded with and have used technology from a very young age.
21ST CENTURY LITERACY AND TECHNOLOGY: PERCEPTIONS

Indications are that there are wide gaps between those who are multi-modally, digitally literate as opposed to those who primarily possess traditional uni-modal literacy. The perceptions or mental models that are formed as part of language acquisition are important to the development of literacy. Those perceptions are also important to how a person interacts in any given context as the mental models formed are what are used to interpret the context. A study of the similarity and differences of the perceptions of 21st Century literacy in light of technological change is important for three reasons. First, research in the area of 21st Century literacy or new literacy is relatively new. It is important that in these early stages of research of new literacy the evidence is gathered to monitor the transition and impact of the increased rate of technology developments on what it means to be literate. Second, it is important to further determine the similarities and differences in the perceptions of various groups in education as to what it means to be literate in the 21st Century. If program leaders, pre-service teachers, and high school students have vastly different perceptions of new literacy, the impact on instruction is significant. The result can be a disconnect at all levels. Finally, a study of perceptions of new literacy can help to inform future pedagogy of educators and serve to minimize the digital divide between teachers and students.
Chapter Two

Our 21st Century world is connected in ways never imagined just a few years ago. Increasingly greater developments and uses of technology have brought about globalization and an explosion of access to knowledge. The advent of the Internet, in particular, has provided a platform for communication, design and development, and participatory activity that is unprecedented. Traditional modes of communication are being challenged, and vast amounts of information are increasingly accessible to people of all ages. The response has been alarm by some and celebration by others. A sense of hurtling toward an unimaginable future has fueled debates about the wisdom and meaning of this journey. At the very center of this debate are the questions: What does it mean to be literate in the 21st Century? What are the implications of technology developments and literacy for 21st Century schools? What are the implications for education as growing numbers of students become technologically literate outside the scope of traditional schooling? Finding the answers for many of these questions rests in the study of how the connections between literacy and technology are perceived at any given time.
Those who would criticize the rapid developments of technology and the impact on learning and literacy uphold the written word and the solitary interaction of a reader to print as sacred. "The book is the best thing human beings have done yet" (Carroll, 2001, p. 2). Some debate the value of technology to improve student achievement contending that students need authentic experiences rooted in the physical as opposed to virtual experiences to which they have access with technology (Monke, 2005). Some researchers question simultaneous use of various forms of technology. Concerns have been raised whether or not deep understanding, critical thinking, and reflection are sacrificed for increased multi-tasking ("Is technology producing a decline in critical thinking and analysis?," 2009). Also among the skeptics are those who promote great caution because research in related fields such as early childhood learning and brain research have not yet been able to determine the long-term effects of repeated use of technology on learning (Healy, 1998; Wolf, 2007).

Yet there are many others who constitute enthusiastic proponents of all this change. They acknowledge the power and potential of the interconnectedness of the Internet to transform literacy and learning (J. P. Gee, 2003; Marcus, 2005; Prensky, 2005; Riley, 2003; Tapscott & Williams, 2008). The ability of search engines, such as Google, to digitally scan and cross reference stores of knowledge provides access to information that is unprecedented. In addition, the interactivity of the Internet through the development of web 2.0 can change the essence of those who use technology as well as change their relationship to literacy. This transformation is indicated in the very definition of web 2.0 which describes a happening rather than reference to software.
(Davies & Merchant, 2009). Literacy now means people are no longer simply consumers of information; they actively participate as designers, creators, and authors.

Literacy in the 21st Century generates significant differences in perceptions and configurations of space (Knobel & Lankshear, 2007). Traditionally, literacy has existed in physical space defined by a person reading text print on a page. Kahn and Kellner (2008) state that literacy has typically been defined as “vocational proficiency with language and numbers such that individuals could function at work and in society” (p. 3). The interaction was considered to be between the reader and text in what is perceived to be physical space. Now a different type of space exists – cyberspace. Knobel and Lankshear (2007) refer to cyberspace as “the contemporary fracturing of space” (p. 9). The emergence of the Internet referred to as cyberspace has caused a reconfiguration of one’s perception of space in general. In this contemporary space, literacy takes on new meaning. How literacy is defined is rooted in one’s conceptions of reading and writing. Twenty-first Century literacy often referred to as new literacy is still rooted in text print, but also encompasses the reconfiguration of our perceptions of space, a significant departure from traditional conceptions of literacy.

Knobel and Lankshear (2007) distinguish between perceptions of space by differentiating between a physical-industrial mindset and the cyberspatial postindustrial mindset. The physical-industrial mindset references an industrial time period in history that assumes maintaining the status quo. Reality is perceived in terms of what can be physically touched or observed. In terms of literacy, the book is the primary representation of this mindset. With the book came an order of genre types, some valuable and some less valuable. “Books exerted great influence on institutional space,
architecture and furniture, as well as on norms for conduct within particular spaces” (Knobel & Lankshear, 2007, p. 14). Literacy, in this mindset, is confined to text, and technology is a tool of value in physical space.

Kahn and Kellner (2008) note two difficulties when defining technology similar to the industrial physical mindset. Often the defining factor is connected to the latest developments of high tech items. Technology is perceived as an add-on most often associated with high tech artifacts related to science, industry, or computers and often seen as devoid of cultural context. In this sense, technology is self-serving (Williams, 2007). Understanding the transition from a physical-industrial mindset to a cyberspatial postindustrial mindset provides insight into the profoundly different perceptions of literacy and technology.

The cyberspatial postindustrial mindset references a post-modern time that perceives reality in cyberspace as well as physical space. Cyberspace does not replace physical space. In cyberspace people can reinvent themselves. Reality can be reconfigured into virtual reality in ways that may or may not be directly connected to an individual’s physical reality. One example of a cyberspace environment is the virtual reality site, Second Life. Such Internet sites provide a person with what some researchers define as the uncanny. Bayne (2008) relates the work of Freud to define virtual reality. Uncanny is the “intellectual uncertainty and the blurring of the boundary between fantasy and reality” (p. 2). Developments such as web 2.0 have created a participatory, collaborative, self-as-designer cyber-reality that creates an environment of technology rather than technology as a tool. The participatory web provides an ethos in which the
fundamental differences between industrial and post-industrial mindsets are in the use of technology to facilitate new ways of doing and being.

A mindset is a way of thinking or perceiving the world. Perceptual simulations are scenarios that a person develops as a mental script by which daily happenings can be interpreted. Each situation encountered provides more information for the script and in this way alters and changes with each experience. In this way, humans try to interpret something new by assimilating the new into something known (Gee, 2008). Perceptions impact the way a person maneuvers daily life. Cognitive science supports that learning in general involves perceptual simulations that have been developed within the context of one’s life. The learner constantly realigns new information with what has already been learned to create new or altered perceptual simulations which are then utilized and applied to still more new learning (Barsalou, 1999). Mindsets develop through the assortment of mental simulations and perceptions accumulated from contextual heritage or upbringing, daily experiences, and both formal and informal learning. Language development and literacy by extension form the same way. “Language is tied to people’s experiences of situated action in the material and social world” (Gee, 2008, p. 49).

Perceptual simulations are essential to how a person processes information including how a person acts and reacts. Perceptual simulations or mindsets are like lenses. How individuals perceive the context of their reality depends on their mindsets. Mental simulations are directly connected to the cultural models by which we form mental simulations.

Comparison of Knobel and Lankshear’s (2007) conceptualization of an industrial physical mindset and cyberspatial post-industrial mindset provide a platform for study of
literacy in the 21st Century. Literacy from a mindset of industrial physical space is a perspective of literacy as mono-modal interaction with text print. This mindset has a historical basis wherein technology is a tool. Literacy, from a cyberspatial-post-industrial mindset perceives literacy as multi-modal, participatory, and collaborative. This mindset is defined by technology as an extension of doing, learning, and being. Understanding differences in perceptions of 21st Century literacy is best achieved through historical perspective as well as understanding of 21st Century learners and schooling.

**Historical Context**

Social forces at any given time in history create the context within which a person’s perceptions develop. Those same social forces precipitate technological advances and serve to define the way literacy is perceived (D. J. Leu, Jr., Kinzer, Coiro, & Cammack, 2004). Over the course of time, as social forces change, tension often exists between attempts to sustain status quo and attempts to adapt to a new order of things. One example of such tension dates back to Socrates and Plato. Socrates represents a rich tradition of oratory. With the advent of the written word, Socrates voiced a concern that the transition to writing thoughts rather than oratory would cause students to lose memory, and they would become weak in the sense that they would become too reliant on the written word rather than the strength of memory in oratory (Parker, 2001). Ironically, the concerns Socrates voiced are very similar to concerns voiced today regarding the overuse of technology in the area of communications. Of course, had Plato not been able to record Socrates’ concerns, we may never have known about them. In addition, the transition from oratory to the invention of written language
is one of the first of many times that literacy and technology have been intertwined as writing is a form of technology (Wolf, 2007). The imbalance that occurs when socio-cultural changes take place impacts how those changes are perceived.

Neither literacy nor technology can be extracted and singularly examined outside the societal context of any given time. Technology “lends itself to radically different interpretations” (ed. Bijker, 1989) within a social context. Literacy also is subject to varied interpretations given the cultural lens at a particular time (Joseph, Bravmann, Windschitl, Mikel, & Green, 2000). Technology and literacy can be studied in parallel fashion through the course of history. At the turn of the 20th Century, behaviorism as psychological theory greatly influenced how human behaviors were perceived as stimulus response. Behavior was analyzed through what was observable in the physical world. Technological developments in the early 1920s provided increased opportunities for mass communication, and theories developed referencing the interpretation of human behavior in terms of stimulus response. Herbert Mead taught his theory of symbolic interactionism which described communication as a relationship existing of three parts – a gesture or statement, a response to that, and a response to that act (Saettler, 2004). Literacy in the form of reading instruction during this same time period was considered a stimulus response interaction between print and reader (Ruddell & Unrau, 2004). In a sense, communication and the process of learning to read were considered two dimensional actions. Technological advancements in the 19th and 20th centuries spawned the Industrial Revolution and continued to increase opportunities for mass communication. Dewey (1916) makes reference to electrical advancements that influenced society in general such as communication, transportation, and lighting. All were catalysts of
change, but within the context of an industrialized society, only a few felt that the context of one’s life was related to the way in which literacy developed.

As early as 1934, Vygotsky (Vygotsky, 1934, 1986) noted that a fundamental weakness of traditional psychology was to consider thought processes and language development as separate from the context of a person’s life. Vygotsky proposed that language develops as a social function then transforms to an egocentric or “inner-personal psychic function” (p.35). Wertsch (1985) describes Vygotsky’s theory of language development as learning that is only understood within the context of a person’s social situation. At the time Vygotsky proposed his theories, most traditional psychologists believed individuals developed apart from any social context. Vygotsky foreshadows current situated learning theory suggesting that humans evolve through labor through the action and use of implements or tools. He believed that human development was not linear. Rather human development, and specifically language development, is transformative and referred to as revolutions as a person continues to interact within the contexts of one’s life (Wertsch). By the end of the 20th Century, learning in general and language and literacy development were being perceived as a complex interaction of a person’s experiences within the context of daily life situated in the larger social context. In addition, as increasing technological developments occurred, technology was perceived to be the answer to modernize daily life. Technology was also seen as the answer to many identified ills of the American educational system.

By the end of the 20th Century, the United States was not seen as the ultimate world presence economically or educationally. When A Nation at Risk (1983) was published, computers and the Internet were already being presented as the way the United
States would regain stature internationally and economically (Kahn & Kellner, 2008). Technology was viewed as the tool that would help America regain power and fix our educational system. Technology was being defined by the capitalist interests of private corporations and the state (Petrina, 2000). Even though the late 20\textsuperscript{th} Century saw an increased presence of the Internet and dot.com economics, technology was still narrowly defined as a tool. Although use of technology to become literate was viewed as innovation, the process of teaching literacy in schools remained rooted in a mono-modal, reader to text print approach. Computer skills became the new basic skills (Kahn & Kellner). A nation focused on technology as a commodity was transitioning from the industrial era to the information age. For 200 years, the world economy was dependent on labor and capital. At the turn of the 21\textsuperscript{st} Century, economics is more dependent on a person’s access to information (D. J. Leu, Jr., et al., 2004). In the past, the nature of work was dependent on labor, land, and money. Now the world economy is a knowledge economy (Riley, 2003) and access to information as well as becoming literate within this new 21\textsuperscript{st} Century context is the key to success.

\textbf{21\textsuperscript{st} Century Learning and Literacy}

What does it mean to be literate in the 21\textsuperscript{st} Century? The answer to this question is complex, and to date there is little consensus in the literature of a definition of literacy in the 21\textsuperscript{st} Century. Clues exist within the broader scope of learning and language development theories, the development of technology specifically in the form of web 2.0, and conceptualization of socio-cultural context or discourse. Current learning theories encompass human behavior as complex social interactions within the context of daily life (ed. Bijker, 1989). Developments of web 2.0 have created an Internet medium that is
more democratic in that technology now provides a participatory environment (Williams, 2007). Consumers have become designers, authors, and collaborators in this new environment. Multi-modal forms of communication are multi-dimensional, and often interpretation requires the need for multi-modal skills. Sight, sound, and movement require decoding as well as text print. In many cases literacy requires interactive analysis of a multi-modal message. Literacy in this sense gains meaning from symbols, sounds, and movement as well as text print (Marcus, 2005). The larger context or discourse provides the medium in which literacy is defined.

Researchers who describe situated learning and literacy acquisition theorize that learning is an integral and inseparable aspect of social practice (Gee, 1996; Lave & Wenger, 2008). All learning is interconnected to the learner’s life experiences, past and present. Situated learning considers the historical past as well as a person’s immediate past and the present. Literacy involves learning that is situated in the cultural and social experiences of the learner (J. P. Gee, 2004). Learning in this sense has more depth than the immediate context. “For humans, language, perception (including emotion), and action in the world are all tightly connected together” (J. Gee, 2004, p. 49). Both individuals and communities live and grow within a context and often develop discord between individuals and communities with the need to reproduce and sustain the status quo. As individuals in communities learn and develop, conflicts between historical constructs and future trajectories have varied effects on learning (Lave & Wenger, 2008). Understanding of situated learning and literacy development is further developed through the concept of social construct as discourse.
According to Kress and Van Leeuwen (2001), a discourse is a socially constructed knowledge of reality or some aspect of reality. A discourse includes all aspects of a known reality. “Discourse exists in language, knowledge, social practices and power” (Gilbert, 2006, p. 111). Language as a conduit of meaning conveys the perception of the discourse of reality at any time, and it is virtually impossible to separate the discourse of language or learning from the complexities of society and culture (Marshall, 2006). Lankshear and Knobel (2006) also emphasize that language in terms of literacy “does not exist apart from the social practices in which they are embedded and within which they are acquired” (p. 13). Within the scope of the Kress and Van Leeuwen’s definition of discourse, 21st Century literacy, which is also referred to as new literacies, extends beyond the ability of learning to read and write to mean having the ability to understand and interpret information however presented (Lanham, 1995 in Lankshear & Knobel, 2006). The discourse of the 21st Century that exists in language, social, political, and economic practices in relation to literacy is very different than traditional contexts.

Ideally, development of a literate electorate has been a cornerstone of American education. In fact, some critical theorists believe quite the opposite. These theorists argue that the purpose of the way in which some students have been taught has served to either promote social change or socially imprison an individual depending on the way a student is taught literacy in order to sustain a type of socio-political power (Apple, 1995; Finn, 1999). This perspective is based on a traditional model of schooling where the teacher is dispenser of knowledge and the student is the consumer. Theorists believe individual students have been trapped in a particular group. In this way some are
emancipated through their learning and some are not. Traditional ways or teaching serve to perpetuate the power of the upper class and keep the lower class powerless (Finn, 1999). Twenty-first Century technological developments provide a context in which traditional acquisition of literacy is being challenged by informal learning outside the school setting. Students now have access to massive amounts of information via the Internet. Learning is varied, multi-modal, and situated. Students are coming to school with increasing numbers of opportunities to design, create, and collaborate on the Internet. School no longer defines what it means to be a child (Des Dixon, 2000). Their experiences provide access to wide ranges of information and experiences far beyond what is offered in most schools. Kahn and Kellner (2008) believe that literacy in the 21st Century is “not a singular set of abilities but is multiple and comprises gaining competencies involved in effectively using socially constructed forms of communication and representation” (p. 4). No longer is the social structure controlled by what is taught and how it is taught in school. Socially constructed forms of communication and representation include multi-media forms of text, light, and motion that convey the meaning of 21st Century discourse. Students have access out of the school setting to situated learning that includes networks of multi-media communication. Within the multi-media context the definition of literacy has changed. In fact, literacy by definition in the 21st Century is defined by change (D. J. Leu, Jr., et al., 2004).

During the 21st Century Literacy Summit – A Global Imperative (A global imperative: The report of the 21st century literacy summit, 2005), experts in a variety of fields from around the globe gathered to examine and define 21st Century literacy in relation to technological developments. The definition formulated by the global think
tank included terms such as multimodal, creative fluency, interpretive facility, new grammar with its own rules of construction, interactive communication, and use of media to evoke emotion. Change was emphasized throughout. The consensus was that “21st Century literacy has the potential to transform the way we learn” (p. 3). The summit contributors envisioned 21st Century literacy as the acquisition of skills that go far beyond mastery of text print. Prensky (2005) notes that although some are still defining literacy to mean mastery of just text on a page, many others define literacy as skills that go beyond text to include a wide range of skills often referred to as multimedia skills. Multimedia skills include the ability to utilize technology to create and interpret in multimodal ways to gain meaning. In addition, terms such as visual literacy, information literacy, and media literacy have all been used to define 21st Century literacy (Robinson & McKenna, 2008). The multimodal skills necessary to be literate in the 21st Century exemplify the participatory nature of the use of those skills. Literacy is further defined by a participatory culture (Jenkins, 2005). Leu Jr. et al. (2004) state that literacy today is defined by “the skills, strategies, and dispositions necessary to successfully use and adapt to the rapidly changing information and communication technologies and contexts that continuously emerge in our world and influence all areas of our personal and professional lives” (p. 2).

As new literacy research increases, some commonalities as to the definition of 21st Century literacy have emerged. Most agree that literacy is defined as the development of students’ engagement with texts and their concern for the meaning-making process, the constructed process of authorship, and questions about how texts represents social realities (Robinson & McKenna, 2008). The authors’ use of texts makes
reference to the multimodal and participatory nature of such interaction with texts within a context of rapid change, and that rapid change has gone global. Twenty-first Century literacy exists within a context of globalization and technology as the world communities increase connectivity and redefine the literacy that will be needed for the future.

**Globalization**

Technology in the 21st Century is a conduit for personal and economic transformation. The potential for transformation lies in the possibilities for collaboration on a global scale, multimodal communication, creative fluency and interpretation, a new grammar, use of media to evoke emotional responses, and the power to transform the way learning occurs (*A global imperative: The report of the 21st century literacy summit*, 2005). The increasing connectedness of communication technologies has precipitated the perception of the world as becoming smaller. The world of the 21st Century is shrinking (Friedman, 2005). Because of the global connectivity made available by the Internet, many modes of doing business as well as communication have changed. A wide range of changes have resulted in the “emergence of completely new social, political, and business modes” (p. 48). Currently, technology can transform ways of thinking and acting by individuals who have access all over the globe. The interactive connectivity of the Internet has produced “new forms of knowledge, new modes of communication, new ways of sharing work and alternative forms of entertainment” (Williams, 2007). Work is no longer a singular activity, and knowledge is no longer the sole commodity of scholars and academicians. Not only can anyone access information, anyone can contribute to the store of knowledge posted to the Internet. Locating, accessing, and interpreting
information now involve, in the form of the Internet, a “global electronic library of billions of pages of information where consumers have become designers and publishers (Armstrong & Warlick, 2008). Global connectivity is increasingly facilitated by the world-wide web; as a result, the Internet has been referred to as “the skin that covers the earth” (Tapscott & Williams, 2008). The metaphor serves to emphasize the connectivity of the world. The metaphor also emphasizes the systems within the skin.

One such system is the world economy. Tapscott and Williams (2008) speak to the way the global economy is changing due to this connectivity, and they emphasize the need to remain innovative and collaborative. “We must collaborate or perish – across borders, cultures, disciplines, and firms, and increasingly with masses of people at one time” (p. 33). The authors describe the interactive web as a workspace for volunteers who collaborate and problem solve. Large corporations can no longer afford to maintain research and development departments to solve complex problems. Value is now found in posing research questions on the Internet. Experts from around the world are able to help develop solutions. The authors note that in the power of collaboration, people who volunteer have expertise in a variety of areas. Therefore, companies are not just limited to expertise within their own employees. They have world-wide access to stores of knowledge and expertise. “Instead of traditional political forms like unions or parties, people are coming together in practical projects, from urban gardening in vacant lots to the suddenly ubiquitous do-it-yourself bike shops” (Carlsson, 2008, p. 1). Networking and collaborating using new technologies have served to develop new communities with new purposes, the result of which is “conjuring new practices while redefining life’s purpose” (p. 2).
The traditional form of collaboration meant the company team problem solved and did not share trade secrets with the competition. The new form of “wikinomics” (Tapscott & Williams, 2008) causes dissonance between traditional forms of doing business where proprietary knowledge was kept secret and new forms of doing business where collaboration and sharing of proprietary knowledge is the norm. Collaboration takes place between those who have the expertise in particular areas and choose to share it. Problems of quality control do exist in this new collaborative model, but the authors feel the gains far outweigh the negatives. One of the growing questions is whether or not peer production in the 21st Century can exist in concert with traditional ideals of democracy and capitalism. The answer to the question may be found by the ways in which innovation does or does not impact tradition.

Christianson (1997, 2003) applies his theory of disruptive innovation to evolving forms of industry and world economics. Change that develops with new forms of technology can be a force that either sustains or disrupts. Christianson discusses his theory of disruptive force in relation to business markets that succeed or fail based on investments, capital, research, and design in various technologies. The author refers to technology innovations that maintain the status quo, and those that disrupt the status quo. Disruptive innovations, if not managed in new ways, lead to failure. Disruptive innovations that are implemented through established systems often fail because an existing system already has an established consumer base with established modes of success. Disruptive innovations that succeed must be implemented in ways that do not already exist in order to avoid failure.
Globalization in the 21st Century provides the context within which students prepare for the future. Christianson (2008) also applies his theory of disruptive innovation to traditional American schools which are designed to “process groups of students in standardized ways in a monolithic mode” (p. 35). Preparing students for a future of globalization by implementing innovative technologies within the traditional format of schooling is doomed to fail according to this author. Restraints of the existing system include limitations of space, lockstep grade level progression, and instructional decisions made on what is best on average. Christianson predicts that within ten years innovative technologies and research design that supports student-centric developments will compensate for a variety of current educational shortcomings such as teacher shortages and rising costs of the current educational system. In keeping with Christianson’s theory of disruptive innovation, implementations must be managed in new ways which also includes scrutiny of current trends and dissonance between the educational context and 21st Century learners.

Educational Context

Traditional models of schooling are considered formal learning and have existed for the last 600 years. No matter what the child’s background, each student attending school is delivered a standardized curriculum and instruction in a one-size-fits-all model. The teacher delivers instruction to impart knowledge, and the student receives the knowledge. Teaching and learning takes the form of instructed processes (J. P. Gee, 2004). Students are rarely, if ever, involved in planning the course of study. The traditional model of schooling has served to perpetuate a physical industrial mindset
described by Knobel and Lankshear (2007), and until most recently, school has
determined what it meant to be a child (Des Dixon, 2000). Although there are some areas
of the United States where pockets of excellence exist, American models of education
largely continue to represent an industrial mindset in the sense that the product is not
considered to be completely assembled until the end of the assembly line is reached.
Children are not completely educated until they reach the end of the leveled and lockstep
program that is K-12 schooling. School is where formal learning takes place. The idea
that learning takes place only within the context of traditional school places little
significance on the learning that takes place informally outside of school. Although both
formal and informal learning are important, the formal ‘half’ is becoming an increasingly
moribund and irrelevant institution” (Prensky, 2005, p. 5). Studies show that access and
use have increased as students utilize the Internet for homework, research, social
networking, and gaming. One study shows that three in five students under the age of 18
and more than 78% of students between the ages of 12 and 17 go on-line (Levin &
Arafeh, 2002). The authors state that students found support on the Internet for
homework as well as tutoring, and students were able to study more in-depth areas of
personal interest. Students also found value in use of the Internet for study groups,
storage place for files, and counseling when needed. Levin and Arafeh (2002) relate that
students encounter many roadblocks when trying to use Internet resources in school
stating that teachers and administrators do not realize the extent to which students utilize
collaborative and communications tools on the Internet while not in school. One reason
teachers do not assign homework that is Internet based is due to continued concern about
access for some student populations, and studies show that there is still cause for concern
Recent studies show that issues of access for students is diminishing (Bransford, Brown, & Cocking, 2000; Breifing memo: The digital divide," 2004; Levin & Arafah, 2002; National Research Council. (2000). How People Learn: Brain, mind, experience and school. Committee on Developments in the Science of Learning. J. Bransford, A. Brown, and R, Cocking (Eds.). Committee on Learning Research and Educational Practice. S Donovan, J. Bransford, and J. Pellegrino (Eds.). Commissiona on Behavioral and Social Sciences in Education. Wahnson, DC: National Academy Press,"). Although there are still concerns that gaps of Internet access due to lack of capability causes lack of access to information, there is growing evidence informal learning that takes place outside of school has hit critical mass in the sense that students perceive their informal learning as more significant than that which is learned in school (Levin & Arafah, 2002).

Informal learning is student-centric, based on individual needs and interests. With increasingly direct access to the Internet and large stores of information, students are able to find a wide range of information related to topics of personal interest. Because of the connection between the student’s personal interests and the information accessed, activities are socially constructed as the student’s personalized choices become the focus. Leu, et al (2004) point out two distinctions in socially constructed learning. First, new skills and strategies are learned with increasingly complex technologies among peers. Second, knowledge that is constructed based on what others know requires that activities are developed to use the collaborative tools available. In addition, informal learning opportunities on the Internet are not constrained by traditional educational structures and are therefore open to creativity to extend traditional forms of
communication with visual imagery and sound (*A global imperative: The report of the 21st century literacy summit*, 2005). Increasing numbers of students have gained access to the Internet outside the formal school setting. Informal learning in the form of socially constructed activities has served to redefine 21st Century students.

Students who graduated from high school twelve years ago have had opportunities to be immersed in technology from birth and are referred to as digital natives (Prensky, 2001a). Those who are older are referred to by Prensky as digital immigrants, and they have had to learn to use technology much like a person learns a second language. Prensky’s (2001a) distinctions between digital natives and digital immigrants provide overt examples of the differences Knobel and Lankshear (2007) delineate between “physical industrial mindsets” and cyberspatial postindustrial mindsets.” Those who have grown up immersed in TV, cell phones, computers, video games, and the Internet know how to speak the digital language, and as learners, they prefer alternate modes of learning. The digital native’s first language of learning is much different than the digital immigrant’s, which creates a conflict as the 21st Century learner goes to school. “Today’s students are no longer the people our educational system was designed to teach” (p. 1). According to Prensky (2001a), natives are used to receiving information very quickly. They like to multi-task, and they do it very well. They are multi-dimensional in their learning style preferences and more random in their approach to learning. Natives desire graphics before text when reading and prefer random access as in hypertext. Networking and collaborating are preferred over singular study, and natives prefer games and virtual experiences over traditional work (Prensky, 2005).
Those who have not grown up immersed in technology and who have had to adapt are digital immigrants. According to Prensky (2005), digital immigrants are best distinguished by the fact that they print out email and do not manipulate the digital language the same way natives do. Digital immigrants find the behaviors of digital natives distracted. Immigrants prefer to learn and teach in linear step-by-step ways, and in the eyes of a digital native, they do so slowly.

The differences in delivery, communication, and processing described by Prensky (2001a, 2007) are substantiated in research studies related to the digital divide and access to technology. Although access to technology for certain populations is increasing, there still are groups who have access but whose use of technology is limited. These studies show that those who have not been immersed in technology since birth use technology far less than those who have been immersed in technology since birth (Lenhart, et al., 2003; Levin & Arafeh, 2002). For digital immigrants, technology has not been an integral thread in the development of their mindset. Their perception of its importance is directly related to their use of technology. On the other hand, the digital native has a completely different mindset in that technology has been integral to the development of perceptions of what is useful and important. The cyberspatial postindustrial mindset prevalent in today’s students can further be understood by examining how they learn in informal situations.

Meaningful, deep learning for students today involves learning in a collaborative and participatory context. Students are connected to each other in a variety of ways and have access to overwhelming amounts of information via cell phones and the Internet. They belong to on-line communities, create new forms of expressions such as truncated
vocabularies, and they engage in collaborative problem solving through their access to technology (Jenkins, 2006). This collaborative culture is defined as one with “low barriers, strong support for creating and sharing, and some type of informed mentorship, and membership that feels some sort of social connection” (p. 7). Jenkins makes a very important distinction in relation to communication in this context. The focus is one of community involvement, not simply individual expression. The sense of community students find online brings with it a sense of empowerment. Leu, et al. (2004) refer to this learning as socially constructed learning with a strong element of creativity and experimentation. In addition, “speed counts in important ways” (p. 14). The speed at which information is processed in a multi-tasking way significantly changes the way information is disseminated and received. Bestak (2003) states that technology has allowed us to experience a multi-level reality spanning time zones, night and day, where “laws of the natural world are no longer barriers” (p. 54). Healy (1998) cautions that the lack of barriers may be contributing to a child’s lack of ability to process cause and effect events and “escalating social and personal malaise” (p. 177). Although research is not definitive relative to the long term effects of consistent exposure to technology on the brain, one thing is clear. Differences between the brains of digital natives and digital immigrants are being detected, made evident through neuroscience and its improved imaging technology.

Prensky (2001b) cites a number of studies that indicate the brain maintains its plasticity for life. Although the basic structure of the brain has not changed since our earliest ancestors, the functions of the brain have changed based on environmental stimuli (Wolf, 2007). The brain does not reorganize casually. The process takes long periods of
concentrated attention (Prensky, 2001 b). Extended periods of exposure to TV, video games, and web-surfing have developed minds that work in non-linear ways, like hypertext. Many believe that constant use of technology has produced a generation who are believed to have brains that are physiologically different than generations before. “We now recognize that the brain never loses its power to transform itself on the basis of experience” (Bestak, 2003, p. 7). It seems the process of selectivity is in progress as the brain adapts to increased uses of multimodal technologies. Bestak suggests that humans are selecting for the capacity to multi-task as part of the evolutionary process. Attention is divided so that full attention on any one task becomes difficult. The desire is to accomplish all that is possible in record time. “Speed is the standard applied to all we do” (p. 52). Describing students, Prensky (Prensky, 2001 b) states, “They crave interactivity – an immediate response to every action. Traditional school provides very little of this. It’s not that digital natives can’t pay attention, it’s that they choose not to” (p. 4).

No matter the choice, there are limits to how much the human brain can absorb at one time. Lankshear and Knobel (2001) refer to an attention economy when analyzing students’ attention spans and technology distractions. The idea of an attention economy is based on the “fact that the human capacity to produce material things outstrips the net capacity to consume the things that are produced” (p. 2). Attention requires effort, and with an overabundance of information, referred to as data smog, good information can often be camouflaged by large amounts of information (Murray, 1998). Informal learning takes place for those immersed in technology in a context of an overabundance of information disseminated at high speeds. Those who have been immersed in
technology since birth would be expected to have a higher propensity to develop a
cyberspatial postindustrial mindset. Those who have utilized technology later in life have
a greater likelihood of having a physical industrial mindset. The differences in a person’s
experiential context determine how each perceives technology. These differences also
exist in the ways each negotiates meaning (Finn, 1999).

Many students have started to demonstrate skills in informal learning situations
that foreshadow how the global population will need to negotiate meaning in the future.
Schools do not provide an environment that promotes skills used by 21st Century learners.
This results in tension between the educational system and its clientele. The implications
for K-12 schools, students and teachers, post-secondary institutions, and teacher
education programs are directly connected to the perceptions or mindsets described by
Knobel and Lankshear (2007). The differences between a physical industrial mindset and
that of the cyberspatial postindustrial mindset indicate the need for changes in teaching
and learning for the 21st Century.

Learning in the 21st Century has already started to take on a different meaning.
One significant difference is described by Prensky (2001b) who distinguishes between
legacy learning and future learning. Legacy learning emphasizes curriculum of the past,
and although the author does not suggest discarding that curriculum, he does suggest
students be taught the skills that are already predominant in the 21st Century such as
programming, filtering knowledge, and connectivity. Collaborative knowledge
construction requires skill in critical literacy and the ability to discern valid sources of
information. The comprehension of online reading requires different skills than just
reading text and also requires different instruction (Leu, 2007). In the 21st Century it will
be important for the teacher to be able to plan and implement learning experiences that allow students to collaborate and distribute their knowledge with one another (Leu Jr., Kinzer, Coiro, & Cammack, 2004). New teachers will need to develop pedagogy that is effective in the collaborative context of the 21st Century. Teacher preparation should develop adaptive learners rather than “a fixed storehouse of facts and figures” (Darling-Hammond & Bransford, 2005, p. 3). To do so, cues need to be taken from 21st Century students. “We can no longer decide for our students; we must decide with them, as strange as that may feel to many of us” (Prensky, 2001 b, p. 9). Students are learning empowered through informal interactions with technology outside of school. A steady dose of teacher directed learning will no longer be effective.

Teaching in the past has been predicated on tradition and precedent, and it has not lent itself to innovation and change (Darling-Hammond & Bransford, 2005). The primary reason for the lack of change is that it is widely accepted that those who are preparing to teach will do so in much the same way they were taught. It is often also true that faculty in teacher education programs do not model the technology literacy skills new teachers will need in the future. Although technology has been infused in higher education programs, not all faculty members are leading the charge to exhibit proficient use (Keenwge, 2007). In order to break the traditional mold of teacher education, it is important for teacher education programs to provide emerging teachers with various models that include the effective use of technology in the 21st Century (Savery, 2002).

Sanyal (2001) emphasizes that the implications for higher education are “to create an education whose contents and methods are geared to your social and cultural realities” (p. 4). The realities of the 21st Century include immersion in a digital world. The author
also suggests higher education must set the tone for the country’s entire educational system. One of the first steps in setting the tone involves development of 21st Century literacy standards for higher education students (Appendix A). These standards reflect the ability to interpret multiple literacies, and define fluency as much more than simply competent use of technology as a tool. Although the student standards are a start, higher education continues to have a multi-faceted responsibility to provide education for students, particularly in teacher education programs that recognize the realities of the 21st Century student.

The responsibility of teacher education is to provide emerging teachers with the skills necessary to facilitate 21st Century learning. Collaborative networking is one way colleges and universities can support K-12 schools by sharing resources in the form of faculty and expertise. Faculty in teacher education programs must model the integration of technology by assigning students a wide variety of multimodal tasks for project completion (Bleed, 2005). This author emphasizes the importance of embedding 21st Century literacy and technology in teacher education programs. The effort cannot be limited to one course in instructional technology in order to learn the skills to maneuver and make meaning of the massive amounts of information available on the Internet.

Teachers must know how to teach the literacy skills for meaning making in the 21st Century. Henry (2005) identifies five functions important to integrating 21st Century literacy into the classroom: identifying important questions, locating information, evaluating critically the information’s usefulness, synthesizing information, and communicating with others. Development of teacher education programs to include the needs of the 21st Century learner will require extensive research to continually analyze
The needs of the 21st Century learner. Research at the universities should “study how the Internet and other digital technologies profoundly redefine what it means to be literate” (Coiro, 2008, p. xi).

The New Literacies Research Team at the University of Connecticut identifies three areas of concern in the area of educational research in general as well as specific to literacy research (Leu, 2007). First, there is a lack of researchers adequately trained to examine and analyze 21st Century literacy. Second, this shortage of researchers is challenged by the constant change in new literacies that are developing. Third is the population of students who need help most but who have the least amount of access to the Internet outside of school. The authors note that even though The No Child Left Behind Act of 2002 mandates that all children must be literate in technology skills as well as math and reading, not one state test assesses students’ ability to access, read, and analyze information and resource legitimacy on the Internet. Students are not being supported in the literacy skills they will need most in the 21st Century. Research in the area of 21st Century literacy will be crucial to developing consensus when defining new literacies and in developing constructs and theories about literacy in the 21st Century. Research will need to clarify “what works from the perspective of individual students in different circumstances as opposed to what works on average for groups of students or groups of schools” (Christensen, 2008, p. 162).

Traditionally literacy was defined as two dimensional interaction of the reader and text. Twenty-first Century literacy involves multiple participants in a collaborative effort involved in non-linear activities. The differences call for drastic changes in K-12 schools, teacher education, and research. The nature of teaching and learning must
change also. The rapid change which defines learning in the 21st Century calls for increased numbers of trained researchers and additional research in the areas of new literacy in order to more clearly identify and define the skills needed to navigate meaning within the current context of change.

Summary

Daily life has always been impacted by technological developments. Never has this been truer than in the 21st Century. In the past, technology was perceived as a tool of change. Now technology has become the catalyst and medium of change. What it means to be literate in the 21st Century is vastly different than what it meant to be literate in the past. Rapid change has spawned a whole new set of learners who enter school with expectations of engagement in a variety of activities that involve the technology in which their lives have been immersed. These digital natives are accustomed to maneuvering in cyberspace as well as physical space. Their needs as learners challenge traditional schooling.

Although there is no consensus as to the definition of 21st Century literacy, much is known about the 21st Century learner. Students no longer come to school as blank slates waiting to be filled with knowledge. Many come to school with far greater skills in manipulating their digital world than those who instruct them. Informal learning outside the school has reached a critical mass, in that students see more value in informal learning than the formal learning that constitutes school. Change that has become the status quo provides increased challenges for K to post-secondary schooling for a number of reasons.
First, it is important to realize that the digital divide no longer is limited to access to the Internet. The digital divide also refers to wide discrepancies in perceptions between those who have grown up immersed in technology and those who have come to use technology later in life. There is a growing body of evidence that there are physiological differences in the brains of digital natives and digital immigrants, and those differences are related to levels of use of technology. Also significant to note in these comparisons is that neuroscience now supports that the human brain does not lose its plasticity as was previously thought.

Second, no matter what time period in history, there is always some form of a generational gap. Current learning theories support learning as situated in the complex daily lives of the learner. Mental models or mindsets are formulated and reformulated based on a person’s daily experiences. Those mental models determine how a person interprets reality, and they act as filters that effect how a person responds and reacts in daily life. If teachers have vastly different mental modals in relation to literacy and technology in the 21st Century, the ramifications for teaching and learning are significant. How much difference can exist between the perceptions of teachers and students before the two do not exist in the same reality?

Finally, the importance of research at the university level must be emphasized. Multi-disciplinary research in the field of new literacies and learning theories provides insight relative to learning as situated in a person’s experiential context. No one discipline provides greater insight. Research into the socio-cultural and political implications of our digitized world, as well as the perceptions of technology and literacy
21ST CENTURY LITERACY AND TECHNOLOGY: PERCEPTIONS

at any given time, will provide for the development of future teacher education programs in order to prepare teachers for tomorrow’s world rather than to sustain the status quo.
Chapter Three

The purpose of this study was to compare types and amount of usage of technology, as well as gauging the perceptions of 21st Century literacy of three groups: deans of education, emerging teachers, and high school students. Learning theories support that learning is situated (Gee, 2004, Lave & Wenger, 19, Davies & Merchant, 2009). Learning takes place in the social context, where a person’s experiences provide the basis for development of perceptions. Identified perceptions are indications of the mental models that people have formed through past experiences. Those mental models are utilized to act and react in situated contexts (J. P. Gee, 2004) and govern the ways people interact in any given social context. Specific to 21st Century literacy, the perceptions of these three groups are significant. Deans of education are instrumental in overseeing policy and programming at the post-secondary level. Emerging teachers are those who are prepared to work with students in our schools. Students in high school represent the group that has been most immersed in technology use (Prensky, 2001 a, 2005). The field of 21st Century literacy is relatively new, evidenced by the lack of current consensus as to 21st Century literacy defined (Leu Jr., et al., 2004). Identified similarities and differences in these three groups will inform the research on new literacy
and provide the potential to better plan curriculum programming and instructional staff development in higher education and in the K-12 educational system.

**Research Questions**

The research questions addressed in this study were as follows:

1. With what frequency do deans of education, emerging teachers, and high school students use technology?
2. In what ways do deans of education, emerging teachers, and high school students use technology?
3. What are the perceptions of deans of education, emerging teachers, and high school students about 21st Century literacy and technology?
4. What similarities or differences exist between the frequency of use and type of use of technology of deans of education, emerging teachers, and high school students?
5. What similarities or differences exist between the perceptions of deans of education, emerging teachers, and high school students relative to 21st Century literacy and technology?

**Research Design**

The researcher used a mixed methods design for the study, which is increasingly being considered a third research design, in addition to quantitative and qualitative methods (Johnson and Onwuegbuzie, 2004; Viadero, 2005). Johnson and Onwuegbuzie do not suggest that mixed methods design is the answer to all research design questions. They do feel that “research approaches should be mixed in ways that offer the best opportunities for answering important research questions” (p.16). Both quantitative and
qualitative research design methods are beneficial in examining, measuring, and comparing the perceptions of any group of people due to the abstract nature of individuals’ perceptions. DeVellis (2003) states that “among theoretically derived variables, there is an implicit continuum ranging from relatively concrete and accessible phenomena to relatively abstract and inaccessible phenomena” (p. 9). Measurement of perceptions, as is the main purpose of this study, is on the abstract end of this continuum. Even so, “measurement is a fundamental activity in all branches of science, including the behavioral and social sciences” (p.13). Quantifying the comparisons made in this study is one important aspect, but given the perceptions being measured and the size of one of the groups in the study, additional research methods were necessary to understand the breadth and disparities of those perceptions.

Due to the contextual nature of this study, a mixed method design provided the most insightful opportunity for analysis of perceptions. Perceptions are formed through the construction of a person’s mental models, which are formulated based on experiential contexts or discourses (Gee, 2004). Biesta & Burbules (2003) explain that “regardless of paradigmatic orientation, all research in the social sciences represents an attempt to provide warranted assertions about human beings (or specific groups of human beings) and the environments in which they live and evolve” (p.15). A mixed method design provided this researcher with an opportunity to further delve into the perceptions of each group in a multi-perspective way.

The study of perceptions dates back to the early twentieth Century through the development of philosophy referred to as phenomenology. This philosophy has historically been an important influence in the social sciences as a construct by which to
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According to Hutchings, understanding one individual’s perceptions is initially important. Determining the similarities and differences of a group’s perceptions are more significant. “There is an essence or essences to shared experiences” (Patton, 1990, p. 70). Therefore, analyzing the ways in which various groups perceive similar experiences is valuable in the study of what is determined to be social reality. The importance is to “understand the meaning that people give to their actions and the actions of others who share their world” (Goodman, 1992, p. 120). It is the actions of people that reflect perceptions as mental models utilized as frameworks for those daily actions. Obtaining data related to the types of usage, amount of usage, and perceptions of technology within a framework of literacy from the three different groups has specific significance in the area of education in that if perceptions vary to any great degree, the impact on teacher education and instruction can be significant.

Because one of the three groups, the deans of education, was a particularly small group, they were not able to be analyzed through quantitative methods. Research methods that included interviewing further helped to explain possible disparities in the quantified research results gained through the on-line survey. A mixed research design helped to provide a deeper understanding (Videro, 2005), in the case of this study, of three groups’ use of technology and perceptions of 21st Century literacy.

The Survey

A survey questionnaire was constructed to gather initial data related to the five research questions formulated for the purpose of this study. The first section of the survey requires participants to rate their perceptions of technology as it relates to areas of
literacy. The second section of the survey requires participants to relate demographics and levels and types of technology usage. Corresponding Survey and Interview Items to Research Questions (Appendix E) shows the relationship of each survey item to each research question.

The researcher designed the survey items relating those areas and types of technology usage with areas related to literacy. The items were also designed to address the perceptions of the high school students and emerging teachers of technology and 21st Century literacy. Because of the small size of the deans of education as a group, the survey was not administered to them. The researcher developed the survey with a mixed methods focus. DeVellis (2003) recommends, and the researcher followed this guidance, the following steps in creating and implementing the survey:

1. Determine the goal and the objectives of the study.
2. Determine the survey item pool.
3. The survey item pool is reviewed by experts.
4. Consider inclusion of validation items.
5. Administer items to sample group.
6. Evaluate the survey items.
7. Optimize survey length.
8. Finalize survey for dissemination to identified populations.
9. Disseminate the survey to the populations through e-mail.
10. Collect and record results of survey using SPSS software.

The researcher compiled mailing lists with e-mail addresses utilizing the campus technology departments at each of the four post-secondary schools in the study. The
survey was administered to the high school junior and senior students during their English classes utilizing school labs. The English classes were chosen since that is one course that all juniors and seniors are required to attend.

Information detailing the purpose of the study was disseminated through an introductory letter to the deans of education, emerging teachers, and to principals and English teachers at the high schools where the students were surveyed. All subjects were assured that their names and schools’ names would be kept anonymous. All subjects were assured that the data collected would be available at the completion of the study via a web site created by the researcher.

The high school students were first informed of the study via the high school principals or their designees, and the emerging teacher groups were first informed of the study via a letter attached to the link to the survey that explained the purpose of the study. SurveyMonkey.com was utilized to administer the survey. An e-mail reminder was sent to the emerging teacher group two weeks after the initial contact to increase response rates. Response rate is often less when utilizing e-mail (Dillman, 2007), and the reminder was utilized for that reason. Since the high school students were completing the survey in a captive audience setting, the reminder was not deemed necessary.

The results of the survey were tabulated, compared to the qualitative data collected, and reported. Notification was sent to participants of the study’s completion and posting of results.

**Interviews**

In addition to administration of a survey to participant emerging teachers and high school students, qualitative data were collected via interviews. Interviews were
conducted with all four deans from the representative post-secondary schools, one emerging teacher from each of the post-secondary schools and two students from each of the two high schools in the study. The interview questions (Appendix D) were formulated to establish a deeper context of technological use on the part of the participants as well as context of expectations and perspectives of technology and 21st Century literacy. Eight additional questions were added that specifically addressed the deans’ leadership positions at each of the post-secondary schools. The importance of including the deans as a group, albeit small, was to examine their perspectives as leaders who have influence to varying degrees over the programs from which emerging teachers gain training.

Interviews were then completed with four emerging teachers, one each from each of the post-secondary schools and four representatives (two juniors and two seniors), two each from the high schools surveyed. Subjects who were interviewed indicated their willingness to participate at the end of their surveys. Again, interview questions (Appendix D) were formulated to establish a context within which further discussion of perceptions of technology and 21st Century literacy would be possible. All interviews were recorded to optimize data collection and ensure consistency between interviews.

**Description of Samples**

Four post-secondary schools were chosen from which student populations were selected for the purpose of this study in addition to the deans of education who were interviewed for the study. These academic institutions were chosen: Ball State University, Indiana University at South Bend, Bethel College in Mishawaka, Indiana, and
Goshen College of Goshen, Indiana. These four schools were chosen for two primary reasons. Each represents a different size of school as well as different student populations. Ball State is a large state school attracting students from all over the United States. Indiana University at South Bend is a growing regional campus whose students primarily commute and are from the northern Indiana and southern Michigan area. Goshen College is a mid-sized, faith-based undergraduate school whose students are primarily of the Mennonite faith. Bethel College a small multi-denominational faith-based school whose students also come from all over the United States.

In addition the four schools are within driving distance to the researcher which provides improved opportunity when conducting the interviews as part of the study.

The Survey

The deans of education group included the current deans from each of the four post-secondary schools included in this study. All four varied in years of experience in that particular position at the time of the study.

The emerging teacher group included all juniors and seniors in the schools of education at the four post-secondary schools utilized in the study. Samples were configured this way in an attempt to have sample sizes that were similar in size. Juniors and seniors were chosen as subjects due to the likelihood that they were decidedly on a path to become teachers. Therefore, their perceptual context would be more likely to be that of a teacher than a student who had not yet decided teaching would be their career path. Each student’s name coincided with a code in order to identify who completed the survey for the purpose of identifying possible subjects for the interview stage of the
The primary researcher did not have access to student names or code numbers until after subjects were randomly chosen to be interviewed.

The high school juniors and seniors were chosen for two reasons. First, as a group they had the most experience of K-12 students, and they represent a group of students immersed in technology from the beginning of their formal school careers. (Prensky, 2001, 2005) In addition both juniors and seniors were chosen for this group in order to provide a larger sampling survey group than just seniors. Through the office of Student Accounting and Program Assessment, each student was assigned a code to identify survey completion. The primary researcher did not have access to the list of student codes throughout the process and chose subjects randomly for the purpose of interviews.

The Interview

After students at the two high schools completed the survey, two students from each school were chosen to interview. Two were juniors and two were seniors. Numbers were assigned to students as they returned parent consent forms, and it was from this group that random selection was made for high school students to interview.

In order to choose the four teacher education students to be interviewed, the surveys of this group included a statement that indicated the interviewee was willing to be further involved in the study. From this group two juniors and two seniors were chosen randomly by selecting two males and two females, one from each school. To achieve greater ethnic / racial representation, the ethnic / racial profile of all four schools was examined. Each school representing the highest percentage of the four greatest ethnic / racial groups had one student from each school.
Finally, all four deans of education were interviewed. These participants were not included in the survey portion of the study due to the statistical insignificance of the size of the group.

**The Instruments**

The researcher developed a survey for the purpose of collecting data related to the subjects’ type and frequency of use of technology as well as the subjects’ perceptions of 21st Century literacy. The Guttman scale developed provides information in graduated degrees in order to determine subjects’ perceptions (DeVellis, 2003). The Guttman scale provides a graduated series of responses from which the subject can choose to respond to the survey item. By doing so the subject also agrees with those responses of lower order on the scale.

The interview questions were in part developed from the survey in order to collect more in-depth information. After developing the initial survey (Appendix C) and interview questions (Appendix D), copies were distributed to the following experts for their critique of the validity of each item of the survey and interview questions:

**Shawn Hannon, Director of Student Accounting and Program Evaluation:** Ms. Hannon is responsible for student and program evaluation for Elkhart Community Schools. One of her many responsibilities is to create and administer on-line surveys and to analyze results for the corporation.

**Dr. Marilynn Quick, Professor Educational Leadership School of Education Ball State University:** Dr. Quick has expertise in educational research and is the researcher’s committee chair.
Dr. Barbara M. Thomas, Lecturer School of Education Indiana University at South Bend: Dr. Thomas has extensive background in the area of literacy both as a teacher, a school administrator, and a university instructor.

Dr. Susan Karrer, Professor, School of Education Bethel College, Mishawaka, IN: Dr. Karrer is an experienced educator of emerging teachers at both the elementary and secondary level. Literacy is her area of expertise.

Dr. David McGuire, Supervisor of Curriculum and Instruction / Literacy: Dr. McGuire is responsible for overseeing the development of literacy programs through curriculum and instruction for Elkhart Community Schools. His area of expertise is in the growing field of digital literacy.

Dr. John Hutchings, Director of Student Services: Dr. Hutchings’ responsibilities are to oversee all aspects of student services for Elkhart Community Schools, but his area of research continues to be qualitative having completed his dissertation conducting case studies in the area of special education.

These experts provided excellent advice for improving survey items and interview questions. The instruments were altered based on the suggestions made. The second set of survey items and interview questions were met with approval of the expert group, and the final product was submitted to the Ball State Institutional Review Board for approval to proceed with the study.

In order to verify reliability of the on-line survey, a test / retest pilot study was conducted. Ten individuals were selected for the first pilot. One week later, the same individuals were surveyed again to determine if the survey elicited similar responses. A KAPPA coefficient was computed to analyze group administrations of the survey.
KAPPA is the test-retest method to measure reliability and consistency. The researcher looked for variation in responses from the first to second administration after one week. Items determined not to be reliable through the KAPPA cross tabulation were then examined. The researcher elicited the assistance of four students from the pilot group to discuss individually those items. At that time the researcher determined three items should be discarded and five items were re-worded for the final draft of the survey.

Data Collection

SurveyMonkey.com was used to collect data from the surveys. Letters explaining the study and parent consent forms were sent home with every junior and senior of the two participating high schools. The survey was then made available to all juniors and seniors who returned signed parent consent forms. The introduction and purpose of the study was delivered via parent and student letters and verbally via the high school principals or their designees. Additionally, the researcher taped a message of explanation that was played for students during announcements each day for an entire week. Students completed the surveys in their advisory classes in one of the schools’ computer labs. One designee at each high school served as proctors. Proctors were given specific instructions by each building administrator to not provide any assistance to students in the completion of the survey other than technical assistance in the event there was an equipment malfunction.

The survey was also sent to all juniors and seniors in education programs of the four participating post-secondary institutions. The introductory letter was sent via e-mail
along with the participant consent form. The e-mail communication included a link to the SurveyMonkey.com to provide access to the survey.

Data Analysis

\textit{The Survey.}

Data generated from the surveys were analyzed with the assistance of Dr. James Jones of University Computing Services at Ball State University. Data were organized and analyzed as results were returned via SurveyMonkey.com. After a period of ninety days from the first mailing, responses were tabulated and analyzed.

The source of data for this project was a 63 item survey that included demographic and technology usage data as well as perceptions of 21\textsuperscript{st} Century literacy for two of the three participation groups. Items on the survey were matched to each of five research questions. Analysis of data results from the survey of two groups was subjected to an assessment of an independent samples \( t \) test.

Also included as a source of data for this project were transcripts from interviews with the four deans of education, interviews with four junior and senior high school students, and interviews with four junior and senior students in education programs (emerging teachers).

\textit{Guttman Scale Analysis.}

The survey was constructed as a scale to evaluate a construct on a continuum regarding frequency, types of use, and perceptions of technology and 21\textsuperscript{st} Century literacy. The Guttman Scale was utilized to provide a dimension of research constructs and represent factors of the research questions, developed for this study, as scales in order
to prove research questions valid or not valid. The survey instrument represents three scales in order to gather data related to the perceptions of two groups regarding types of use, frequency of use, and perception of those two groups of 21st Century literacy.

This study has been based on the concept that perceptions are formed via mental models, which in turn effect daily manipulations within any given context. The mental models represented in perceptions reflect a person’s daily actions. Perceptions as indicated by the responses to the survey instrument were measured through analysis procedures.

**The Interviews.**

In addition to survey results which generated quantitative data regarding use, frequency of use and perceptions of technology and 21st Century literacy, interviews were conducted with representative subjects from all three groups. All four deans were interviewed and were not included in the survey due to the fact that the group was not large enough to be statistically significant. Four high school students – two juniors and two seniors – were interviewed as well as four students in emerging teacher programs. Random sampling techniques (see sample) were utilized to choose subjects to be interviewed. Interview questions were formulated from the survey questions, and additional survey questions were generated and replicated with each of the groups’ subjects during the interviewing process. All interviews were recorded. Interviews were analyzed for themes using NVivo 9 software.

**Limitations of This Study**

Limitations of the study include the size of the deans of education group and the number of participants of the juniors and seniors (emerging teachers) in the schools of
education in the four post K-12 schools. Another limitation of this study was the fact that only four post K-12 schools and two high schools were involved in the study. This will seriously limit generalization of results to the general population. Yet another limitation of the study was the possible lack of objectivity at the time of survey administration at both high schools.

The intention of the study was to gain participants’ perceptions of 21st Century literacy in general, as well as their use of technology and frequency of use. The intention was not to gain information on any specific person or instructor; rather a general or global perception.

Summary

The purpose of this chapter has been to detail the mixed method research design utilized for this study to collect and analyze results related to perceptions of deans of education, emerging teachers, and high school juniors and seniors of 21st Century literacy. Included in the study was information collected pertaining to types and frequency of use of technology. Chapter IV provides detailed analysis of the results gained through the mixed method research design.
Chapter Four

The purpose of this study was to compare perceptions of three different groups regarding 21st Century literacy and technology. College juniors and seniors in teacher education programs of four different post-secondary schools, high school juniors and seniors in two urban high schools, and four deans of the schools of education of the four post-secondary schools participated in the study. These three groups were identified as representative of significant groups in comparing perceptions of 21st Century literacy and technology. College juniors and seniors in education programs represent emerging teachers who will work directly with students preparing for 21st Century work. High school juniors and seniors represent a group of students who, for the most part, have grown up immersed in technology their entire lives. College deans who oversee the teacher education programs at the post-secondary level represent a group of leaders who hold positions that significantly impact the direction of program planning for teacher preparation for the 21st Century.

The researcher determined that a mixed methods study design was best suited to collect data for the purpose of this study. Mixed methods design provides opportunities to determine statistical significance of survey results as well as qualitative analysis of
face-to-face interviews to further examine the perceptions of individuals (Viadero, 2005). Self-reported perceptions through survey and interviews provide an opportunity for the researcher to delve deeper and clarify perceptions of 21st Century literacy and technology. Perceptions are formed through the construction of a person’s mental models, which are formulated based on experiential contexts or discourses (Gee, 2004). Given the variety in experiential contexts of each of the participant groups related to types of use of technology, frequency of use, and perceptions of literacy and technology, the mixed methods design was beneficial in helping to clarify differences. The interview process of the mixed methods design was invaluable in order to further understand a person’s experiential context for the purpose of this study.

A survey was designed to measure the perceptions of both groups of high school and college juniors and seniors. The four deans were not surveyed due to the small size of the group. The survey was designed using a Likert scale which has been determined to be a suitable instrument for measuring self-reported perceptions (DeVellis, 2003). The 53 item survey appeared to be internally consistent at $\alpha = .92$. All items were retained. The greatest increase in alpha would result from deleting item 2-24 (I use technology more outside of classes than during classes), but deletion of this item would only increase alpha by .002.

Some survey items determined age of participants, gender, types of use of technology, and frequency of use. These items were included in order to establish a context of participants’ types and frequency of use of technology. Those items were directly related to research questions 1, 2 and 3 in order to gain data to make comparisons
for research questions 4 and 5. Comparisons of types and frequency of use establish a context of experiences that govern essential elements of the self-reported perceptions held by participants.

The survey was administered to college students on the Internet through Survey Monkey. E-mail addresses were secured from representatives of all four post-secondary schools for all four groups of college junior and senior education students. A letter of introduction and an informed consent including a place to electronically sign as an agreement to take the survey were included. College students were sent three reminders spaced two weeks apart encouraging them to complete the survey. The reminder messages included comments about the importance of the study and a personal plea on the part of the researcher for participants to complete the study.

High school students first returned parent permission / informed consent forms prior to completing the survey. In addition to parent letters sent to explain the study, a taped personal message from the researcher was shown during student advisory periods for one week explaining the importance of the study to students. Incentives in the form of a raffle to win iTunes cards were offered to encourage students to return parent permission slips. Once parental consent was secured, the students were administered the survey through Survey Monkey in respective school computer labs with a school official as proctor. This stage of the research process took over three months from beginning to end due to the time involved getting students to return parent informed consents.

In addition, an interview was also conducted to further investigate perceptions of use of technology and perceptions of 21st Century technology and literacy. Four college
students and four high school students were chosen to complete interviews. The random selection process for college participants involved students checking a box that indicated they would be willing to be interviewed. One college student was chosen from each of the four post-secondary schools. The selection process of high school students involved random numbers being assigned to those students who returned permission slips. Two high school students were randomly chosen from each of the two high schools.

All four deans were interviewed using the same ten questions the college and high school participants were asked. The college deans were asked eight additional questions specific to their positions as dean of teacher education programs. The interview instrument is in Appendix D.

Chapter four is organized to first provide a description of the three participant groups utilizing demographic data obtained from each location and from the information collected on the survey. Survey data analysis for each of the five research questions is reported. Then, interview data analysis specific to corresponding research questions is reported with each section. The interview data for the deans’ interviews is reported in a separate section. Finally, a summary of all research findings related to the five research questions is included.

The research questions that guided this study were:

1. With what frequency do deans of education, emerging teachers, and high school students use technology?
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2. In what ways do deans of education, emerging teachers, and high school students use technology?

3. What are the perceptions of deans of education, emerging teachers, and high school students about 21st Century literacy and technology?

4. What similarities or differences exist between the frequency of use and type of use of technology of deans of education, emerging teachers, and high school students?

5. What similarities or differences exist between the perceptions of deans of education, emerging teachers, and high school students relative to 21st Century literacy and technology?

Survey and interview items related to questions 1 and 2 provided the data necessary to address research question 4. Survey and interview items related to question 3 provided the data necessary to address research question 5.

Participant Groups

The first participant pool consisted of juniors and seniors of two large urban high schools in northern Indiana. Those two schools were chosen for two reasons. The first reason was due to the proximity of their location to the researcher. Given the need to interview students, proximity was a significant factor. In addition, both high schools represent diverse student bodies. Both schools are in the same corporation. The second reason was that school demographics reflect a student population of 26% Hispanic, 16% African American, 2% Asian, and 56% Caucasian. The total student population of juniors and seniors combined between the two high schools on the day of distribution of the consent forms was 1,637 students. On the day that informed consents were
distributed to students to take home there were exactly 200 students absent from the two schools combined. Those students were excluded from the study. Ninety-nine students from the combined schools attend the Elkhart Area Career Center, and they too were excluded from the study due to limitations in the available personnel to oversee the students during survey completion. Finally, between the two high schools, 103 students were not present in advisory periods where the consent forms were distributed due to internships or other obligations that removed them from the period.

Of the 1,637 consent forms sent home, 109 were returned. One hundred nine surveys were completed which is .096% of the student population targeted in the study.

Demographics, as indicated from the survey responses, are shown in Table 1.

Table 1

*High School Student Distribution*

<table>
<thead>
<tr>
<th>Distributed Informed Consent</th>
<th>Returned Informed Consent</th>
<th>Completed Surveys</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1637</td>
<td>109</td>
<td>109</td>
<td>.096</td>
</tr>
</tbody>
</table>

Table 2 describes demographic data related to age and gender of high school participants.

Table 2

*High School Student Age and Gender*

<table>
<thead>
<tr>
<th>Age Population</th>
<th>Gender</th>
<th>Return Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-25</td>
<td>Female</td>
<td>52.3%</td>
</tr>
<tr>
<td>N = 56</td>
<td>Male</td>
<td>47.7%</td>
</tr>
<tr>
<td>N = 51</td>
<td></td>
<td>Total 100%</td>
</tr>
</tbody>
</table>
Demographic data related to race and socio-economic status is noted in the narrative in order to emphasize the diversity of the district from which the participant pool was chosen. Those demographics were not included in the study analysis because the purpose of this study was not to report comparisons of perceptions based on such demographics.

The second participant pool was identified from four post-secondary schools in Indiana – Goshen College in Goshen, Indiana University at South Bend in South Bend, Ball State University in Muncie, and Bethel College in Mishawaka. These four schools were chosen in part due to the proximity to the researcher. Each school represents a difference in student population as well as organizational differences, providing a potential of variety of perspectives to the study. Ball State is a large state school attracting students from all over the United States. Ball State also is a post-secondary program with a strong presence on the Internet. Each department has many Internet course opportunities, and technology is advertised as a strength at this institution. Indiana University at South Bend is a growing regional campus. Students primarily commute and are from the northern Indiana and southern Michigan areas. At the time of this study, Indiana University at South Bend had no Internet presence in terms of Internet courses, but reportedly plans were being explored to pilot courses in the education department. Goshen College is a small, faith-based undergraduate school whose students are primarily of the Mennonite faith and come from a large geographical area. Bethel College is a small multi-denominational faith-based school whose students also come
from all over the United States. At the time of this study, neither Bethel nor Goshen Colleges had plans to expand to Internet courses.

The researcher chose to include in the study only juniors and seniors in teacher education programs at each of the four post-secondary schools because of the likelihood that these students were more definitely on track to become teachers. Table 3 reflects the breakdown of the number of students for each post-secondary school at the time of the survey and interview administration. E-mails included the link to the study survey and targeted 1,461 college students. One e-mail was returned due to an incorrect e-mail address and could not be corrected. Of those surveys sent, 169 were completed for a total of 12 % return. Table 3 shows the survey return rates for the college participants.

**Table 3**

*Emerging Teacher Distribution*

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Surveys Sent</th>
<th>Complete Surveys</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bethel College</td>
<td>69</td>
<td>20</td>
<td>29%</td>
</tr>
<tr>
<td>Goshen College</td>
<td>52</td>
<td>16</td>
<td>31%</td>
</tr>
<tr>
<td>IUSB University</td>
<td>426</td>
<td>85</td>
<td>20%</td>
</tr>
<tr>
<td>Ball State University</td>
<td>914</td>
<td>48</td>
<td>5%</td>
</tr>
<tr>
<td>Totals:</td>
<td>1461</td>
<td>169</td>
<td>16%</td>
</tr>
</tbody>
</table>
Age and gender demographics of college student participants are reported in Table 4. It should be noted that a significantly larger number of college females completed the survey than did college males.
Table 4

Emerging Teacher Participants

<table>
<thead>
<tr>
<th>Age</th>
<th>Participants</th>
<th>% Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-25</td>
<td>102</td>
<td>73.4%</td>
</tr>
<tr>
<td>26-35</td>
<td>17</td>
<td>12.2%</td>
</tr>
<tr>
<td>36-45</td>
<td>15</td>
<td>10.8%</td>
</tr>
<tr>
<td>46-70 or older</td>
<td>5</td>
<td>3.6%</td>
</tr>
<tr>
<td>Skipped item</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>169</td>
<td></td>
</tr>
</tbody>
</table>

Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>Participants</th>
<th>% Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>110</td>
<td>80.3%</td>
</tr>
<tr>
<td>Male</td>
<td>27</td>
<td>19.7%</td>
</tr>
<tr>
<td>Skipped item</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>169</td>
<td></td>
</tr>
</tbody>
</table>

For the purpose of this study, no racial or socio-economic data was collected for emerging teacher or high school participants.

NOTE: It is important to note here three limitations of the study. First, the low percentages of survey return rates for college students and low return rates of parent consent forms for high school students are indicative of two current challenges – one which can be documented with research and the other which can be explained only anecdotally. Studies show an increasing decline in response rates on Internet surveys since the early 1980’s (Dillman, 2007). It would seem that the decline in response rate has grown with the increase in use of the Internet for the purpose of surveying populations. Dillman also notes that with increased Internet surveys, respondents have increased control to choose. One variable that impacts a respondent’s choice to complete a survey is the length of the survey. The researcher’s survey tool included 65 total items,
and this factor may have contributed to the low return rate particularly from the emerging teacher group.

Additionally, the researcher chose to send parent consent forms home with students and experienced a low return rate. Anecdotally, those who work with high school students on a daily basis state that this is a growing phenomenon. Even with personal messages and incentives, students exhibit a low return rate when returning documents to school that require parent signature.

Yet another limitation of the study was the small number of deans included. The third participant pool was the four deans who oversee teacher education programs at each of the four post-secondary schools in the study. This group was not surveyed due to the small number, but demographic data was obtained through the interviews and included gender and age range for the four which is shown in Table 5.

### Table 5

*Gender and Age of Deans of Education*

<table>
<thead>
<tr>
<th>Gender</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>1</td>
</tr>
<tr>
<td>Male</td>
<td>3</td>
</tr>
</tbody>
</table>

**46-70**

**Frequency and Types of Use of Technology**

Survey items and interview questions pertaining to frequency and types of use of technology provided data to compare participants’ perceptions of frequency and types of use of technology. Participants responded to survey items that addressed their own frequency and types of use, as well as perceived frequency and types of use of their
instructors. Data relevant to frequency and types of use of technology were determined to be essential elements indicating a person’s experiential context because those would be ways, in addition to identifying perceptions, in which to determine a person’s mindset about technology.

For the purpose of results analysis, survey items for both research questions 1, frequency of use of technology, and 2, types of use of technology, are subdivided into statistically significant items that relate to participant’s perceptions of teachers’ use of technology and participants’ use of technology. An independent $t$-test was calculated comparing the mean scores for all survey items for which high school participants and emerging teacher participants answered using the Likert scale.
Table 6

*Frequency of Use of Technology*

<table>
<thead>
<tr>
<th>Item # (tailed)</th>
<th>Item</th>
<th>Mean Score</th>
<th>t-value</th>
<th>Sig (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-2</td>
<td>Technology is included in most classes.</td>
<td>2.25</td>
<td>1.86</td>
<td>3.77</td>
</tr>
<tr>
<td>2-5</td>
<td>Teachers instruct daily with the use of technology.</td>
<td>2.47</td>
<td>1.99</td>
<td>3.98</td>
</tr>
<tr>
<td>2-6</td>
<td>Most teachers use technology as part of instruction.</td>
<td>2.42</td>
<td>1.90</td>
<td>4.66</td>
</tr>
<tr>
<td>2-8</td>
<td>A majority of teachers are frequent users of technology.</td>
<td>2.01</td>
<td>1.68</td>
<td>3.17</td>
</tr>
<tr>
<td>2-10</td>
<td>A majority of teachers integrate technology into their lessons.</td>
<td>2.38</td>
<td>1.95</td>
<td>3.91</td>
</tr>
<tr>
<td>2-11</td>
<td>When teachers teach a concept, they regularly integrate technology.</td>
<td>2.58</td>
<td>2.27</td>
<td>2.95</td>
</tr>
<tr>
<td>2-33</td>
<td>Most teachers instruct with the use of the computer each day.</td>
<td>2.91</td>
<td>2.15</td>
<td>5.94</td>
</tr>
<tr>
<td>2-35</td>
<td>The use of instructional technology is a priority.</td>
<td>3.17</td>
<td>2.64</td>
<td>4.04</td>
</tr>
<tr>
<td>2-51</td>
<td>Teachers regularly integrate technology in course work.</td>
<td>2.91</td>
<td>2.26</td>
<td>5.41</td>
</tr>
</tbody>
</table>

Participants’ Frequency of Use of Technology

<table>
<thead>
<tr>
<th>Item # (tailed)</th>
<th>Item</th>
<th>Mean Score</th>
<th>t-value</th>
<th>Sig (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-24</td>
<td>I use technology more outside classes than for my class work.</td>
<td>1.49</td>
<td>1.72</td>
<td>-2.13</td>
</tr>
<tr>
<td>2-36</td>
<td>I spend more time using technology in school than out of school.</td>
<td>3.82</td>
<td>3.21</td>
<td>3.94</td>
</tr>
<tr>
<td>2-37</td>
<td>I text more than talk on the cell phone.</td>
<td>1.67</td>
<td>2.38</td>
<td>-4.30</td>
</tr>
<tr>
<td>2-45</td>
<td>I rarely use the same technology skills in school than I do outside of school.</td>
<td>2.50</td>
<td>3.25</td>
<td>-5.27</td>
</tr>
</tbody>
</table>
Table 6 shows the statistically significant results of the independent samples t-test comparing the mean score of both high school and college participants related to frequency of use of technology. The response scale range on the survey was Completely True, Mostly True, Equally True and Untrue, Mostly Untrue and Completely Untrue with responses quantified by Completely True as 1 and Completely Untrue as 5. The lower mean score indicates the item that was statistically significant, and those means are reflected in bold type. Items listed at the top of the chart relate to participants’ perceptions of teachers’ frequency of use of technology. Items listed at the bottom of the chart relate to participant’s self-reported frequency of use of technology.

Results for items related to instructors’ frequency of use of technology show that college students perceive their instructors as using technology frequently and that frequent use is incorporated into instructional practice. Figure 1 shows a line graph illustrating, as a composite, the statistically significant data for emerging teachers’ and high school students’ perceptions of their instructors’ frequency of use of technology.
Table 6 also details four statistically significant survey items related to participants’ frequency of use of technology. High school participants use technology more outside of school and do not use the same technology skills in school as out of school. College participants use technology more in class than they use out of class. High school students text more than talk on the phone. Figure 2 shows a line graph illustrating, as a composite, the statistically significant data for emerging teachers’ and high school students’ perceptions of their own frequency of use of technology.
Multiple Response Items Related to Demographics and Frequency of Use

A chi square test of independence was calculated on age demographics for both college and high school students. As expected, results showed a statistically significant difference in the age range of the two groups $\chi^2 (3, \text{N}=247) = 33.81, p = .00$ with college participants’ ages covering a wider range than the high school participants.

A chi square test of independence showed a significant difference in gender for the two groups $\chi^2 (1, \text{N}=244) = 21.60, p = .00$. Of the participants in both groups combined who completed the survey, 68% were females and 32% were males. In order to determine if there was any significant interaction between level of participant and gender, a two-way ANOVA between subjects was calculated comparing gender to high school and college groups. The interaction was not statistically significant $F(3,238) = 1.15, p = .40$. 

Figure 2
A Chi-square test of independence was calculated between level of group and hours on the Internet and showed the percentage of college and high school participants’ time spent on the Internet approaching significant difference ($\chi^2 (2) = 5.82, p = .054$).

Chi square test of independence for responses related to level of technology skills, number of hours on the Internet, and top three daily uses of technology showed no significant difference between the two participant groups ($\chi^2 (2) = 3.35, p = .19$). Table 7 shows that a majority of participants in both groups rated themselves as either highly proficient or fairly good.

**Table 7**

*Level of Skill of Technology Use*

<table>
<thead>
<tr>
<th></th>
<th>HS</th>
<th>College</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highly Proficient</td>
<td>55%</td>
<td>43%</td>
</tr>
<tr>
<td>Fairly Good</td>
<td>42%</td>
<td>53%</td>
</tr>
<tr>
<td>Enough to get by</td>
<td>3.7%</td>
<td>3.6%</td>
</tr>
</tbody>
</table>

It should also be noted that although there were no significant differences between participant groups in types of daily Internet use, there are still interesting comparisons to be made between groups. Frequency distributions for both groups’ top three uses of the Internet are reported in Table 8.
### Table 8

*Top Three Uses of the Internet*

<table>
<thead>
<tr>
<th></th>
<th>High School</th>
<th>College</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-mail</td>
<td>______</td>
<td>73.4%</td>
</tr>
<tr>
<td>Social Networking</td>
<td>64.8%</td>
<td>64.0%</td>
</tr>
<tr>
<td>Surfing the Net</td>
<td>64.8%</td>
<td>49.6%</td>
</tr>
<tr>
<td>Research</td>
<td>50.9%</td>
<td>______</td>
</tr>
</tbody>
</table>

### Interview Question Related to Frequency of Use of Technology

Interview question #4 queried interview participants on their frequency of use of technology in a day’s time. Every participant reported using technology often during a day’s time, ranging from “every 10-15 minutes” to “all the time.” Interviews of participants emphasized the increase in messaging throughout each day, noting e-mails and text messaging as the primary ways of communicating. In regards to frequency, it should be noted that there was a distinct difference in the way in which the deans and college participants reported frequency and the way the high school participants reported frequency. Deans and college participants used terms such as “often, majority, and regularly.” High school students made reference to “all the time, 10-12 hours a day, whenever I am not sleeping.” One high school participant reported text messaging at least 200 times a day.

### Types of Use of Technology

Survey items related to research question 2 queried participants about types of use of technology. An independent-samples *t*-test was calculated comparing the mean scores of high school and college participants. Listed in Table 9, are the nine items for which
statistically significant differences were found. For the purpose of discussion, the items are separated into subgroups. Those items related to participants’ perceptions of instructor use of technology are listed in the top of the chart and those items of statistical significance related to participants’ use of technology are listed at the bottom of the chart.

Table 9

*Types of Use of Technology*

Participants’ Perceptions of Instructors’ Use of Technology

<table>
<thead>
<tr>
<th>Item # (tailed)</th>
<th>Item</th>
<th>Mean Score</th>
<th>t-value</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>2-12</strong> Teachers emphasize the collaborative interactive value of the Internet.</td>
<td>2.74</td>
<td>2.30</td>
<td>3.54</td>
</tr>
<tr>
<td></td>
<td><strong>2-13</strong> Teachers regularly model the use of technology.</td>
<td>2.59</td>
<td>2.22</td>
<td>3.21</td>
</tr>
<tr>
<td></td>
<td><strong>2-23</strong> Teachers use technology to instruct class.</td>
<td>2.46</td>
<td>2.11</td>
<td>3.45</td>
</tr>
<tr>
<td></td>
<td><strong>2-32</strong> Podcasts are used to provide lesson alternatives.</td>
<td>4.10</td>
<td>3.63</td>
<td>3.34</td>
</tr>
<tr>
<td></td>
<td><strong>2-34</strong> Expectations for use of technology are clearly stated.</td>
<td>2.88</td>
<td>2.53</td>
<td>2.62</td>
</tr>
</tbody>
</table>

Participants Use of Technology

<table>
<thead>
<tr>
<th>Item #</th>
<th>Item</th>
<th>Mean Score</th>
<th>t-value</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-21</td>
<td>Drill and practice are the primary uses of technology.</td>
<td><strong>2.79</strong></td>
<td>3.32</td>
<td>-4.24</td>
</tr>
<tr>
<td>2-28</td>
<td>Course work cannot be completed without the use of technology.</td>
<td>3.05</td>
<td><strong>1.88</strong></td>
<td>8.80</td>
</tr>
<tr>
<td>2-40</td>
<td>I play video games on the computer</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
21ST CENTURY LITERACY AND TECHNOLOGY: PERCEPTIONS

with people from other countries.  3.62  4.33  -3.94  .00

2-42  I spend more time surfing the Net than reading books.  2.53  3.05  -2.96  .00

Results support that college instructors are perceived to emphasize the interactive value of the Internet, and they model the use of technology as well as clearly state expectations for the use of technology. College students perceive that a goal of education is to use technology to learn. They report that they cannot complete course work without the use of technology. College students also report that podcasts are used as lesson alternatives. E-mail is their favorite way of communicating. Figure 3 is a visual of the mean differences in the participants’ perception of their instructors’ use of technology.
Figure 3

![Participants' Perception of Instructors' Use of Technology](image)

The data in Table 9 showing statistical significance related to participants’ use of technology reflects that high school participants perceive the primary purpose of technology use as drill and practice. High school participants also report interacting with people in other countries to play video games. Results reflect that high school students spend more time surfing the Net than reading a book (2-42).

**Survey Items with Multiple Responses Related to Technology Use**

Survey multiple response items 5, 6, 11, and 12 relate to primary access to technology, daily use of technology, types of cell phone use and primary support with technology. A Chi-square test of independence was calculated comparing access to the Internet for both high school and college participants. A significant interaction was found (\( \chi^2(2) = 25.62, p = .00 \)). Figure 4 shows the interaction between high school and college participants and primary access to the Internet.
Figure 4

A between-subjects 3 x 2 factorial ANOVA was calculated comparing primary Internet access at home, school/work, or equally at school and home/work. A significant main effect was found (F(5, 236) = 3.65, p = .03). High school students had greater Internet access at home (M = 2.83, SD = .45) than college students (M = 2.50, SD = .35), whereas, college students had greater access at school (M = 2.57, SD = .51) than high school students (M = 2.43, SD = .48). High school participants (M = 2.52, SD = .44) and college participants (m = 2.51, sd = .44) do not differ significantly in access equally at home and school/work.
Item 12 queried participants about their primary support when in need of help with technology. A chi-square test of independence was calculated comparing high school and college participants’ primary support for technology assistance. There was significant interaction between the level of participant and what source each group relied on for technology support with 48% of high school participants and 44% of college participants relying on friends for tech support ($\chi^2 (4) = 16.30, p = .003$).

**Interview Questions Related to Types of Use of Technology**

When participants were asked to identify the types of technology used in a day’s time, the top three types of technology named by all participants were laptops, cell phones, and desk top computers. The researcher chose to separate laptops and desk top computers due to the reference to mobility of laptops. Participants did not use laptop and desk top computers interchangeably. College and high school participants referred to the use of laptops “anywhere.”

Interviewees identified their top five uses of technology as e-mail, texting, homework / research / word processing, phone calls, and management activities such as calendar and organizing information. Other types of use mentioned were digital camera / cell phone camera, multi-media presentation, Power Point, and Flip Video for record keeping and family memories. In more than one interview, e-mail was referred to as “eats most of my life” and “I’m always checking e-mail.” Text messaging was most often referred to by college and high school participants. One high school interviewee reported sending a minimum of 200 text messages in a day’s time.

In order to provide deeper insight into participants’ technology use, participants were queried about when they started using technology, and how they learned best to use
technology. Each of the three groups interviewed provide distinctly different ranges of times to the onset of their technology use. The deans reported a time range from the mid-70’s to the mid-80’s. The college participants reported starting to use technology within a range of being 10-15 years old. None of the high school participants interviewed referred to a specific age when discussing onset of technology use. Each either referred to a grade in school, the oldest being third grade, or they referred to being “very young.” In addition, the high school participants referred to game playing as an initial primary activity for which the technology was used.

Responses to the question about how participants best learned to use technology overwhelmingly reinforced the interactive nature of technology use. Again, there was some distinction between the deans and college and high school participants, in that the deans noted going to a workshop or calling on the technology department to learn technology, whereas the emerging teachers and high school participants referred to “exposure, perseverance, trial and error, jumping in and trying things, talk to friends, mess around, and experiment.” One high school participant referred to the need to “learn technology by using technology.” Emerging teachers and high school participants emphasized the need to learn technology without the use of an instruction manual because the manuals “do not tell you everything.”

Also related to technology use was how interviewees determine a legitimate resource when working on the Internet. All 12 interviewed participants made reference to resources that were pre-determined to be legitimate either as identified through a college data base, or by making reference to .edu or .gov as an identifier of legitimacy. In addition, all four high school and two college participants interviewed made reference to
the use of Wikipedia. They all stated that they knew this was not a valid source, but they checked it as a reference anyway. No dean interviewed made any reference to Wikipedia.

**Similarities and Differences in Perceptions of 21st Century Literacy and Technology**

Research Question #5: What similarities and differences exist between the perceptions of deans of education, emerging teachers, and high school students relative to 21st Century literacy and technology?

Survey items and interview questions related to participants’ perceptions of 21st Century literacy and technology provided data to make comparisons between the perceptions of participant groups. The data for the survey items listed in Table 10 show statistically significant differences. For the purpose of comparisons, the survey items at the top of the chart are specific to lower mean scores for high school participants’ responses on those items, and those at the bottom of the chart are specific to lower mean scores for college participants’ responses on those items.
21ST CENTURY LITERACY AND TECHNOLOGY: PERCEPTIONS

Table 10

Perceptions of 21st Century Literacy and Technology

High School Participants’ Perceptions

<table>
<thead>
<tr>
<th>Item #</th>
<th>Item</th>
<th>Mean</th>
<th>t-value</th>
<th>Sig. (2 tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS</td>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-17</td>
<td>Technology defines the future.</td>
<td>1.53</td>
<td>1.85</td>
<td>-3.28</td>
</tr>
<tr>
<td>2-18</td>
<td>Learning to read and learning to use technology are equally important.</td>
<td>2.06</td>
<td>2.46</td>
<td>-2.90</td>
</tr>
<tr>
<td>2-41</td>
<td>Surfing the Net is a good use of time.</td>
<td>2.87</td>
<td>3.26</td>
<td>-2.91</td>
</tr>
<tr>
<td>2-47</td>
<td>Computers are the most important learning tools.</td>
<td>2.47</td>
<td>3.11</td>
<td>-2.69</td>
</tr>
<tr>
<td>2-48</td>
<td>Textbooks are the most important learning tools.</td>
<td>2.74</td>
<td>3.09</td>
<td>-2.58</td>
</tr>
</tbody>
</table>

Emerging Teachers’ Perceptions

<table>
<thead>
<tr>
<th>Item #</th>
<th>Item</th>
<th>Mean</th>
<th>t-value</th>
<th>Sig. (2 tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-1</td>
<td>Learning to use technology is part of becoming literate.</td>
<td>2.18</td>
<td>1.93</td>
<td>2.11</td>
</tr>
<tr>
<td>2-3</td>
<td>Technology is a top priority in this school.</td>
<td>2.84</td>
<td>2.15</td>
<td>6.15</td>
</tr>
<tr>
<td>2-4</td>
<td>I learned how to determine the value of on-line resources in school.</td>
<td>2.29</td>
<td>1.77</td>
<td>2.11</td>
</tr>
<tr>
<td>2-7</td>
<td>I must be literate in order to understand information using 21st Century digital tools such as the Internet, social networking, smart phone applications, podcasting, blogs, etc.</td>
<td>1.89</td>
<td>1.53</td>
<td>3.47</td>
</tr>
<tr>
<td>2-20</td>
<td>Teachers use multi-media technology to communicate what I am supposed to learn.</td>
<td>2.53</td>
<td>2.17</td>
<td>3.32</td>
</tr>
<tr>
<td>2-26</td>
<td>Reading information on the Internet requires a different set of skills than reading a book.</td>
<td>2.78</td>
<td>2.29</td>
<td>3.26</td>
</tr>
</tbody>
</table>
2-29 Literacy and technology go together. 2.66 2.23 3.42 .00

2-30 A goal of education is to use technology to learn. 2.58 2.23 2.72 .01

2-38 Use of e-mail is my favorite way of communicating. 3.71 2.75 6.25 .00

2-43 Blogs are effective ways to encourage student writing. 3.05 2.56 3.48 .00

2-50 Technology standards are incorporated in every course. 3.03 2.75 2.23 .00

2-52 Teachers adapt to new innovations in technology. 2.81 2.43 3.12 .00

Based on the independent t-test comparison of means shown in Table 10, high school students perceive that technology defines the future. Also, learning to read and learning to use technology are equally important. High school students also report that surfing the net is a good use of time. This would be consistent with high school students rating their top three uses of the Internet as research, social networking and surfing the net. When considering text books or computers as “the most important learning tools,” high school participants view both as the most important.

The data of statistical significance in Table 10 also shows that college students report that technology and literacy are connected in that technology is part of becoming literate, and one must be literate in order to utilize 21st Century digital tools. In the college setting participants report technology as a priority. Priority is substantiated in that instructors use technology to convey learning objectives, and instructors are
perceived to adapt to new innovations as well as standards are incorporated in every course. Specific to reading and writing skills, college students perceive that reading on the Internet requires a different set of skills, quality of on-line resources was learned in school, and blogs encourage student writing.

**Interview Questions Related to Participants’ Perceptions of Technology**

Interview questions #1, #6, #8, and #10 reference perceptions of 21st Century literacy and technology in four respects: how 21st Century literacy is defined, what it takes to use multi-media technology, the importance of being digitally literate, and perceptions of a digital divide. Patterns of responses emerged through the analysis of interview narratives. Reoccurring words or phrases were identified and coded as positive or negative, maximum or minimum importance, or digital native or immigrant traits (Prensky, 2002). It is important to note when identifying positive or negative in any of the participants’ interviews, the researcher noted body language such as smiling, relaxed demeanor, eye rolling, and head shaking as well as words with positive or negative connotations.

Another pattern of response that emerged was when participants were asked to define 21st Century literacy. The narrative of responses to interview question #1 asking participants to define 21st Century literacy supports consistent interchange of terminology related to traditional definitions of literacy such as text print and reading with more recent terms such as technology, computer and functional literacy requiring technology skills. Table 11 reflects a word frequency distribution queried from all interview participants’ responses in regards to 21st Century literacy. The word frequency distribution shows that
definitions of 21st Century literacy acknowledge the interaction of technology with traditional references to literacy such as reading.

**Table 11**

**Word Frequency**

<table>
<thead>
<tr>
<th>Word</th>
<th>Frequency of Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology</td>
<td>10</td>
</tr>
<tr>
<td>Literacy</td>
<td>8</td>
</tr>
<tr>
<td>Computer</td>
<td>8</td>
</tr>
<tr>
<td>Reading</td>
<td>7</td>
</tr>
<tr>
<td>People</td>
<td>6</td>
</tr>
</tbody>
</table>

Interview questions #6 and #8 address the mindsets necessary to use multi-media and the importance of digital literacy in general. Participants’ responses identified another pattern that was overwhelming acknowledgement of the importance of digital literacy, but within the interview participants there were positive and negative responses. In general, those participants who could be considered digital immigrants had a pattern of response that was negative in the sense of being overwhelmed with the demands of digital literacy. Those participants who could be considered digital natives had a more positive, matter-of-fact response when noting the need for digital literacy and how learning should be approached.

More complex were the responses to the question concerning the mindset necessary to use multi-media technology. It should be noted here that the researcher was prepared to define multi-media/digital technology, but no participant made the request
for definition. High school students emphasized common sense, knowledge of how things work, experience (“it’s hard not to catch on”), patience when things do not work, and expectations there will be “glitches.” None of the high school interview participants made reference to instruction manuals as part of a necessary mindset to use multi-media / digital technology.

College students also referenced background knowledge in the sense that growing up with technology provides one with a schema as opposed to people who have not grown up with technology and do not have a frame of reference. This group emphasized the need for creativity, time to figure things out, and experimentation. Instruction manuals were mentioned only in the sense that they do not tell you everything.

The Deans more often made reference to tutorials, patience, to have open mindedness, willingness to learn, maintaining perspective – these are just tools. One Dean in particular made the comparison between a lug wrench to fix a tire and a keyboard to communicate in an attempt to put into perspective the mindset needed to learn and use multi-media technology.

**Interview Questions Specific to Deans of Education**

The researcher determined that in addition to those questions asked of all 12 interview participants, including the four deans of education programs at the four post-secondary schools, it was necessary to ask eight additional questions specific to the deans’ leadership perspective and position. The additional questions are listed below:

11. As a dean of a teacher training institution, what is your vision for training future teachers to integrate technology and literacy?
12. How do you ensure that technology is integrated into the curriculum? How do you know it is happening?
13. Is technology one of the first things to go when there are budget cuts?
14. How up-to-date is current technology in use?
15. When cuts are made, who gets to decide?
16. Is the approach to acquisition / development standardized or individual?
17. Are the researchers in the teacher education department modeling / using technology more than others?
18. When staff members prove to be deficient in integrating technology into the curriculum, what remediation is available?

The four post-secondary schools in this study were organized similarly with one dean overseeing a greater number and variety of department heads. One of the four deans relies heavily on the head of the education department for input on departmental decisions. All four deans agreed that in terms of vision for teacher training institutions, emerging teachers should be up-to-date on current technologies and should have every opportunity to be prepared to teach in whatever environment they choose. All but one made reference to the need for emerging teachers to be aware of the most up-dated technology and the need for students to experience the technology through course assignments. When asked how this implementation of curriculum was assured, none of the deans referenced any direct method of observation. In other words, deans did not make mention of directly observing instructors. Three of four deans made reference to indirect methods as ways to ensure technology is being infused into the curriculum. One referred to looking at student end of course products. One mentioned student products included in NCATE course development. One referred to ISTE standards being included
in each course in the education department courses, and one stated that “we have no way of knowing for sure.”

In the areas of budget cuts, state of technology at that particular school and those involved in budget cut decisions, all four deans answered much the same. In general, budget cuts in technology are ill advised in this day, but one dean did report the need to cut technology support this past year. All four deans felt that the technology currently used at their school was “state of the art.” When budget cuts were made, all four deans report some type of in-put gained from colleagues in their departments, but ultimately the deans were responsible for the final decisions.

According to the four deans in this study, acquisition of technology skills by faculty is highly individualized. Each of the four deans referred to individual learning modules and that individuals must ask. When asked what is available for those faculty members determined to be deficient, the deans referenced learning labs and one-on-one availability of technology assistance and again emphasized the need for the individual to request help. Two of the four deans mentioned that the expectation for faculty to have and use technology was also driven by student expectations.

Finally, the deans were asked if the research faculty in the education departments in their schools modeled higher levels of technology than in other departments. One responded they were the leaders and three stated the education staff was about the same as others.
21ST CENTURY LITERACY AND TECHNOLOGY: PERCEPTIONS

Table 12 outlines the significant findings with reference to both statistical measures and qualitative data discussed in chapter four.
### Summary of Significant Findings

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Significant Findings / Qualitative Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. What similarities or differences exist between the frequency of use and type of use of technology of deans of education, emerging teacher, and high school students?</td>
<td>● In general emerging teacher participants perceive their instructors to more frequently use and incorporate technology into instructional practice. (Table 6)</td>
</tr>
<tr>
<td>1. With what frequency do deans of education, emerging teacher, and high school students use technology?</td>
<td>● High school participants use technology more outside of school and do not use the same skills in school as out of school.</td>
</tr>
<tr>
<td>2. In what ways do deans of education, emerging teachers, and high school students use technology?</td>
<td>● High school text more than talk on the phone.</td>
</tr>
<tr>
<td></td>
<td>● Although no significant interaction was found between the level of participant group and the amount spent on technology daily, responses to interview question 4 supports time spent in the range of 2-3 hours, “it eats my life, and “except when I’m sleeping.”</td>
</tr>
<tr>
<td></td>
<td>● In general, emerging teachers perceive their instructors to emphasize the interactive value of the Internet, to regularly model its use, and expectations for technology use are clearly stated. Podcasts were perceived by emerging teachers as being used as lesson alternatives. (Table 9)</td>
</tr>
<tr>
<td></td>
<td>● High school students perceived technology as being used for drill and practice and to play games with people from other countries. (Table 9)</td>
</tr>
</tbody>
</table>
| | ● Responses to interview questions #2 and #3 support the top three
types of technology used as a desktop computer, laptop, and cell phone and that the top uses of those technologies as e-mail, texting, homework and/or word processing, and management activities such as grade programs and calendars.

- Additionally, responses to interview questions #5 revealed distinctly different ranges of time when each of the three participant groups started using technology and perceptible differences how best each group learned technology.

- Responses to interview questions #7 suggest a more standardized approach by the deans when learning technology as opposed to an experimentation approach by emerging teachers and high school participants.

- Responses to interview question #9 support that all participants have a standardized approach to identifying legitimate resources on the Internet. Both emerging teachers and high school participants understand that Wikipedia is not a valid resource, but both groups read it anyway to support their research.

- In the area of technology use, a significant interaction was found between the level of participant and primary access to the Internet. (Figure 3) High school participants’ primary access was at home, and emerging teacher participants’ primary access was a school/work.

- Primary support was reliance on friends when in need of help with technology for both high school
5. What similarities or differences exist between the perceptions of deans of education, emerging teachers, and high school students relative to 21st Century literacy and technology?

3. What are the perceptions of deans of education, emerging teachers, and high school students relative to 21st Century literacy and technology?

<table>
<thead>
<tr>
<th>and emerging teacher participants.</th>
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<tbody>
<tr>
<td>- Significant findings in the area of similarities and differences of perceptions of 21st Century literacy and technology found distinct differences between high school and emerging teacher participants. High school participants perceive technology as defining the future. Learning to read and use technology are equally important, and computers and textbooks are both seen as the “most important learning tools.” Surfing the net is a valuable use of time. (Table 9)</td>
</tr>
<tr>
<td>- Significant findings related to emerging teachers’ responses more in-depth perception of the connection between literacy and technology as reflected in the greater numbers of items showing significant findings. Emerging teachers perceive technology as a top priority and the skills necessary to read on the Internet as a different set of skills. In addition to the schools’ incorporation of technology standards, instructors adapt to new innovations. Literacy and technology are perceived to be connected. (Table 9)</td>
</tr>
<tr>
<td>- Interview questions #1, #6, #8, and #10 provided further information related to interviewees’ perceptions of 21st Century literacy (Table 10), the open mindset necessary to use multi-media technology, the importance of being digitally literate, and perceptions of the existence of a digital divide as primarily generational as opposed to access or lack of access.</td>
</tr>
</tbody>
</table>
### INTERVIEW QUESTIONS SPECIFIC TO DEANS OF EDUCATION PROGRAMS

A synopsis of responses on the part of the participating Deans related to eight additional interview questions were as follows:

- All four Deans state a vision for teacher education that included emerging teachers being as up-to-date as possible and being prepared to teach in whatever environment they choose.
- When asked how they ensured that technology was being infused into the curriculum, each has a different answer, but none has a direct way of monitoring that.
- Budget cuts in technology in this day are ill advised although support services do see cuts in personnel in some cases. When cuts were made, each collaborated with others to make the decisions.
- All four noted a highly individualized approach to staff development in technology, and all four noted that if an instructor was deficient, it was up to that instructor to seek assistance either from an IT department or other colleagues.
- Only one out of four Deans stated that education faculty doing research modeled greater use of technology than other departments.

### Descriptive Summary of Findings

Chapter four presented the analysis of significant findings from 278 surveys of high school and emerging teacher participants as well as interview data collected from 12 interviewees representative of the high school and college population surveyed in addition to the four Deans of each of the post-secondary schools included in this study.
21st Century Literacy and Technology: Perceptions

This study represents a blended research methodology in which quantitative data from surveys and interview responses were analyzed.

The major findings of the analyses completed in relation to the research questions were:

Comparison of Frequency and Types of Use of Technology of the Deans, Emerging Teachers, and High School Student

Emerging teacher participants’ perceive their instructors use technology frequently in instruction. In the area of participants’ use of technology, high school students report they use technology more out of classes than for their class work; they text more than talk on the phone; and they rarely use the same technology skills in school as out of school. The reverse appears to be true of emerging teacher participants in that they report spending more time using technology in school than out of school.

Additionally, emerging teacher participants perceive that their instructors use technology to emphasize, model, set expectations, and instruct. High school students perceive the use of technology in school for drill and practice and for playing video games with people in other countries. Emerging teachers perceive that their course work cannot be completed without the use of technology.

Perceptions of 21st Century Literacy and Technology

Responses to survey items related to participants’ perceptions of 21st Century literacy and technology showing statistical significance were divided between high school and emerging teacher participants. In general high school participants’ perceptions on this measure are more global in nature supporting that technology defines
the future and learning to read and learning to use technology are equally important. High school participants also responded that both computers and textbooks were the most important learning tools.

Emerging teacher participants perceive 21st Century literacy and technology in terms of connections between literacy and technology, writing and reading and literacy requiring technology skills. Emerging teacher participants perceive technology as a top priority in their school, as well as perceiving their instructors use and emphasize multimedia for instruction and incorporate new innovations. Responses indicate the emerging teachers perceive a connection between literacy and technology, and they perceive that reading on the Internet requires a different set of skills.

**Interview Data Related to Frequency and Types of Use of Technology**

Interview responses related to frequency and types of use of technology as coded and compiled in NIVO 9, overall supported those items of significance on the survey. Interviewees responded that the laptops, desk top computers, and cell phones were the types of equipment most used, and that e-mail, texting, homework / word processing, phone calls, and management duties as the top ways in which technology was used. References to the amount of time spent on technology each day included “eats up most of my life,” and “I’m always checking e-mail.” When asked about the amount of time spent on technology, one high school student responded that “it would be easier to tell when they were not using technology.” This same interviewee added “when I’m sleeping is the only time I am not on technology.”
Interview responses related to perceptions of 21st Century literacy and technology revealed a definition that references technology, literacy, computer, and reading. Being literate required a command of reading and writing, and a third skill was necessary for functional literacy – skills in the use of technology.

Interview participants were queried about the mindset necessary to use multimedia and the importance of digital literacy. All interviewees responded that to some degree digital literacy is important. Some distinct differences were noted in responses to the mindset necessary to use multi-media in that high school students and emerging teachers made reference to experimentation, common sense, knowledge of how things work, and patience. None of these interviewees made reference to a workshop, class or instruction manual other than that the manual did not tell everything.

Finally, eight additional interview questions were asked the deans. The questions related to the deans’ leadership responsibilities in their current positions. Although the actual positions varied by school, all four deans oversee as part of their responsibilities the teacher education program at their school. All four responded similarly in terms of vision, budget cuts and who makes the decisions, current technology, staff development, and how faculty receive assistance when deficient in technology. Queries about how each assures that technology is infused into the curriculum differed for all four deans. Responses to whether or not the researchers in the department modeled greater use of technology, only one responded in the affirmative.

The results reported in chapter four support that participant groups in the study have perceptible differences in their perceptions and mindsets of 21st Century Literacy
and technology. Findings, conclusions, and recommendations will be discussed in chapter five.
Chapter Five

Chapter 5 will provide a brief re-statement of the research problem and purpose of the study, along with a discussion of methodology. Following that, major findings will be presented.

Summary

Historically, literacy and technology have been intertwined. As schools try to keep up with rapid change that has come to define the 21st Century, what it means to be literate today is very different than before. Preparing 21st Century students for the future requires meaningful response to rapid change. Educators’ daily interactions, choices and decisions are governed by their perceptions and mindsets. Those perceptions and mindsets are formulated through their experiential context, past and present. Specific to teacher education, it is important to understand the perceptions of post-secondary leaders, emerging teachers, and students in order to better understand how they will interact in order to make meaning of literacy based on their perceptions and mindsets. The problem is that differences in perceptions and mindsets of literacy and technology between groups could be much like speaking different languages all at the same time which in turn could impede progress by maintaining the status quo.
The purpose of this study was to compare three participant groups’ perceptions of 21st Century literacy and technology. The three participant groups were deans of education of four mid-west post-secondary schools, juniors and seniors in teacher education programs at those same post-secondary schools, and juniors and seniors of two large, mid-west urban high schools. The study encompassed gathering information about use of technology, including frequency and types of use, to establish experiential contexts of participant groups in order to compare perceptions.

The research questions that guided this study were:

1. With what frequency do deans of education, emerging teachers, and high school students use technology?
2. In what ways do deans of education, emerging teachers, and high schools students use technology?
3. What are the perceptions of deans of education, emerging teachers, and high school students about 21st Century literacy and technology?
4. What similarities or differences exist between the frequency of use and type of use of technology of deans of education, emerging teachers, and high school students?
5. What similarities or differences exist between deans of education, emerging teachers, and high school students of 21st Century literacy and technology?

A mixed methods research design was used incorporating a survey and interview questions that queried participants for information pertaining to the five research questions. Surveys were completed with the emerging teacher and high school
groups. Interviews were completed with all four deans and four representatives each of the emerging teacher and high school groups. Survey data was collected over a period of two months due to the challenge of getting high school students to return parent consent forms and encouraging the emerging teacher group to complete the survey. Data collected from the 278 surveys was downloaded to an Excel spreadsheet and analyzed using Statistical Package for the Social Sciences (SPSS).

Interviews were also conducted with four randomly selected high school students and four randomly selected emerging teachers, all of whom had completed the survey. All four deans were interviewed. All interviews were recorded and stored on the researcher’s computer. Each recorded interview was then transcribed to a word document and transferred to NVIVO 9 software where passages were coded in order to identify big ideas and themes. (Appendix F)

Findings
Data analyses produced the following summary of results for the research questions as discussed in detail in Chapter 4.

**Differences in frequency of use and types of use of technology.**

Comparison of the frequency of use and the types of use of technology between deans of education, emerging teachers, and high school students indicate that emerging teachers in this study perceive technology to be integral to the instructional context of their school and a majority of their instructors model technology use.

Second, it appears that high school students in this study perceive a more restricted use of technology in school. They use technology more outside of school and do not use
the same technology skills in school as out of school. Technology in school is used for drill and practice.

Third, a significant interaction was found between the level of participant and primary access to the Internet. High school participants’ primary access was at home, and emerging teacher participants’ primary access was at school or work.

Fourth, all three groups use similar types of technology for similar activities, but when examining the primary mode for which technology is used, the emerging teachers and deans of education primarily utilize e-mail, whereas high school students utilize texting to a greater degree.

Fifth, there appear to be greater distinctions between participant groups when identifying onset of learning to use technology and the ways in which each participant group learned to use multimedia technology.

Sixth, all three groups responded to queries about the strategies used to identify legitimate resources on the Internet. All interviewed participants have a standardized approach to identifying legitimate resources on the Internet. Both emerging teachers and high school participants understand that Wikipedia is not a valid resource but both groups read it anyway to support their research. No dean mentioned Wikipedia.

Results of this study reflect more differences than similarities in terms of the perceptions of deans of education, emerging teachers, and high school students of 21st Century literacy and technology. High school participants perceive technology in less specific terms than do emerging teachers.
Discussion

Throughout the history of the American educational system, social and political factions have battled for control of school curriculum. What it means to be literate is at the core of the debate but that meaning has always been directly linked to text print, books, and the written word. The 21st Century brings a new literacy that includes the interactive Internet, social networking, multi-media, and instantaneous access to large bodies of knowledge. Coding and decoding to find meaning has taken on new significance as consumers become creative, collaborative participants with current multi-media technology and an interactive Internet.

In the first decade of the 21st Century, literacy has been defined by change (Leu, 2007) and driven by technology. Study of 21st Century literacy and technology has resulted in more questions than answers. What does it mean to be literate in the 21st Century? What are the implications of technology developments and literacy for 21st Century schools? What are the implications for education as growing numbers of students become technologically literate outside the scope of traditional schooling? In actuality, perceptions define reality and our mindsets determine how we govern our daily actions and maneuver interactions with others. Answers to how literacy and technology are connected lie in the perceptions of a variety of groups at any given time. Learning involves the development of perceptual simulations formulated within the context of an individual’s daily life. Those perceptions are constantly redeveloped incorporating new experiences (Barsalou, 1999). Past and new experiences coalesce to formulate revised perceptions and mindsets. Literacy and language development form the same way (Gee, 2007).
In relation to education, perceptions of literacy and technology influence how leaders will plan programs, how emerging teachers will work with students, and how students will accept or reject that which is being taught. In the event that all have similar perceptions, one might say all are speaking the same language. If those perceptions and mindsets are different, disconnect could occur which could lead to impeding progress in communication and student preparation for the 21st Century.

On the basis of this study, definitive answers to questions posed about 21st Century literacy and technology are not forthcoming. However, the study yielded useful insights that will help in ultimately answering the questions. Comparisons between participant groups can be made and tend to support the research of many authors.

The context for comparison between groups is grounded in the distinct differences of behavior and perceptions between those who have grown up immersed in technology and those who have had to learn technology as if they were learning a second language. Prensky (2002) defines these differences in terms of digital natives who are more likely to have been immersed in technology since an early age and digital immigrants who are more likely to have learned technology later in life. The digital native utilizes technology as an event, whereas the digital immigrant utilizes technology as a tool.

Prensky’s (2002) trait descriptions of digital natives and immigrants can be paralleled to Lankshear and Knobel’s (2007) delineations between a physical-industrial mindset and a cyberspatial postindustrial mindset. Digital natives are of the cyberspatial postindustrial mindset. Behaviors include multi-tasking through technology, which is perceived as an extension of a happening. Digital immigrants are of the physical-industrial mindset, which includes adherence to traditional forms of learning, i.e.,
manuals and texts, and technology is perceived as a tool. The groups in this study reflect the differences described by Prensky and Lanshear and Knobel.

Both high school students and emerging teachers in this study reflect traits of digital natives particularly in the area of use of technology to multi-task. Survey and interview responses of these groups support multiple types of uses of technology and a variety of uses, particularly of laptop computers and cell phones. Furthermore, interview responses support what this researcher refers to as a matter-of-fact tone when high school students and emerging teachers discuss types and frequency of use of technology. That tone was reflected in responses to queries about technology use, such as “all day long,” “often,” “2-3 hours a day,” “all the time when I am not sleeping.” Those responses were accompanied by shoulder shrugs and laughing by a majority of the interviewees from these two groups. The body language was interpreted by this researcher as a tone of acceptance and expectation that the technology was there to be used in multiple ways.

The ways in which high school and emerging teacher participants talked about their use of technology also supports the work of Davies & Merchant (2009) who define the interactive web as a happening rather than as a reference to a tool or software. These two participant groups certainly talked of their interaction with technology rather than their use of technology. Examples of these types of activities included creating web sites and deep involvement with social networking to organize as well as to socialize.

Discussion of the interviews of the four deans must be prefaced by reiteration that one of the limitations of this study is the small number of deans included. Due to that small number, this researcher used caution in making connections and drawing conclusions.
Interviews of the four deans of education reflected a different perspective and tone. To a person, the deans spoke of the inundation of e-mail in their professional lives. All four acknowledged e-mail to be a primary mode of communication. They each spoke of the use of technology to manage their jobs, such as developing calendars and student management systems used for grades. These types of comments are consistent with Knobel and Lankshear’s (2007) description of physical-industrial mindset which perceives reality in terms of what can be touched or observed. The tone of these interviews was one of exasperation, and there was a sense that prior to the onslaught of e-mail, life was not quite as consumed by on-going communication. This tone was evident in such responses as “e-mail eats up most of my day” and in body language such as shaking of the head and rolling eyes prior to answering the questions about frequency and types of use of technology. Reference was made to the continual sound of incoming messages and it was noted that responding was almost like a conditioned response.

In addition, two of the four deans referred to technology as a tool, one said, “Technology is a tool after all,” and another commented, “When I want to fix a flat tire, I use a lug wrench, and when I want to write a letter, I use a keyboard.”. The interruption described in these interviews and references to technology as a tool are additional indications of the physical-industrial mindset described by Lankshear and Knobel (2007). Each of the four deans further indicated their immigrant status when they noted the onset of their use of technology as being in the late 1970’s or early 1980’s when each was already well into their professional career.

Further distinctions between participant groups were evident when comparing the ways in which participants learn technology and what it takes to use multi-media
technology. The deans agreed that an open mind was necessary to learn multi-media technology, but they relied on manuals and workshops or a technology department for support. This would be indicative of Prensky’s (2001) definition of digital immigrants who use more traditional types of supports. They rely on support materials that can be touched. Lankshear and Knobel (2007) describe this type of person as having a physical-industrial mindset.

The high school students and emerging teachers reflected a much different perspective when talking about learning technology and what is needed to be able to use multi-media. They too emphasize the need for being open minded when learning multi-media technology; but these two groups perceive open-mindedness in a much different context. Technology to this group is not in and of itself an add-on or tool (Williams, 2007). Technology is not devoid of cultural context (Kahn & Kelner, 2008). It is embedded in these participants’ cultural context. Both groups pointed out that early exposure, perseverance, trial and error, plunging in, and experimentation are all ways in which a person learns, and this learning is situated (Gee, 1996; Lave & Wenger, 2008; Jenkins, 2005) and inseparable from social practice. One interviewee summed it up by saying, “you learn technology by using technology.” Whereas the deans made reference to an instruction manual as a way to learn, the high school students and emerging teachers said a person must learn technology without the manual because the manual “doesn’t tell you all the secrets.” These comments portray perceptions that include a dimension of cyberspace reality that features experimentation, creativity, and participation. The digital natives choose to learn by doing, and the digital immigrants choose more traditional approaches to learn such as reading.
Further insights can be gained through participants’ perceptions of the connections between 21st Century literacy and technology. In relation to how participants define 21st Century literacy, a word frequency query of all twelve interview documents produced terminology representing the intersection of literacy and technology, which is supported in the work of Robinson & McKenna (2008) and Jenkins (2005). Words such as technology, literacy, computer, and reading were most often used reflecting the technology context in relation to literacy. Additionally, the interviews of all participants point to the need to be able to manipulate and interact with technology; including the interactive Internet, as well as coding and decoding text, sight, sound, and movement.

The literate person is no longer just a consumer of text. Kress and Van Leeuwen’s (2001) define discourse as socially constructed knowledge of reality. This construct extends literacy beyond the ability to read and write to the ability to understand, interpret, and participate with multiple forms of communication. Lanham (1995) emphasizes that one must be able to interpret and comprehend information no matter how it is presented. Participants supported this point when discussing the importance of digital literacy in the 21st Century. The extent of the embedded nature of one high school participant was evident when she related that her continual manipulation of social networking technologies had reached a point she felt the need to practice restraint in a very structured way. She determined her need to place an exact limit on the number of times she accessed Facebook in a day’s time. Then she questioned whether this was necessary at all. This would be just one example of the socially integrated nature of taking the interactive web to an extreme. It is also an example of Marshall’s (2006) description of
the impossibility of separating language and learning from the complexities of society and culture – a 21st Century culture that is immersed in technology.

Perceptions of 21st Century literacy and technology are not limited to the individual participant’s definition. Also important relative to current schooling are the high school students’ and emerging teachers’ perceptions of their instructors’ use of technology and how that relates to literacy. Within the confines of this study, this is an area where the two student groups carry divergent perspectives. This study supports that emerging teachers perceive literacy and technology as being connected. Learning to use technology is part of becoming literate. More specifically, emerging teachers in the study believed that in order to be literate, it is necessary to use a variety of technologies. They also indicated that reading on the Internet requires a different set of skills than reading a book, a finding which is consistent with the research of Leu (2007). All of these responses also support those definitions of 21st Century or new literacies as developed by Robinson & McKenna (2008) and Leu (2004). Those definitions include examples of developing media literacy as well as multi-modal skills necessary to adapt to rapidly changing mediums on the Internet. In other words, the emerging teacher participants in this study perceive 21st Century literacy and technology in ways that are consistent with current research in new literacies. Further, it appears the four post-secondary schools in this study are providing situated learning contexts in which emerging teachers are experiencing methodology that models efficacy in 21st Century literacy and technology.

The high school students in this study revealed a different perception. They perceive that as technology defines the future, learning to read and learning to use technology are equally important. Both computers and textbooks are viewed as the most important
learning tools. In this sense, the high school students’ personal perception supports the value of technology in relation to literacy. But when queried about that value in the context of school, the students report that the primary use of technology in school as being for drill and practice. Furthermore, they use technology more outside of classes than for class work. That would account for the significant interaction between level of participant and access to the Internet, with the high school students reporting their greater access to technology as being at home rather than school. Although the high school participants perceived a connection between literacy and technology, there appears to be a clear disconnect with how that is perceived in the school setting. This would be consistent with Prensky’s premise that digital natives utilize technology in multi-modal ways, but are disconnected from the school setting because access and use in schools do not meet their needs.

Further, high school students in this study report one of their top three uses of the Internet is research which is consistent with research completed by Levin and Arafah (2002). In that research, students reported they found support on the Internet for homework, tutoring, and researching areas of personal interest. These same authors report that students find roadblocks in schools when trying to access the Internet. At the very least, results of this study revealed high school students’ primary access to the Internet is at home and not at school, research is one of three top uses of the Internet, and the perception of the use of technology in the context of school is for drill and practice. These findings support the potential of disconnect between high school students’ ability to use technology and their level of its use outside of school versus their perceptions of technology as applied in school.
Finally, it is important to examine the perceptions of the deans represented in this study. Certainly the deans, albeit a small group, reflected traits of digital immigrants (Prensky, 2001), but that in no way means their perception of 21st Century literacy and technology have limited their vision for the teacher education programs for which they are responsible. Sanyal (2001) states educational content and methods must be geared to current realities. More specifically, higher education must set the tone for the entire country’s educational system. Incorporation of technology standards is a first step. In addition, post-secondary faculty must model the use of technology as well as infuse tasks related to the use of technology in course work (Bleed, 2005).

Results indicate all four post-secondary teacher education programs in this study reflect these initiatives. Emerging teachers’ perceived their instructors as using technology and modeling the use of technology daily. Furthermore, incorporation of technology standards is not only evident but also a priority. More specifically, all four deans agreed that emerging teachers should be up-to-date on the latest technological innovations and that technology should be infused in the curriculum of the teacher education program. It was emphasized that technology should be experienced through course assignments. However, when the deans were asked how that was monitored, none utilized direct observation. Rather, student work was examined as a way of telling that technology was infused in course work, in addition to the ISTE standards that have been incorporated in course curriculum.

The perspective that technology is a priority in each of the post-secondary schools in the study was further emphasized by the deans in that they each stated technology was not the first to be eliminated when budget cuts were made. In relation to faculty,
strategies are in place to provide staff development in the area of technology. Acquisition of technology skills is highly individualized. Faculty members are provided opportunities online and in technology learning centers, but a great deal of the initiative is dependent on the individual asking for help. Additionally, student expectations that staff know and use technology drives some of the faculty member’s need to learn.

**Recommendations**

The purpose of this study was to compare three groups’ perceptions of 21st Century literacy and technology. Those three groups were high school juniors and seniors from two large urban high schools, juniors and seniors from four post-secondary teacher education programs, and the four deans of education from the same post-secondary schools. The high school students represent those who have been immersed in technology their entire lives. The emerging teachers represent those who will soon be working with students preparing for work and citizenry in the 21st Century. Their perceptions are key to how they will teach and what will and will not be emphasized. The deans represent a leadership group whose vision for teacher education, along with that of their post-secondary schools, is important to the ways in which emerging teachers are prepared to teach. No prior study was found that either examined perceptions of 21st Century literacy and technology or that included these three groups. Others have studied differences in populations related to the integration of technology use, social practice, and situated learning (Prensky, 2001; Gee, 1996; Lave & Wenger, 2008; Lankshear & Knobel, 2006). Therefore, the area of 21st Century literacy or new literacies is still a relatively new field. In addition, the effect that technological developments will have in a social context of constant change has yet to be determined. Taking into account the
broad scope of what it means to be literate in the 21\textsuperscript{st} Century, the following recommendations for use of the information in this study and future research are:

1. At the current time, there is little consensus on the definition of 21\textsuperscript{st} Century literacy. Since the research field of 21\textsuperscript{st} Century literacies is so new, this study could be replicated and expanded in order to further add growing body of research on new literacies.

2. One group not included in this study was existing teachers. Certainly, as perceptions are analyzed, further research should include those who are currently teaching in order to analyze their prevailing perceptions and mindsets.

3. Another group not included in this study was existing professors of schools of education. Given the differences in the perceptions of high school students and emerging teachers related to perceptions of their instructors, additional research to examine college professors’ perceptions would provide additional insights into those differences.

4. Further research is needed relative to the apparent disconnect currently perceived by the high school students in this study and technology use in school relative to use of technology in school versus out of school.

5. Replicating this study and including a greater number of representatives of each group would further inform the research on new literacies.

6. This study indicates that the perceptions of emerging teachers, in general, reflect that their learning context in the teacher education programs clearly support technology as a priority. It is integrated into the instructional practices of their instructors indicating continued integration of technology in their own
instructional use. An extension of this study could be to track those emerging teachers as they begin their teaching careers in a variety of settings in order to study how those perceptions ultimately affect their instructional practices.

7. The final recommendation would be to further explore the perceptions and mental models of emerging teachers in relation to teaching and learning. Specifically, it is important to analyze how that information can further inform development of teacher education programs in order to incorporate the most current research in 21st Century literacy and technology.

Questions remain. What does it mean to be literate in the 21st Century? As technology continues to redefine our daily context, rapid change has become the norm. Research in the area of 21st Century literacy and technology will be crucial to development of teacher education programs that prepare teachers for a world where students have become very different learners than they were just five to ten years ago. It is very well possible that our greatest cues for these developments may come from 21st Century learners, the students themselves. “We can no longer decide for our students; we must decide with them, as strange as that may feel to many of us” (Prensky, 2001b, p.9). As students become increasingly learning empowered, the greatest change that will need to take place is teacher education that creates educators who are empowered as adaptive learners.
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Appendices

Appendix A: National Educational Technology Standards

National Educational Technology Standards (NETS•S) and Performance Indicators for Students

1. Creativity and Innovation
Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students:
 a. apply existing knowledge to generate new ideas, products, or processes.
b. create original works as a means of personal or group expression.
c. use models and simulations to explore complex systems and issues.
d. identify trends and forecast possibilities.

2. Communication and Collaboration
Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students:
 a. interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media.
b. communicate information and ideas effectively to multiple audiences using a variety of media and formats.
c. develop cultural understanding and global awareness by engaging with learners of other cultures.
d. contribute to project teams to produce original works or solve problems.

3. Research and Information Fluency
Students apply digital tools to gather, evaluate, and use information. Students:
 a. plan strategies to guide inquiry.
b. locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
c. evaluate and select information sources and digital tools based on the appropriateness to specific tasks.
d. process data and report results.

4. Critical Thinking, Problem Solving, and Decision Making
Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. Students:
 a. identify and define authentic problems and significant questions for investigation.
b. plan and manage activities to develop a solution or complete a project.
c. collect and analyze data to identify solutions and/or make informed decisions.
d. use multiple processes and diverse perspectives to explore alternative solutions.

5. Digital Citizenship
Students understand human, cultural, and societal issues related to technology and practice legal and ethical
behavior. Students:

a. advocate and practice safe, legal, and responsible use of information and technology.
b. exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity.
c. demonstrate personal responsibility for lifelong learning.
d. exhibit leadership for digital citizenship.

5. Technology Operations and Concepts
Students demonstrate a sound understanding of technology concepts, systems, and operations. Students:

a. understand and use technology systems.
b. select and use applications effectively and productively.
c. troubleshoot systems and applications.
d. transfer current knowledge to learning of new technologies.

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Appendix B: Standards for Higher Education Students

Standards, Performance Indicators, and Outcomes

The information literate student determines the nature and extent of the information needed.

*Performance Indicators:*

1. The information literate student defines and articulates the need for information.

*Outcomes Include:*

a. Confers with instructors and participates in class discussions, peer workgroups, and electronic discussions to identify a research topic, or other information need
b. Develops a thesis statement and formulates questions based on the information need
c. Explores general information sources to increase familiarity with the topic
d. Defines or modifies the information need to achieve a manageable focus
e. Identifies key concepts and terms that describe the information need
f. Recognizes that existing information can be combined with original thought, experimentation, and/or analysis to produce new information

2. The information literate student identifies a variety of types and formats of potential sources for information.

*Outcomes Include:*

a. Knows how information is formally and informally produced, organized, and disseminated
b. Recognizes that knowledge can be organized into disciplines that influence the way information is accessed
c. Identifies the value and differences of potential resources in a variety of formats (e.g., multimedia, database, website, data set, audio/visual, book)
d. Identifies the purpose and audience of potential resources (e.g., popular vs. scholarly, current vs. historical)
e. Differentiates between primary and secondary sources, recognizing how their use and importance vary with each discipline
f. Realizes that information may need to be constructed with raw data from primary sources

3. The information literate student considers the costs and benefits of acquiring the needed information.

*Outcomes Include:*

a. Determines the availability of needed information and makes decisions on broadening the information seeking process beyond local resources (e.g., interlibrary loan; using resources at other locations; obtaining images, videos, text, or sound)
b. Considers the feasibility of acquiring a new language or skill (e.g., foreign or discipline-based) in order to gather needed information and to understand its context
c. Defines a realistic overall plan and timeline to acquire the needed information
4. The information literate student reevaluates the nature and extent of the information need.
Outcomes Include:
   a. Reviews the initial information need to clarify, revise, or refine the question
   b. Describes criteria used to make information decisions and choices

The information literate student accesses needed information effectively and efficiently.

_Performance Indicators:_
1. The information literate student selects the most appropriate investigative methods or information retrieval systems for accessing the needed information.
   Outcomes Include:
   a. Identifies appropriate investigative methods (e.g., laboratory experiment, simulation, fieldwork)
   b. Investigates benefits and applicability of various investigative methods
   c. Investigates the scope, content, and organization of information retrieval systems
   d. Selects efficient and effective approaches for accessing the information needed from the investigative method or information retrieval system
2. The information literate student constructs and implements effectively designed search strategies.
   Outcomes Include:
   a. Develops a research plan appropriate to the investigative method
   b. Identifies keywords, synonyms and related terms for the information needed
   c. Selects controlled vocabulary specific to the discipline or information retrieval source
   d. Constructs a search strategy using appropriate commands for the information retrieval system selected (e.g., Boolean operators, truncation, and proximity for search engines; internal organizers such as indexes for books)
   e. Implements the search strategy in various information retrieval systems using different user interfaces and search engines, with different command languages, protocols, and search parameters
   f. Implements the search using investigative protocols appropriate to the discipline
3. The information literate student retrieves information online or in person using a variety of methods.
   Outcomes Include:
   a. Uses various search systems to retrieve information in a variety of formats
   b. Uses various classification schemes and other systems (e.g., call number systems or indexes) to locate information resources within the library or to identify specific sites for physical exploration
   c. Uses specialized online or in person services available at the institution to retrieve information needed (e.g., interlibrary loan/document delivery, professional associations, institutional research offices, community resources, experts and practitioners)
   d. Uses surveys, letters, interviews, and other forms of inquiry to retrieve primary information
4. The information literate student refines the search strategy if necessary.
   Outcomes Include:
   a. Assesses the quantity, quality, and relevance of the search results
to determine whether alternative information retrieval systems or
investigative methods should be utilized
b. Identifies gaps in the information retrieved and determines if the
search strategy should be revised
c. Repeats the search using the revised strategy as necessary
5. The information literate student extracts, records, and manages the
information and its sources.
Outcomes Include:
a. Selects among various technologies the most appropriate one for the
task of extracting the needed information (e.g., copy/paste software
functions, photocopier, scanner, audio/visual equipment, or exploratory
instruments)
b. Creates a system for organizing the information
c. Differentiates between the types of sources cited and understands the
elements and correct syntax of a citation for a wide range of resources
Information Literacy Competency Standards for Higher Education, © ALA, 2000 11
d. Records all pertinent citation information for future reference
e. Uses various technologies to manage the information selected and
organized

The information literate student evaluates information and its sources
critically and incorporates selected information into his or her knowledge
base and value system.

Performance Indicators:
1. The information literate student summarizes the main ideas to be extracted
from the information gathered.
Outcomes Include:
a. Reads the text and selects main ideas
b. Restates textual concepts in his/her own words and selects data accurately
c. Identifies verbatim material that can be then appropriately quoted
2. The information literate student articulates and applies initial criteria
for evaluating both the information and its sources.
Outcomes Include:
a. Examines and compares information from various sources in order
to evaluate reliability, validity, accuracy, authority, timeliness, and
point of view or bias
b. Analyzes the structure and logic of supporting arguments or methods
c. Recognizes prejudice, deception, or manipulation
d. Recognizes the cultural, physical, or other context within which the
information was created and understands the impact of context on
interpreting the information
3. The information literate student synthesizes main ideas to construct
new concepts.
Outcomes Include:
a. Recognizes interrelationships among concepts and combines them
into potentially useful primary statements with supporting evidence
b. Extends initial synthesis, when possible, at a higher level of abstraction
to construct new hypotheses that may require additional
information
c. Utilizes computer and other technologies (e.g. spreadsheets, databases,
multimedia, and audio or visual equipment) for studying the
interaction of ideas and other phenomena
12 Information Literacy Competency Standards for Higher Education, © ALA, 2000
4. The information literate student compares new knowledge with prior
knowledge to determine the value added, contradictions, or other unique characteristics of the information.
Outcomes Include:
a. Determines whether information satisfies the research or other information need
b. Uses consciously selected criteria to determine whether the information contradicts or verifies information used from other sources
c. Draws conclusions based upon information gathered
d. Tests theories with discipline-appropriate techniques (e.g., simulators, experiments)
e. Determines probable accuracy by questioning the source of the data, the limitations of the information gathering tools or strategies, and the reasonableness of the conclusions
f. Integrates new information with previous information or knowledge
g. Selects information that provides evidence for the topic
5. The information literate student determines whether the new knowledge has an impact on the individual’s value system and takes steps to reconcile differences.
Outcomes Include:
a. Investigates differing viewpoints encountered in the literature
b. Determines whether to incorporate or reject viewpoints encountered
6. The information literate student validates understanding and interpretation of the information through discourse with other individuals, subject-area experts, and/or practitioners.
Outcomes Include:
a. Participates in classroom and other discussions
b. Participates in class-sponsored electronic communication forums designed to encourage discourse on the topic (e.g., e-mail, bulletin boards, chat rooms)
c. Seeks expert opinion through a variety of mechanisms (e.g., interviews, e-mail, listservs)
7. The information literate student determines whether the initial query should be revised.
Outcomes Include:
a. Determines if original information need has been satisfied or if additional information is needed
b. Reviews search strategy and incorporates additional concepts as necessary
Information Literacy Competency Standards for Higher Education, © ALA, 2000

Standard Four
The information literate student, individually or as a member of a group, uses information effectively to accomplish a specific purpose.
Performance Indicators:
1. The information literate student applies new and prior information to the planning and creation of a particular product or performance.
Outcomes Include:
a. Organizes the content in a manner that supports the purposes and format of the product or performance (e.g. outlines, drafts, storyboards)
b. Articulates knowledge and skills transferred from prior experiences to planning and creating the product or performance
c. Integrates the new and prior information, including quotations and paraphrasings, in a manner that supports the purposes of the product
or performance
d. Manipulates digital text, images, and data, as needed, transferring them from their original locations and formats to a new context
2. The information literate student revises the development process for the product or performance.
Outcomes Include:
a. Maintains a journal or log of activities related to the information seeking, evaluating, and communicating process
b. Reflects on past successes, failures, and alternative strategies
3. The information literate student communicates the product or performance effectively to others.
Outcomes Include:

The information literate student understands many of the economic, legal, and social issues surrounding the use of information and accesses and uses information ethically and legally.

Performance Indicators:
1. The information literate student understands many of the ethical, legal and socio-economic issues surrounding information and information technology.
   Outcomes Include:
   a. Identifies and discusses issues related to privacy and security in both the print and electronic environments
   b. Identifies and discusses issues related to free vs. fee-based access to information
   c. Identifies and discusses issues related to censorship and freedom of speech
   d. Demonstrates an understanding of intellectual property, copyright, and fair use of copyrighted material
2. The information literate student follows laws, regulations, institutional policies, and etiquette related to the access and use of information resources.
   Outcomes Include:
   a. Participates in electronic discussions following accepted practices (e.g. “Netiquette”)
   b. Uses approved passwords and other forms of ID for access to information resources
   c. Complies with institutional policies on access to information resources
   d. Preserves the integrity of information resources, equipment, systems and facilities
   e. Legally obtains, stores, and disseminates text, data, images, or sounds
   f. Demonstrates an understanding of what constitutes plagiarism and does not represent work attributable to others as his/her own
   g. Demonstrates an understanding of institutional policies related to human subjects research
3. The information literate student acknowledges the use of information sources in communicating the product or performance.
Outcomes Include:
a. Selects an appropriate documentation style and uses it consistently
to cite sources
b. Posts permission granted notices, as needed, for copyrighted material
Appendix C: Survey Instrument

**DIRECTIONS:** Please rate the following questions based on the rating scale provided.

Completely true Mostly True
Equally true and untrue
Mostly untrue Completely untrue

1. Learning to use technology is part of becoming literate.

2. Technology is included in most classes.

3. Technology is a top priority in this school.

4. I learned how to determine the value of online resources in school.

5. Teachers instruct daily with the use of technology.

6. Most teachers use technology as part of instruction.

7. I must be literate in order to understand information using 21st Century digital tools such as the Internet, social networking, smart phone applications, podcasting, blogs, etc.

8. Most teachers use technology on a daily basis.

9. Most students have access to the Internet.

10. A majority of teachers integrate technology into their lessons.

11. Teachers use technology when they teach something new.

12. Teachers emphasize the collaborative / interactive value of the Internet.

13. Teachers regularly model the use of technology.

14. Connecting with students in other regions / countries is encouraged.
15. Multimedia projects are assigned to demonstrate learning.

16. Technology signifies change.

17. Technology defines the future.

18. Learning to read and learning to use technology are equally important.

19. Learning to interpret multi-media presentations is a necessary skill.

20. Teachers use multimedia technology to communicate what I am supposed to learn.

21. Drill and practice are the primary use of technology.

22. Teachers seem to enjoy using technology.

23. Teachers use technology to instruct class.

24. I use technology more outside of classes than during class.

25. I need to learn how to analyze multi-media communication.

26. Reading information on the Internet requires a different set of skills than reading a book.

27. My teachers are as skilled in the use of technology as I am.

28. My school work cannot be completed without the use of a computer.

29. Literacy and technology go together.

30. A goal of education is to use technology to learn.

31. Teachers send text messages to communicate with students.

32. Podcasts are used by my teachers.
33. Most teachers instruct with the use of the computer each day.
34. Teachers clearly state their expectations for the use of technology.
35. Teachers emphasize technology on a daily basis.
36. I spend more time using technology in school than anywhere else.
37. I text more than talk on the cell phone.
38. Use of e-mail is my favorite way of communicating with technology.
39. I regularly communicate in chat groups.
40. I play video games on the computer with people from other countries.
41. Surfing the Net is a good use of time.
42. I spend more time surfing the Net than reading books.
43. Blogs are effective ways to encourage student writing.
44. Texting is altering the way we spell and write English.
45. I rarely use the same technology skills in school than I do outside of school.
46. Technology is my way to success in the future.
47. Computers are the most important learning tools.
48. Textbooks are the most important learning tools.
49. Technology standards are incorporated in every course.
50. Teachers regularly
4. Age:
5. Gender

6. My primary access to technology is:

7. Check the items you use daily:

8. My overall level of skills with the technology I use is:
9. The number of hours I use a technology falls within the range of:
10. The number of hours I spend on the Internet falls within the range of:
11. The primary purposes of my technology use are (choose only 3):
12. The primary purposes of my cell phone are (choose only 2):
13. My primary support when I need help with technology is (choose only 1):
   - my friends
   - my instructors
   - the Internet
   - technology support over the phone
   - a technology support department at school
Appendix D: Interview Questions

1. How would you define 21st Century literacy? or What does 21st Century literacy mean to you?
2. In a day’s time, what types of technology do you use?
3. What do you use these technologies for?
4. In a day’s time, how often do you use any type of technology?
5. When did you start using digital technology?
6. What does it take to use multi-media/digital technology? (may have to define multi-media)
7. In what way did you learn most about digital media?
8. Is it important to be digitally literate?
9. When you are working on the Internet, how do you decide what resources are valid and what ones are not valid?
10. Do you think there is a digital divide? How would you define digital divide?

Add for Deans:

11. As a dean of a teacher training institution, what is your vision for training future teachers to integrate technology and literacy?
12. How do you ensure that technology is integrated into the curriculum? How do you know it is happening?
13. Is technology one of the first things to go when there are budget cuts?
14. How up to date is current technology in use?
15. When cuts are made, who gets to decide?
16. Is the approach to acquisition / development standardized or individual?
17. Are the researchers in the teacher education department modeling / using technology more than others?

18. When staff member prove to be deficient in integrating technology into the curriculum, what remediation is available?
## Appendix E: Corresponding Survey and Interview Items to Research Items

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Corresponding Survey / Interview Item</th>
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<tbody>
<tr>
<td>1. With what frequency do deans of education, emerging teachers, and high school students use technology?</td>
<td>Survey item: 5,6,8,10,11 24,33,35,36 37,39,45,51  Interview question: 9,10</td>
</tr>
<tr>
<td>2. In what ways do deans of education, emerging teacher, and high school students use technology?</td>
<td>Survey item: 9,12,13,21 23,28,31,34 40,42  Interview question: 2,3,7</td>
</tr>
<tr>
<td>3. What are the perceptions of deans of education, emerging teachers, and high school students about 21st Century literacy and technology?</td>
<td>Survey item: 1,2,3,4 7,14,15,16 17,18,19,20 22,25,26,27 29,30,38,41 43,44,46,47 48,50,52,53  Interview questions: 1,6,8,9,10</td>
</tr>
<tr>
<td>4. What similarities or differences exist between the frequency of use and type of use of technology of deans of education, emerging teachers, and high school students?</td>
<td>Survey item: 1,2,3,4 7,14,15,16 17,18,19,20 22,25,26,27 29,30,38,41 43,44,46,47 48,50,52,53  Interview questions: Responses to interview questions were compared to determine similarities and differences of type and use of technology.</td>
</tr>
<tr>
<td>5. What similarities or differences exist between the perceptions of deans of education, emerging teachers, and high school students relative to 21st Century literacy and technology?</td>
<td>Comparisons were made of survey item responses of the two groups surveyed and interview responses of the three groups interviewed to establish similarities and differences in perceptions.</td>
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### Appendix F: Interview Analysis of Themes

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<thead>
<tr>
<th>Node</th>
<th>Descriptors</th>
<th>Positive</th>
<th>Negative</th>
<th>Field Notes</th>
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<tbody>
<tr>
<td>21st Century literacy defined</td>
<td>• Reading&lt;br&gt;• Internet&lt;br&gt;• Computers&lt;br&gt;• Cells&lt;br&gt;• E-mail&lt;br&gt;• Texting&lt;br&gt;• Tools&lt;br&gt;• Functional literacy&lt;br&gt;• Knowing consumers&lt;br&gt;• Process in multiple ways</td>
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<tr>
<td>Tech use in a day’s time</td>
<td>• Minutes&lt;br&gt;• Hours&lt;br&gt;• Non-stop&lt;br&gt;• Types of&lt;br&gt;• Uses of</td>
<td></td>
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<tr>
<td>Digital literacy</td>
<td>• Ability to manipulate equipment&lt;br&gt;• Understand purpose of&lt;br&gt;• Interpret meaning in multi-modal ways</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Digital literacy learning mindset</td>
<td>• Experiment&lt;br&gt;• Creative&lt;br&gt;• Resourceful&lt;br&gt;• Open minded&lt;br&gt;• Willing to try</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Digital divide defined</td>
<td>• Access&lt;br&gt;• Money&lt;br&gt;• Age</td>
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### 21st Century Literacy and Technology: Perceptions

<table>
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<th>Generational</th>
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<tbody>
<tr>
<td>Connection between known .edu, .gov Wikipedia strategies</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How you learned technology</th>
<th>manuals classes workshops experiment jump in intuitive</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>When you learned technology</th>
<th>specific age / time always knew</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Deans: vision</th>
<th>level of importance purpose staff modeling teacher prep</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Deans: tech &amp; budget</th>
<th>staff in-put tech stays personnel cuts deans decide</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Deans: staff development</th>
<th>opportunities student expectations remediation</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Deans: current quality</th>
<th>cutting edge</th>
</tr>
</thead>
</table>

**Note.** Table F is an example of the document used to analyze interview data. Nodes denote themes discussed in the interviews. Descriptors emerged through interview dialogue and were used to identify reoccurring ideas.