

RECREATIONAL TECHNOLOGY AND ITS IMPACT ON THE LEARNING
DEVELOPMENT OF CHILDREN AGES 4-8:
A META-ANALYSIS FOR THE 21ST CENTURY CLASSROOM

by

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ABSTRACT

This research focuses on technology (specifically video games and interactive software games) and their effects on the cognitive development of children ages 4-8. The research will be conducted as a meta-analysis combining research and theory in order to determine if the educational approach to this age group needs to change/adapt to learners who have been affected by this technology. I will focus upon both the physical and mental aspects of their development and present a comprehensive review of current educational theory and practice. By examining current curriculum goals and cross-referencing them to research conducted in fields other than education (i.e. technology, child development, media literacy, etc.) I hope to demonstrate a need for change; and, at the end of my research, be able to make recommendations for curriculum adaptations that will work within the current educational structure. These recommendations will be made with respect to budget and time constraints.

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CHAPTER 1: INTRODUCTION

Video and computer games affect the learning development of children ages 4-8. The developmental impact upon these children introduces a “new learner” with different needs and/or abilities. Educational leaders should re-examine and possibly re-construct the current classroom curriculum so it will better address the “new learner.”

The Purpose

The purpose of this study is to examine research pertaining to technology (specifically video and computer games) and its effect on the cognitive development of children ages 4-8, as well as its impact on the learning process. I will conduct a meta-analysis of research and theory in order to determine if the educational approach to this age group needs to change and/or adapt to learners who have been affected by this technology. By examining current curricular goals and cross-referencing them to research conducted in a variety of fields (e.g. technology, education, child development, early childhood education, media literacy, neuroscience, psychology, etc.), I hope to demonstrate a need for change; and, at the end of my research, be able to make recommendations for curricular adaptations that will work within the current educational structure. These recommendations will be made with respect to budget and time constraints critical to individual state governmental agencies.

It is important to note that the goal of this study is not to determine the relevance of new technologies as educational tools, nor is it a means to present technology as a positive or negative impact on learning skills. Instead, this study begins with the position that recreational technology *is* a large part of our culture; therefore, we need to determine *how* (and if) it affects our learning development. Then we can address the more practical issues of change: do we need to change the classroom structure; do we need to address new stages of child development, etc.?

The Topic

This study covers a wide range of topics. We will examine research and theory in fields such as education, technology, media literacy, early childhood development, cognitive development, neuroscience, and psychology. The links between these fields will guide the direction of the research and create a foundation for conclusions and recommendations. For purposes of clarification, I will place all areas of study in three general groups: education, recreational technology, and learning process (e.g. cognitive development and literacy acquisition).

Does recreational technology affect the learning development of children? In order to answer this question we should examine the physical and mental development of children ages 4-8. We will also examine the classroom curriculum for this age group. Furthermore, we will explore recreational technology and its impact on the user.

Education (Curriculum)

It is critical to acknowledge the impact technology has on text—text in this case refers to the modes of communication used to teach a child. In order to approach educational leaders we should have a firm understanding of the pre-existing curriculum. It may be that pre-existing teaching methods can be applied to the new “text” without strenuous effort or cost. A major goal of this meta-analysis is to help make transition smooth and minimal, yet effective.

The current classroom is a mix of traditional theory, state standards, federal standards, available funding, standardized testing, the teacher, the student, and, as in most aspects of our culture, a hodgepodge of current trends. In order to grasp a strong understanding of the classroom we must first define parameters. In this study, we will focus on children ages 4-8. Traditionally (within the United States) this age group attends the Pre-K to 2nd grade classrooms. We will examine both traditional and contemporary, more progressive, educational theory as it pertains specifically to learning development and classroom curriculum.

Standardized Tests and No Child Left Behind

One of the most debated trends in the U.S. classroom is the Federal government’s implementation of the No Child Left Behind Act (NCLB). It is important to discuss this trend because much of our current classroom curriculum surrounds it. The new text that may arise from the influence of technology on a child’s cognitive development may or may not be

compatible with NCLB. Without a firm understanding of the NCLB Act, proposals stand a chance of losing credibility.

In theory, the No Child Left Behind Act furthers the American dream, making sure every child has an equal chance at a good education. Yet the NCLB Act has also been the subject of severe criticism. Many educational leaders are frustrated with the state of today's classroom. They feel that NCLB may be a great idea but making it work is a difficult challenge, one that is not often accomplished. For example, standardized tests (a critical component of NCLB), are meant to keep all students "on target." However, they may sometimes smother the individual student. A focus on this type of testing demands strict definitions of ability and has little room for individual needs. Dr. Mel Levine of the University of North Carolina Pediatrics advises, "Never use testing as a justification for retaining a student in a grade. Retention is ineffective and seriously damaging to students. How can you retain a student while claiming you are not leaving anyone behind?" (17). Monty Neill, the executive director of the National Center for Fair & Open Testing, has serious reservations about the NCLB Act. He states, "Under NCLB, education will be seriously damaged, especially in schools with large shares of low-income and minority children, as students are coached to pass tests rather than to learn a rich curriculum that prepares them for life in the 21st century" (225). The NCLB Act's influence (whether positive or negative) on the education system is not crucial to this study. What is important, however, is that it is an integral part of the education system, thus making standardized tests an important part of the classroom curriculum. In order to help students pass the test, teaching practices must focus on the testing material.

The NCLB also requires that the schools use only those educational programs based on “rigorous scientific research” (U.S. Department of Education). The Department of Education has established guidelines to determine if the educational programs adhere to their standards. For example, according to DOE, a child learning to read is expected to develop certain foundational skills:

The skills include: *oral language* (expressive and receptive language, such as vocabulary development); *phonological awareness* (rhyming, blending, segmenting); *print awareness*; and *alphabetic knowledge* (letter-sound knowledge). (U.S. Department of Education)

The reading programs used in Pre-K and kindergarten classrooms must target the development of these skills—but in order to be used in the classroom they must also adhere to the “rigorous scientific research” standards defined by the Department of Education. Ideally, the current classroom curriculum incorporates only those educational programs “approved” by the DEO. Monetary initiatives are used to guarantee the school system’s support of DEO and the NCLB Act (U.S. Department of Education). More radical and experimental programs will have less of a chance of success within the current educational system, simply because they may not adhere to the standards. This should protect the students against faulty educational materials; but it may also hurt those who do not fall into the general population or need alternative ways of learning.

Transition into formal education

Another major factor in classroom curriculum is transition. This is most prevalent in the kindergarten classroom. An important goal of the kindergarten classroom is to provide a smooth transition into a structured learning environment. Yeboah stresses the importance of smooth transition claiming, “Successful transition to school is a sure way of consolidating the child’s early childhood education achievements and development” (52). Furthermore, he suggests that the classroom must acknowledge and respect individual needs in order to pave the way for a smooth transition (64).

Educational theorists such as Piaget, Montessori, and Rousseau adamantly stress the role of the environment. A child’s exploration of her environment must be encouraged—and she should be allowed to play an active role in choosing how she explores. The kindergarten classroom enables the child to grow and explore, while minimizing stress and anxiety. Bright colors, large pictures, familiar games, and other recreational activities all help a child’s transition from the informal to formal learning process.

It is crucial to explore the current classroom curriculum. Without a strong knowledge of what makes up the classroom it will be difficult to determine how to incorporate new teaching materials or even if new materials are needed. We will examine the classroom curriculum further when we discuss educational foundations.

Recreational Technology

This meta-analysis will examine how video and computer games (e.g. GameBoys, interactive computer software games such as Sims, and online games) affect a child's learning development. I propose that if the child's learning development changes due to use of such technology then the classroom curriculum should also change—to better address new learning styles and needs. Through the meta-analysis, I expect to be able to adequately assess the classroom and suggest positive, attainable changes.

Much controversy surrounds the topic of video games and children. Many claim that such recreational technology harms the user, impeding the growth of certain social and learning skills (e.g. Healy). There are others, however, who argue that video games may benefit the user because they demand critical thinking and problem solving skills (e.g. Gee, Papert). Whatever the case, it remains almost indisputable the amount of time and money our culture spends on video games. In the twenty-first century, we, as a culture, have embraced video games, entertainment software, and various forms of recreational technology—“Ninety-two percent of youngsters ages 2-17 now play video or computer games” (Walsh et al). These technologies have become so commonplace that a small child is familiar with their language and character. In 2003 the Kaiser foundation conducted a study to find out how many young children (0-6 years) are exposed to various entertainment technology and media. The study shows “A high proportion of very young children are using digital media, including 50% of four to six year olds who have played video games and 70% who have used computers” (Rideout, Vandewater, and Wartella 12). Do these technologies affect the way children learn? Do they walk into the classroom with

needs ignored and unrecognized by our current educational system? Has technology affected the stages of cognitive development believed to be critical to a child's development?

Seymore Papert, a pioneer in the field of technology and education, claims that video and computer games encourage the child to practice "hard learning." The user grows as they confront greater and greater challenges. This demands that the child accept the challenge as the reward. He claims, "Serious players of video games get their glory largely from being the first on the block to master the game that just came out, and this means that kids have a powerful incentive to get good at learning well and quickly. But the games provide more than incentive. They also provide excellent exercises for practicing the development of the skill of learning" ("Does Easy Do It").

Others agree with Papert, claiming that video games enable the development of certain skills crucial to learning. Marc Prensky, for example, claims that research in both social psychology and neurobiology has demonstrated that the brain is malleable, that it changes due to one's experiences. His article "Digital Natives Digital Immigrants" examines how video and computer games affect the brain and learning. He believes that video and computer games enhance the development of certain areas of the brain, yet our school system does not address these "new" brains, these "digital natives."

James Gee claims that video games lead to a new definition of literacy (2003). He encourages a thorough examination of this new definition in order to attain a better understanding of learning in the 21st century. He also assigns specific learning principles to video game use.

The Education Arcade, a joint venture between MIT and the University of Michigan, examines how video games affect the user's learning skills. They propose a move toward accepting video games as a learning tool within the classroom. They also seek a better understanding of video games and learning by developing relationships with large video and computer game corporations.

Education and Technology

As previously discussed, controversy, surrounds our educational system, and many educators, psychologists, and philosophers are frustrated at the state of the modern day classroom (e.g, Howard Gardner, Gavriel Salomon, and Seymour Papert). Gardner claims, "With the possible exception of the church, few institutions have changed as little in fundamental ways as those charged with the formal education of the next generation" (Disciplined Mind 41). Papert believes we need to look outside of our educational system to find those who truly know how to develop good learning materials; "The crux of what I want to say is that game designers have a better take on the nature of learning than curriculum designers. They have to. Their livelihoods depend on millions of people being prepared to undertake the serious amount of learning needed to master a complex game"("Does Easy Do It?"). In order to embrace video and computer games as relevant issues within learning development and classroom curriculum, we must present research that demonstrates that video games impact our learning. Then we need to explore future possibilities for the classroom. A closer look at our modern day classroom, however, reveals a gross resistance to change. The Bush administration encourages educational

policies that center upon traditional learning theories that are measured by standardized tests, which are themselves subjects of much controversy (e.g. No Child Left Behind Act 2001). It is critical that our society examine technology, not simply as a learning tool, but as an evolutionary influence on the learning development of our children. Because technology has become a major factor in our children's lives, our current classroom curriculum may need to expand to address new definitions of text, of communication. With a thorough understanding of the technology that plays an integral role in the lives of our children, we give our culture a strong foundation upon which to improve its educational system.

This Study

Its Purpose

Recent research shows that certain technologies may affect the developmental learning processes of their users. New learning processes require new teaching practices and educational theories. Before we "rearrange" our classrooms, though, a thorough examination of the most recent research needs to be performed in the areas of technology and education. The goal of this examination is to discover possible links between learning development and certain technologies. These links can be incorporated into current teaching practices and classroom theory. Furthermore, this examination will lead to proposals that may upgrade our classroom structure and create a classroom that successfully addresses the needs of the 21st century child.

An examination of this nature would be immense. Thus, my research will focus on specific technologies and a specific age group. This should limit my research and enable the audience to better understand and even initiate the proposals that arise from this meta-analysis.

Its Scope

This research will focus on technology that includes video games, computer games, and online games and their effects on the learning development of their user. Currently, educational software enhances our traditional classroom. It enables the student to practice and develop certain skills. However, I choose to focus primarily on the entertainment software because when a five-year old enters her kindergarten class, she may have already spent hours playing Leapfrog, GameCube, or GameBoy Advance.

Even though such technology may have influenced learning development, one may argue that the way we approach the classroom has not changed. A child's development, according to many college textbooks and childcare training modules, loosely follows Piaget's theories of growth e.g. *Early Childhood Education* (Department of Children and Families) or *Teaching Young Children* (Henninger). A more liberal educator may turn to Howard Gardner or Mel Levine. However, the child that many of our textbooks and psychology books tell us about may no longer exist. Her hand-eye coordination may surpass that of her teacher. Sights and sounds may have stimulated the development of different senses, ones that never developed with a traditional storybook. Interaction and role-playing—a critical focus for many kindergarten classrooms—is already an active part of the student's life. Do we continue to approach the

student with our traditional concepts of learning? Or, do we re-develop teaching methods so that they address new types and stages of child development?

Such technologies may offer new direction for teaching practices. Oftentimes this simulated world can be used to explore concepts, enhance memory, and to develop other learning skills. The question of the value of video and computer games as an educational tool is almost irrelevant, because whether or not one believes they are “good or evil” they do play a large role in our society. A study conducted by the Entertainment Software Association (2005) revealed that two hundred and three million video game units were sold in 2004 in the U.S. Also, Pricewaterhouse Coopers predicts “By 2010, the worldwide video game market should grow to 46.5 billion, at an average 11.4% compound annual rate” (qtd. in Kolodny).

Academic institutions as well as the multi-billion dollar computer game industry conduct much research concerning video and computer games. Many use this research to demonstrate the impact that computer and video games may have on our children’s education. This study will be conducted as a meta-analysis that examines research concerning the effects video and computer games have on a child’s learning outside of the classroom.

This research will also focus on children ages 4-8 (pre-k to 2nd grade). This population was chosen because learning processes that enable a child to function in the classroom are in the early stages of development. The influences outside of the classroom may be more noticeable. Once fully immersed in the school system a child’s learning processes are affected by the technology within the classroom as well as the technology outside of the classroom. By targeting children who have been in the school system only 1-3 years it may be easier to

determine how outside technologies have affected learning. A younger child has less exposure to the classroom, thus it will be easier to examine and isolate these outside influences.

A more practical reason to choose this age group is because any future changes that result from the technological impact upon learning development should begin in the early years of education. Applying new theory to children who have been in our educational system 8-12 years may not be as effective. Much of the technology was not as available or popular as it is now. By targeting this younger group, we can assess and evaluate any classroom changes as the students move through the educational system

The Meta-analysis

This study is a critical examination and compilation of the literature and research surrounding children's learning ("learning" in the context of this paper goes beyond the classroom) and the technology embedded within these children's lives. This study will target children ages 4-8. Technology will refer to technologies that children are exposed to outside of the classroom: Gameboys, PlayStations, Nintendos, GameCubes, and interactive computer software games. This examination will serve as a guide for educators and designers of educational material. By understanding how technology affects learning, more specifically, the text that surrounds learning and communication, we will be better able to create quality children's educational material *and* curricula. I predict that the research of such literature will demonstrate that video and computer games have had a profound impact on learning and that we need to restructure the classroom in order to prepare children for a successful future.

I will conduct a thorough meta-analysis of the available literature and research that covers these areas:

1. Children's video and computer games and their affect on learning processes of children ages 4-8,
2. Children's video and computer games and their value as a learning tool within the classroom,
3. Current classroom curricula and the foundations upon which they have developed,
4. Cognitive development and brain development with respect to learning,
5. Shifting definitions regarding learning and technology (e.g. text, "new literacies," "new learners," etc.).

Through this meta-analysis, recommendations will be made for changes within the current curriculum (for grades K-2) that address new learning needs that stem from an expanded definition of text. Until these needs are understood and accepted, the classroom may become static and unproductive.

In this meta-analysis certain limitations will be recognized and established. The research examined will come from credible sources. Their credibility will be established using specific guidelines. Furthermore, the information gathered from this meta-analysis will be categorized and presented in specific formats (i.e. charts and tables). This will provide a means to quickly examine relationships and trends within current studies/literature. Such charts and tables will be useful to those wishing to revise or create teaching tools and strategies for today's classroom.

Recreational and educational technologies are closely tied to a capitalist market, therefore, many may argue that some of the research is biased because of its link to the multi-

billion dollar game industry (Nintendo, Microsoft, etc). Profit and media-influence play a large role in the amount of money and time allotted to certain research. Some necessary research may be ignored that would hinder the sale of certain products. However, many major corporations fund huge amounts of research that could benefit educational studies. This meta-analysis will examine the ethical implications of such research and it will attempt to define clearly its role in the learning processes of children ages 4-8.

Theoretical Framework

Education and Theory: An Expanded Text

Through metaphors, new technologies become a critical part of our language and subtly change the ways we perceive the world around us. Through metaphor and rhetoric, we understand our world; and through metaphor and rhetoric, our minds adapt to the new technologies. Lakoff and Turner claim, “To study metaphor is to be confronted with hidden aspects of one’s own mind and one’s own culture” (214). More radical theorists, such as Donna Haraway, author of *Simians, Cyborgs, and Women*, propose new metaphors, combining computer with human, to guide humanity’s progress. New vocabulary, new metaphors, affect our culture at a most primal level—language. Language is the human form of communication, and children enter the classroom with a language created by history and culture. Reading, writing, and arithmetic are considered the fundamentals in primary and secondary educational institutions by both traditional and progressive educationalists. Yet, what happens when the

definitions of any or all of these terms change, or grow? In the 21st century, reading and writing are no longer limited to written text.

Learning to decipher symbols, to put them together to make sounds and meaning, is a primary goal of our educational system. We must understand the text around us before we begin to learn, to grow. When our children enter kindergarten their teachers have one major goal, teach them to read—to understand the symbols that make up our text. The government adamantly supports this goal and funds much research that explores teaching theories, such as phonics, to help children achieve a fluency in reading before a certain age (e.g. Reading First Program under the No Child Left Behind Act). Florida has implemented its own policies that further demonstrate the importance of learning to read:

Section 1008.25, Florida Statutes - (Public school student progression; remedial instruction; reporting requirements) ensures that no student is promoted from third grade without demonstrating proficiency in reading. (Florida Department of Education)

Unless the third grade student displays a proficiency in reading based upon the Florida Comprehensive Assessment Test (FCAT), they will be retained in the third grade. Thus, teaching strategies within the kindergarten through 3rd grades focus upon the child as reader. Of course, math is also a large part of early learning, but, once again, knowledge of math begins with an understanding of the symbols, the numbers. Understanding the text is an essential skill within our school system.

Twenty-five years ago a child would become familiar with text through books. The early books were primarily pictures (e.g. *Where the Wild Things Are* by Maurice Sendak). In order to comprehend the full story the “reader” would need to determine the meaning of both words and pictures—and their relationship to each other. A four year old may need the parent to read the words while they explore the story through pictures. By the time the child gains a familiarity with the alphabet they can take over and decipher both written text and pictures on their own. In 2006, however, the text has expanded. Words, pictures, sounds, links, and graphics that shift may all be part of a child’s chosen text. Text itself is no longer limited to inscribed codes. New technologies are redefining our traditional concepts of text. Do we also need to redefine the traditional concepts of teaching? Or, do we need to expand upon our existing teaching strategies in order to help children better understand the text around us?

It is through language that we, as teacher and as educator, are able to communicate and teach. New technologies subtly transform language and meaning even before a child reaches a classroom. In *New Literacies: Changing Knowledge and Classroom Learning*, Lankshear and Knobel discuss the definition of literacy, showing how it has adapted to cultural needs and expectations throughout history. Gunther Kress delves deeper into shifting definitions and meanings by specifically defining the different modes of literacy and their relationships to the space that surrounds them; “When in the past image appeared on the page it did so subject to the logic of writing, the relation of image to writing which we still know as ‘illustration’. When writing now appears on the screen, it does so subject to the logic of image” (9-10). How do we determine the best teaching strategies, the best learning tools, if all of our knowledge and research is based on a language, a literacy, which is quickly diminishing and/or drastically

changing in shape and form? What is the text? Where is the text? Children develop different strategies to understand and process the language and world around them. It would follow that the educational system needs to develop different strategies for the 21st century classroom. These new strategies must recognize the impact of technology on the learning processes of children. They must target the needs of children in a technological society. They must address a new and/or expanded definition of text.

Technology and Theory

Papert, Gee, and Prensky are among many who advocate the use of recreational technology as a learning tool. They believe that this technology affects the way the brain works. They present ways to improve and enhance the quality of school curricula. For example, Seymour Papert praises computer technology saying, “And the computer is offering unprecedented opportunities to craft alternatives by creating an environment in which children can learn algebra and geometry and spelling and history in ways more like the informal learning of the unschooled toddler (or the exceptional child) than the educational process now followed in schools (“Children’s Machine”). Papert firmly believes that certain programs can enhance and stimulate the learning processes of children. Gee states “The games exemplify, in a particularly clear way, better and more specific and embodied theories of meaning, reading, and learning” (What Video Games 26). Others argue, however, that careful planning and guidance is needed before utilizing technology and, in some cases, technology should be avoided. Healy in Failure to Connect, discusses recreational and educational technology and their possibly detrimental effects on brain development (e.g. listening skills, social skills, ADHD, etc). In “Is Our Children

Learning” Landry explores many concerns surrounding the role of technology in the classroom. She argues that although there is a lack of sufficient evidence that the technology is beneficial for a child’s educational development, the government and the educational software and tech companies have spent millions of dollars to introduce and keep technology in the classroom. Landry claims, “Schools need more substantial proof that their investment in technology has made learning better—not just cheaper or faster.”

The video game industry is also spending time and money to research technology and its impact on children. This research strives to justify the marketing of recreational technology as a learning tool. Landry (2002) cautions individuals as to the credibility of such research—“Nearly every tech company selling into the education market has commissioned independent studies that find, not surprisingly, that technology has a positive effect on education.” She argues that using technology as a “learning” tool may have a negative impact on our educational system. Some of the research funded by larger industries, however, is performed at credible and reputable institutions. For example, Games-to-Teach Project is a Microsoft and MIT joint venture research project whose mission is to “demonstrate the social, cultural, and educational potentials of games by initiating new game development projects, coordinating interdisciplinary research efforts, and informing public conversations about the broader and sometimes unexpected uses of this emerging art form in education” (The Education Arcade).

Some believe that, whatever our feelings are about technology, technology *is* a strong force in our culture and we should make an effort to acknowledge and respect its power (e.g. Kress 2003, Gee 2003, Lankshear and Knobel 2003). Computer technology is a part of our culture—thus any questions regarding the *use* of technology in the classroom should be

irrelevant. We must incorporate technology into the educational system—it is the “hows” of this incorporation that we need to explore. Gardner claims, “We want to educate youngsters so that they can cope successfully with a world that has already changed dramatically and that is changing more rapidly still” (Disciplined Mind 61).

Video and computer games offer new possibilities for education. They incorporate visual and auditory stimuli that create an interactive world where the student explores and interacts with her simulated environment. Decision-making skills and communication skills are tested and refined as the student delves deeper and deeper into simulation. Oftentimes this simulated world can be used to explore concepts, enhance memory, and to develop other learning skills. The question of the value of video and computer games as an educational tool is almost irrelevant—with the success of video and computer games in our society, 12.5 billion in sales in 2005 according to the Businessweek Online they have already become an integral part of a child’s development (Brightman). Academic institutions as well as the multi-billion dollar computer and video game industries conduct much research concerning video and computer games. This research is used to demonstrate the impact that computer and video games can have on our children’s education. It is crucial, though, to step back from this research, to not only evaluate computer and video games as tools, but to also determine the effect video and computer games have on a child’s learning outside of the classroom. Currently, the educational software enhances our traditional classroom. It enables the student to practice and develop certain skills. Let’s look at recreational technology as another means to enhance learning—does this suggest that children may be developing critical learning skills outside of the traditional classroom? Should the classroom curriculum acknowledge these skills?

Relevance

This research is critical for the future of our classroom. Currently many studies demonstrate that modern recreational technologies affect the way a child learns. Much research shows that certain educational software benefit the classroom. However, links should be made within this research to guide and develop the classroom. If research exists that show us that children are developing certain skills before they reach the classroom—or, if they are developing new skills that are not addressed or understood—our classrooms need to develop new teaching strategies that acknowledge such research. Instead of looking at technology as a separate entity, we need to understand its role in the child’s life. Also, if a child’s development has changed because of technology, we will need to re-define the text upon which our classroom curriculum is built.

This research will benefit the child. It will also benefit the teacher and the administration. It will save our educational institution time and money. Currently, millions of dollars are spent for the research and implementation of educational technologies within the schools. In the Fiscal Year 2005 Budget Summary from the Department of Education, Bush allotted over million for Educational State Grants (2003). Much controversy also surrounds the issue of standardized tests. Monty Neill (2003) and Mel Levine (2003) claim that standardized tests do not address the needs or individuality of the students. By examining new ways to approach and teach our children, we could save much time and money. Thus, standardized tests may shift in design and content, adapting to the 21st century student.

This research will also serve as a guide to educational software designers. The research will guide the designers, showing them how the child approaches learning. Although this research will focus primarily on children ages 4-8, it is also of critical importance to the development of general theory pertaining to technology. As a society, we have delved into technology accepting it as an intimate part of our lives. Unless we take a closer look at technology, not only its role in our culture, but its intimate relationship with our thought and learning processes, we may have little control. Some believe that technology will essentially enslave humankind, forcing the human to serve his/her machine. Sven Birkerts argues that if we lose our connection with the book, the traditional concept of text, we risk losing an important part of who we are (*The Gutenberg Elegies*). I believe that if we know technology and understand its power, we regain control; we become the leader. As a culture, we are young in a new world that is infiltrated daily with new technologies. By building a strong theoretical and philosophical framework from which to make decisions that are ethically sound and culturally beneficial, we better the world in which we live.

CHAPTER 2: THE FOUNDATIONS

Terminology is critical in research conducted as a meta-analysis. These are the words that “find” our sources. The meta-analysis begins with a word—a term; the term locates the material; the material becomes the basis of our analysis. All terms used in the meta-analysis are directly related to the topics discussed in this chapter.

In order to conduct the meta-analysis we must first understand and assign working definitions to some of the words/terminologies that will be used to find and examine relevant material. We must also explore their history and impact upon education. In this chapter we will discuss, in detail, educational theory, classroom curriculum and teaching practices (as it pertains to today’s classroom), cognitive development and other terms that are related to brain development (e.g. neurobiology), and recreational technology. Once we understand the parameters of the terminology we use to search for relevant material, we can begin an effectual meta-analysis.

We will begin this chapter with a brief examination of the history of education and recreational technology. This is crucial because an “expert” in the field of education may have little or no knowledge of recreational technology and a designer of recreational technology may have no experience or knowledge of formal educational practices. After an introduction to both areas, we will have a broader understanding of the terminology and its relevance to this meta-analysis.

Educational Theory

Educational theory is no new concept. In the Western world the ancient philosophers such as Aristotle, Socrates, and Plato paved a road for the pedagogy of education with their discussion of text and literacy, of reformation and growth, of knowledge and morals.

Thus it is clear that education should be based upon three principles- the mean, the possible, the becoming, these three. (Aristotle, Politics, Book 8)

But let us not quarrel with one another about a word, provided that the proposition which has just been granted hold good: to wit, that those who are rightly educated generally become good men. Neither must we cast a slight upon education, which is the first and fairest thing that the best of men can ever have, and which, though liable to take a wrong direction, is capable of reformation. And this work of reformation is the great business of every man while he lives. (Plato, Laws)

Education, historically, has played a significant role in the development of history and culture. Aside from the ancient philosophers, numerous educators, child psychologists, and politicians, as well as a multitude of theorists from other disciplines (e.g. technology, economics, sociology, etc), have helped define and develop the role it plays in our society today.

In 1692 John Locke wrote *Some Thoughts Concerning Education*. Although modern educational practice has strayed from his most famous theory, *tabula rasa* or “blank slate,” (a

theory that described a child as a blank slate, with no innate knowledge of moral issues) evidence of his beliefs is apparent in today's classroom. Everything must be taught or presented to the child in a specific way in order to guarantee a healthy, moral, and educated human being. Locke presented education as a practice with guidelines and regulations that clearly define how a child must be educated.

Beating them, and all other sorts of slavish and corporal punishments, are not the discipline fit to be used in the education of those we would have wise, good, and ingenuous men; and therefore very rarely to be apply'd, and that only in great occasions, and cases of extremity. On the other side, to flatter children by rewards of things that are pleasant to them, is as carefully to be avoided. (Section 52)

Today, education is viewed upon as a practice, and, although different theorists choose different guidelines, most agree that a certain structure must be in place to guarantee an effective education. In order to determine the structure of the classroom, an understanding of the child is essential. In Rousseau's *Emile*, Rousseau attempted to understand education by understanding the child. He observed the child, Emile. From these observations, he discussed the educational approach most effective for the child. His book turned the focus of education to the individual child, acknowledging needs that a child must fulfill in order to learn. Unlike previous theory, Rousseau believed the child needed to explore his/her environment with limited guidance from the teacher. Less structure, more freedom would enable a child to learn at his/her full potential.

In the late 19th and early 20th centuries, philosophers and educators such as John Dewey, Johann Friedrich Herbart, and Francis Wayland Parker mark a change in direction for educational theory. The classroom environment became a critical issue especially in relation to the child's individual experiences.

Dewey discusses the importance of a child's experience in education claiming that the teacher must be able to create an environment that could adapt to different children (*Democracy and Education* 1917). Furthermore, he believed that the children would learn more quickly if they could relate their "learning" to real-life experiences (*Experience and Education* 1937). Johann Friedrich Herbart also discussed the importance of experience in the development of the individual. He stressed the importance of interest and relevance and he argued that the teaching should stimulate a student's interest in learning (Hilgenger). Francis Wayland Parker moved theory into practice by training teachers in Quincy, Massachusetts. He then started the Chicago Institute where he trained teachers so that the children could receive a quality education by trained professionals. He felt that the teaching and curriculum were the basis of a solid educational system (Korzenik).

Other theorists, such as Maria Montessori, took a more extreme approach to education claiming, "The principle of slavery still pervades pedagogy, and, therefore, the same principle pervades the school. I need only give one proof—the stationary desks and chairs." (Montessori 16). She advocated a "free" child able to explore the environment at his/her own pace, choosing what they learn and how they learn. Their natural instincts would guide them correctly through the learning process: "It is not enough, then, to prepare in our Masters the scientific spirit. We must also make ready the school for their observation. The school must permit the *free, natural*

manifestations of the *child* if in the school scientific pedagogy is to be born. This is the essential reform” (15).

In the 1920s, while educational reforms were infiltrating American education, child development was on the rise. “Psychology contributes to a better understanding of the aims of education by defining them, making them clearer; by limiting them, showing us what can be done and what can not...” (Thorndike 5). Edward L. Thorndike strongly advocated a link between education and psychology. His writings influenced the field of child development. He also encouraged the use of statistical techniques to evaluate and measure learning (7).

One of the most important contributors to child development is Jean Piaget. His studies in cognitive science identified a series of cognitive stages through which a child must progress in order to learn and grow. He draws much of his theory from constructivist concepts, those most commonly associated with John Dewey. Each child is an active and individual participant in this “knowledge construction.” Once again, the environment plays a critical role in helping the child move smoothly through the developmental process. Much of our current educational material is developed with Piaget’s stages of cognitive development in mind. For example, early child development classes incorporate activities that help the child move through different stages based on age and individual development (Office of Head Start).

Current Classroom Curriculum

Our current classroom curriculum relies heavily upon state standards. This meta-analysis will focus primarily on Florida state standards as a model for classroom curriculum. The most critical standards relate to language arts, math, science, and social studies. There are other

subjects but most consideration is given to these subjects simply because No Child Left Behind Act focuses upon these subjects.

The classroom curriculum addresses these standards plus many more. Furthermore, materials and exercises used should reinforce the standards. Some of the standards overlap and some apply to more grade levels than do others. What is important to note is that the curriculum must support the students' attainment of the standards. This will be discussed further as we move into the actual meta-analysis.

Teaching Practices

Teaching practices cover the methods, styles, and materials used by teachers in today's classroom. We will specifically examine the most common practices because we want to address the majority of the students and educators. We will look at some less common practices if they have endured a long life within the educational system. We will examine a variety of teaching forums and online websites as well as popular books and articles that discuss, define, and provide teaching materials and tools to the elementary school teacher.

Cognitive Development

Cognitive development explores brain development as a process influenced by the environment. Since video games are a relatively new addition to the environment it is critical to explore their impact on the brain.

The processes affiliated with cognitive development are covered in a variety of sciences. In this meta-analysis we will focus on specific sciences and those “sub” fields that fall within these sciences: e.g. neuroscience, social psychology, and cognitive science.

There are many leaders in the research and discussion of cognitive development. We can delve deep into history, as far as Plato and Aristotle, to find its roots. Aristotle discussed the role of the environment and experience in cognitive development. His position is an example of the philosophical viewpoint known as empiricism. John Locke also took the empiricist approach believing that the mind developed as a result of the exploration of the environment through the senses.

The senses at first let in particular ideas, and furnish the yet empty cabinet, and the mind by degrees growing familiar with some of them, they are lodged in the memory, and names got to them. Afterwards, the mind proceeding further, abstracts them, and by degrees learns the use of general names. In this manner the mind comes to be furnished with ideas and language, the materials about which to exercise its discursive faculty. (An Essay Concerning Human Understanding, John Locke 15)

Cognitive development is a newer term, derived from a variety of scientific explorations such as cognitive science. In the late 1800’s William James wrote Principles of Psychology, the first psychology textbook. This book caused a shift in the studies of the brain for it discussed the brain development as a functional process. He explored the brain in relation to environment and personality in relation to social factors (William James Website). Psychologists, scientists,

linguists, and mathematicians such as Noam Chomsky, George Miller and Allen Newell frame the most recent discussions of cognitive science and cognitive psychology (mid to late 20th century). Much of their theories have been discussed in the context of behavior, and much has also been applied to the development of computer systems.

Cognitive development is probably most commonly associated with the work of Jean Piaget who applied the principles of cognitive psychology to human development—specifically, children. His work brought a focus to the issue of education in regards to developmental needs. Threads of his work are still evident in our current educational curriculum. His work is recognized abundantly in the newer field of early childhood development.

Another science directly related to brain development is neurobiology. Marc Prensky (2001) argues that neurobiology offers proof that the brain is directly influenced by its interaction with video games. He discusses the term “neuroplasticity,” which means that the brain is “constantly reorganizing itself.” Studies in this field show that certain areas of the brain develop differently based on environmental factors.

We will examine articles and studies that directly relate to cognitive development. We will expand this examination to include terms associated with cognitive development (e.g. neurobiology, cognitive psychology). During the meta-analysis new terms may be discovered and included. This will help eliminate bias within the research, because prior knowledge of these words is minimal and the exploration could lead the study in new directions.

Recreational Technology

Recreational technology covers a wide range of technologies; video games (e.g. GameCube, Playstation), hand held games (e.g. GameBoy, PSP), recreational/educational software (e.g. Reader Rabbit, ClueFinders), and online interactive computer games (e.g. RuneScape, NeoPets). All of this technology is used recreationally and outside the classroom. The technology targets children of all ages. We will limit the material used for the meta-analysis to that which specifically addresses children ages 4-8. We will explore research and statistics related to video and computer games. Many areas of research are related to recreational technology; e.g. educational technology, software development, interactive environments, etc. Within these different areas, we may find research significant to this study. For example, Marc Wolf in The Medium of the Video Game discusses the emergence of video games, referring to them as a medium that has borrowed traits from television, yet introduces new “elements” (e.g. interactivity and collaboration). Although he does not specifically address education—he points out elements of the video that are also important to education.

Historically, recreational technology has shifted in design and structure—yet its goal remains the same: entertain the user. A puzzle is a form of recreational technology that demands physical and mental interaction, whereas television is more passive, engaging the user through visual and auditory stimulation. Technology is not a new word, and the new technologies, though different in design and appearance, share much in common with older technologies. Carolyn Marvin claims “*New technologies* is a historically relative term” (3). These new technologies are simply “elaborations” on earlier technologies. In her book *When*

Old Technologies Were New Marvin shows how culture, politics and economics shaped and defined the technologies. She discusses the novelty of new technologies. She also discusses how they often became tools used to oppress and stereotype. Her discussion of technologies covers the telegraph, the telephone, and the electric light. She examines their relationship to the people, to the culture. She is adamant in her assertion that communication is a key factor in the development of technology. We seek faster ways to communicate—those that provide us with “real-time” communication.

More recently recreational technologies have been a source of criticism—not as tools for oppression or a means to define and stereotype—but as a major factor in the degeneration of the brain (Healy). Early film may have avoided the worst of the criticism, but as soon as it mainstreamed, and definitely when it reached the small screen, scholars jumped at the opportunity to reveal its destructive nature. Even now, reputable studies are performed to determine the effects of television violence on the viewer or to determine its role in the increase of diseases like obesity (American Psychological Association; Klesges, Shelton and Klesges). Parents and teachers often condemn its impact on the physical development of children. Anthony Smith in *Books to Bytes* argues that societies shun new technologies: “Every generation of technologies of perception has left behind a newly reduced version of the human mind or limited image of the world” (29).

New technologies, historically, have also affected our ways of thinking. We can look as far back as Aristotle and Socrates debating over the pen, the word, the meaning. We can examine the printing press, which enabled a much larger audience to have access to text, to what was written. Smith argues that the printing press encouraged the development of new mental

skills, a “codified system of thinking” (126). This is reflective of the newer arguments concerning video games.

The recreational technology prevalent in today’s society combines the elements of many types of recreational technology. For example, the GameBoys use graphics and sounds to draw the user, but in order to continue and advance in the game the user must interact mentally and physically. Although the term “physically” may arouse some doubts in the minds of those concerned with healthy physical activity, some newer games now engage the user in a more complete “physical” manner, e.g. the Dance Revolution, Guitar Hero. However, this type of interactive recreational technology targets an age group that is more advanced in coordination than children of 4-8 years. The more popular recreational technologies for this younger age group are games like the Nintendo GameCube and GameBoy. Physical interaction is limited to handheld devices that are triggered by hand-eye coordination. Development stimulated by this type of technology is directly related to the physical and mental demands required to succeed within the games representative of such technology.

Although some scholars may argue that there may be little new in “new” technologies (e.g. Bolter and Grusin), it is important to point out what distinguishes video games from other modern technologies such as the telephone and television. Video games are interactive, demanding that the user make choices in order to continue playing. Scholars like Wolfe, Gee, and Jenkins are quick to point out the “uniqueness” of the video game. The skills needed to play a video game (e.g. hand-eye coordination, visual attention, response to multiple stimuli, visual reflexes, spatial positioning) are different than those needed for viewing television (listening and viewing) or talking on the phone (verbal and listening). Most importantly the video game places

the user in a new space, a three-dimensional world in which she is a part of. Her essence becomes part of the simulated world.

Summary of Terminology and Relevance

After examining the scope and history of the general terminology used to examine and conduct the meta-analysis, we can produce a framework from which to begin our study. Process seems to be a critical part of our educational system and the curriculum should stimulate and nurture this process. There are debates as to the exact steps to the process and the best ways to benefit and assess this process. The No Child Left Behind Act may support standardized tests, defending the position that these tests adequately assess a child's development according to standards created to make sure a child moves forward in his/her learning development. Howard Gardner and Mel Levine argue that a more individualized approach is necessary because the learning process is constantly shifting and adapting to our culture and a child's individual needs. However, we can approach this meta-analysis with the position that learning is a process—how video games and other recreational technologies fit into this process can only be determined after an analysis of available research and theory. I believe that a thorough examination of available research is only the beginning of the type of framework that should surround our educational foundations, and thus become a basis for our current classroom curriculum. As recreational technology adapts to the user and vice versa, the user may develop in ways that need to be explored and addressed in our educational system. In addition, text, a critical component to learning and communication, becomes an ever-evolving term that is defined by the technologies

prevalent in today's culture. In order to advance and grow with our children, we need to acknowledge new definitions, specifically those pertaining to text and technology.

CHAPTER 3: RESEARCH METHODS

This research will be conducted through a meta-analysis. Meta-analyses are traditionally used in the medical, social, educational, and health sciences to help the researcher bring together a large body of research either to determine a common link and/or uncover inconsistencies within a chosen body of literature. Since it is considered primarily a quantitative form of research (Rosenthal & DiMatteo 2001), it can be used to measure the consistencies and inconsistencies discovered in qualitative research thus bringing statistical standards to the findings that may not be available within an isolated research study. Gene Glass discusses the emergence of the term “meta-analysis” in her article “Primary, Secondary, and Meta-Analysis of Research” (1971); “I use it to refer to the statistical analysis of a large collection of analysis results from individual studies for the purpose of integrating the findings. It connotes a rigorous alternative to the casual, narrative discussions of research studies which typify our attempts to make sense of the rapidly expanding research literature” (3).

Many associate a meta-analysis with the medical and scientific fields, the goal being to find a statistical means to quantify the “results” of a larger group of research studies. However, definitions associated with the term meta-analysis invite a science with a more “qualitative” or “soft” reputation (e.g. psychology, social service, education, criminology) to employ such a method so that some sense can be made of a huge body of rapidly expanding research. Rosenthal and DiMatteo claim “Meta-analysis has come to occupy a major place in

contemporary scientific research partly because, [as demonstrated in the above examples], it helps overcome much of the equivocation about research findings in the social sciences and medicine by providing a method for combining research results” (63).

This study will incorporate the methods associated with a meta-analysis. A meta-analysis will allow me to examine research from different disciplines to explore relevant issues and search for answers to my research questions. I will restructure the frameworks of different meta-analyses to create a working structure for my own research. Unlike traditional meta-analysis, I must consider a more narrative, qualitative approach because of the types of disciplines from which I will derive my research. Statistical data is available within much of the research, but it needs to be cross-examined with respect to more subjective types of research, i.e. field studies, surveys, interviews, etc. I will be using *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins & Green, eds 2005); *Primary, Secondary and Meta-Analysis of Research* (Glass 1971); and *Meta-analysis: Recent Developments in Quantitative Methods for Literature Reviews* (Rosenthal & DiMatteo 2001) to determine the direction of my meta-analysis. My research will cross disciplines to examine ongoing discourse in the areas of technology, education, and psychology. Therefore, I will also incorporate methods associated with other types of reviews considered variations of meta-analyses (e.g. integrated reviews, Jackson 1980; research & literature reviews, Pillemer 2001; and meta-narrative approaches, Greenhalgh et al 2005).

The steps for this meta-analysis will be adjusted to accommodate the variation in research methodologies that make up the material presented. One research article may present scientific data gathered from instruments used to measure certain frequencies in the brain (neuroscience).

Another may examine an individual's reading progress with certain educational software using observational notes and standard reading tests (educational technology). The articles are from different fields and they use very different methodologies, yet they could both be relevant to the research questions. How do we properly address the diversity of research methodologies? Is there a way to examine and present the information from these different types of research while staying true to respectable academic standards?

As mentioned earlier in this chapter, a meta-analysis is generally associated with "hard" sciences, e.g. the medical and scientific fields. It uses quantitative means to analyze the statistics from different research in the same or similar fields. In order to use methodology associated with a meta-analysis yet stay true to the variation of research methodologies and the diversity of fields that will make up the meta-analysis, I will include steps associated with integrative and narrative reviews.

Integrative reviews are not new to research. Gregg Jackson discusses ways to make integrative reviews more consistent and credible (*Methods for Integrative Reviews*). He discusses the importance of forming good questions. He recommends a number of sources from which to develop good research questions (442-444). One source is the existing theory that pertains to the topic. Another source is the primary research being used in the review. Jackson also claims "One's intuition, insight, and ingenuity is a fourth source that ought to be consulted before finalizing the questions..." (443).

Another important part of the integrative review is the way in which the studies for the review are chosen. Jackson claims that many of the existing integrated reviews do not adequately "report how they searched for sources" (444). He argues "...it is particularly

important for the investigator to report the search strategy so that others can judge its adequacy” (444). He also strongly supports the use of bibliographies and abstracts (or “information retrieval systems”) as means for determining which studies to use (444). He claims that many of the researchers fail to mention the bibliographies, which he believes is a critical means to determine relevant existing research.

Another crucial part of an integrative review is the “representation of the characteristics of the primary studies” (445). Jackson mentions the importance of determining and discussing the significant and non-significant findings (both positive and negative). When analyzing the sources it is important to note variations and “missing information” (446-447). He discusses ways to test results for statistical significance, claiming that this analytic procedure is more representative of a meta-analysis and can add credibility to an integrated review (455-456). Although this meta-analysis covers much broader areas of research, by examining terms and phrases that are repeated within different articles we may be able to determine (by percentage) which are more significant to the research questions, and which are not. Then we can determine the major areas of concern for classroom curriculum and learning development.

From his research, Jackson determined that integrative reviews need to be very detailed, reporting their search strategies and providing an explanation of how they analyze their sources (457). He urges the use of tables to support and present the findings, arguing that this strategy helps make the information readily available to the reader. “Such information would allow any reader to reanalyze the studies and second-guess the reviewer’s inferences. Such opportunity is always a little threatening, but one of the oldest conventions of the scientific community is

making one's methods and evidence easily available for the scrutiny of other researchers" (458). He also stresses the importance of future recommendations based on the results.

Greenhalgh et al. discuss a meta-narrative review (*Storylines of research in diffusion of innovation: a meta-narrative approach to systematic review*). This review is used for the purpose of "Producing literature reviews of complex evidence for policymaking questions" (1). Using Khun's The Structure of Scientific Revolutions Greenhalgh et al. create a meta-narrative method that also has elements of a meta-analysis and an integrated review. Although this method is created for large organizations that need to make policymaking decisions based on large bodies of research, the steps are adaptable and can be applied to this meta-analysis.

Greenhalgh et al divide the process into phases. The first phase in this approach is the planning phase. Some of the planning phase is not applicable to my research (e.g. "Agree outputs with funder or client"). However, the planning phase does state that the researcher should "Outline the initial research in a broad, open-ended format" (2). The search phase is reflective of Jackson's integrative review and includes searching for sources through "references of references," databases, and intuition. In the mapping phase a discussion of the "key elements of the research paradigm" and of the main findings is crucial. The appraisal phase consists of an evaluation of each study for "its validity and relevance to the review question" and a "grouping" of comparable studies. In the synthesis phase the researchers "a) identify all key dimensions of the problem that have been researched; b) taking each dimension in turn, give a narrative account of the contribution (if any) made to it by each separate research tradition; c) treat conflicting findings as higher order data..." The final phase is the recommendations phase and discusses the

importance of summarizing the messages from both the research literature and “other relevant evidence.” It also claims that future recommendations should be included.

Both Greenhalgh et al. and Jackson’s approaches share common elements. For example, research questions must be formed before the search begins. Both articles stress the importance of using references and bibliographies to look for relevant sources. Both also urge the use of databases (or “information retrieval systems”). A discussion of each source is necessary. Jackson supports an analytic approach based on strict definition of significant and non-significant findings. Greenhalgh et al. urges an identification of key elements and findings. Evaluation/appraisal and synthesis varies a bit between the two approaches—but both encourage a comparison of data (Jackson focuses on variation). Greenhalgh et al. discuss the importance of evaluating each source within its own “paradigm” then re-evaluating it in a different “paradigm.” This idea, though initially intended for huge bodies of varying research, will be applied to this meta-analysis. Each source will be placed in an individual category and then analyzed with respect to others in its category. Subsequently, it will be examined in a larger category that includes *all* the categories with *all* of their respective sources.

A meta-analysis consists of a few basic steps that can be broken down or expanded upon due to the nature of the research and the discipline it examines. The following summary of the steps important to a meta-analysis (and/or variations of the meta-analysis) is based upon information gathered from Jackson, Greenhalgh et al., Allen and Seaman, Rosenthal and Dimatteo, and Glass. A very general summary of the literature on meta-analysis points to the following steps.

1. Define research question(s) (Greenhalgh et al 2005; Jackson 1980).

2. Define criteria for gathering research (Allen & Seaman 2005; Greenhalgh et al. 2005; Jackson 1980).
3. Examine the research, pulling out statistical evidence (Glass 1971; Jackson 1980).
4. Analyze the evidence and calculate results (the means of this calculation will vary depending upon the research) (Rosenthal & Dimatteo 2001; Jackson 1980).
5. Offer recommendations (Greenhalgh et al. 2005; Jackson 1980).

The Steps: An Overview

In order to create steps that best represent my research questions and to establish a valid research methodology I have relied heavily on Greenhalgh et al and Jackson to create appropriate steps.

1. The first step in this meta-analysis is to define the research question(s).
2. The second step is to define the criteria that will determine the relevance specific studies and literature may have to this research.
3. The third step is to collect the material.
4. The fourth step is to examine the material looking for consistencies and inconsistencies that are related to the research questions.
5. The fifth step is to create a means to display this information showing relationships and their relevance to the overall research questions.
6. The final step is to make recommendations based upon the presentation of data.

Step 1: The Research Questions

1. Do recreational technologies (specifically video games and other interactive computer games) affect the learning processes of children?
2. How do these recreational technologies affect the learning processes of children?
3. Do these identified effects on learning processes suggest changes to the classroom curriculum and/or the teaching processes used to educate our children??

We cannot examine the learning processes of children without addressing our educational process. The educational process determines the manner in which we teach our children (teaching process). If we ask how technologies affect the learning process, we need to examine the implications this would have upon the teaching process.

I use the term “process” instead of development because development implies a specific level of change within the user that is directly related to the brain and body. I use the term process to suggest a ‘way of learning’ or a ‘way of teaching.’ The term “process” is an umbrella term meant to include development of the brain and body in both a physical and mental sense as well as on an educational level. I will include research on brain development in this study. However, my primary focus will be on the educational level. *How* do children learn? *How* do they process information? This study will focus on learning, education, and teaching as processes that directly influence each other. In order to address the impact an outside influence may have on one process, all processes should be taken into consideration. Their relationships will be explored.

Step 2: Choosing the sources

The criteria used to choose relevant literature for this study are crucial. Because this study will incorporate literature from different disciplines, I have chosen to divide the criteria into three sections.

- 1) Section I: Learning and cognitive development
 - a. Journal articles will be examined from the following fields: education, psychology, child development, neuroscience
 - b. More contemporary and specified fields will also be explored such as child psychology, clinical psychology, and early childhood development
 - c. Content of the material used in this section must include
 - i. Discussion of children ages 4-7,
 - ii. Discussion of learning and/or developmental processes,
 - iii. Discussion of technology only if related to learning and/or developmental processes.
 - d. The discourse within the material should cover specific areas
 - i. Learning with regards to the child,
 - ii. Education with regards to learning development/processes,
 - iii. Psychology with regards to learning development/processes.
- 2) Section II: Video games and recreational technologies

- a. Journal articles will be examined from the following fields: technology, communication, education, psychology.
- b. More “contemporary” and specified fields will also be explored such as media literacy, early childhood education and recreational studies
- c. The research content is important in this type of meta-analysis because of the huge amount of research in the area of technology.
 - i. Research examined must include the terms video games and/or recreational technologies (or some form of this term, i.e. interactive software games and computer games)
 - ii. Research examined must include (but not necessarily be limited to) discussion of children in any or all age groups from 4-8 years of age.
- d. Ongoing discourse is pertinent to this study because it establishes a framework within which we can place ‘new’ knowledge. Without a current dialogue, both qualitative and quantitative research would stand alone—without being used to its fullest potential.
 - i. Literature examined must include a discussion of the relevance and/or impact of recreational technologies and/or video games.
 - ii. Literature examined must include (in some form) discussion of children in any or all age groups from 4-8 years of age.
 - iii. Literature examined must include some form of the term “learning” as it pertains to gaining or expanding knowledge.

- e. Statistics must be incorporated to establish credibility. It is true that statistics are a result of research studies—but because of the nature of this research (the dynamic nature of current recreational technologies, i.e. Nintendo GameCube, Sony Playstation, Microsoft GameCube, each having new versions in sometimes less than a year) many statistics are published as a result of a multitude of long-term studies or a conglomeration of ongoing studies. This study will use statistics from certain sources to establish credibility.
 - i. Federal and State Government Agencies: Department of Education, Department of Commerce, National Telecommunications and Information Administration, Department of Consumer Affairs, etc.
 - ii. Media Literacy and Awareness non-profit organizations: Media Awareness Network, Center for Media Literacy, The National Institute on Media and Family.
 - iii. Statistics released through national press releases by large organizations that design and sell video games and other recreational technologies used by children ages 4-8 (Nintendo, Microsoft, Sony, Sega, etc.).

3) Section II: Learning, education and curriculum

- a. Journal articles will be examined from the following fields: education, communication, technology, and psychology.

- b. More specified fields may include: early childhood education, child development, educational leadership, media education, neurobiology, cognitive psychology, literacy, etc.
- c. Research content must include one or more of the following:
 - i. Stages of learning for children ages 4-8 (learning development, child development),
 - ii. Teaching process (methods, tools, practices) in Pre-K to third grade classrooms,
 - iii. Educational technologies in Pre-K to third grade classrooms,
 - iv. Curriculum in Pre-K to third grade classrooms,
 - v. Goals, expectations, standards on either federal or state levels for Pre-K to third grade classrooms,
 - vi. Changes in definitions that are relevant to education and learning (e.g. literacy, text, learners).
- d. Ongoing discourse in this field must be examined in order to determine what role, if any, that technology plays, on an educational or developmental level, with its users.
 - i. Literature must include, but not be limited to, a discussion of children ages 4-8.
 - ii. Both education and learning (or some form of either term) must be discussed within the same work.
- e. Statistics from the following sources may be incorporated:

- i. Federal and State Government Agencies: Department of Education, Department of Children and Families, U.S. Department on Health and Human Resources, etc.
- ii. Media Literacy and Awareness non-profit organizations that focus on children and education: Media Awareness Network, Center for Media Literacy, The National Institute on Media and Family, etc.
- iii. American Psychological Association
- iv. Online research organizations that either gather and/or perform research in the area of childhood education. (The credibility of these organizations will be established through an examination of their content/source contributors and resource links.)

It is important to note that I will search for sources within the references and bibliographies of the research I examine. If I see authors repeatedly mentioned within my own investigations, I will also examine their research to determine if it may be a relevant source for the meta-analysis. The method in which I conduct the search is important as it provides the reader with a way to “double-check” my information. In addition, though entirely eliminating bias may be impossible, my methods will show how I strive to eliminate overt and damaging bias.

Step 3: Collecting the Material

Material will be gathered through a comprehensive search of articles, research, and literature that fit the limitations defined through the criteria previously discussed. The material will be presented in a written format that discusses each source individually. For practical purposes, I must further limit my scope in order to make the material manageable and helpful. The following limitations and restrictions will help in the gathering of my sources.

- 1) The articles must be limited to no more than two for any author. This will not only help limit the sources but it should also help eliminate bias or individual preferences. If an author is extremely prolific then I will use the parameters I set for this meta-analysis to determine which material is most relevant.
- 2) For journal articles, I will use only search engines available through Florida's public university system. This system is still large enough not to taint the validity of my sources, yet it will bring further focus to Florida as representative of classroom curriculum and educational practices.
- 3) At least two thirds of the articles pertain broadly to classroom practice and curriculum within our current educational system (United States).
- 4) Journal articles concerning both education and technology must address, or at least not specifically exclude, children ages 4-8.
- 5) Books will be used as part of the meta-analysis, but these restrictions apply:

- i. All books focusing on classroom curriculum must be written by those actively involved in secondary education, e.g. teachers, counselors, administrators.
 - ii. Since this study focuses on current recreational technology all books focusing on classroom curriculum must have a copyright date no earlier than 2000 (seven years to the date of this meta-analysis).
 - iii. Books concerning both education and technology must address children ages 4-8.
- 6) Journal articles pertaining to theory, both education and technology, must be peer reviewed. For purposes of time and content these articles will be restricted to some of the more popular writers in this field—those who are cited most frequently. These authors must be used as sources within at least three of the studies examined while searching for material relevant to this meta-analysis.

It is important to note that in no way will this meta-analysis reflect all literature available on the subjects explored. It will, however, reflect a credible sample of the research and theory available. This meta-analysis can be used alone to trigger possible curriculum exploration and design or it can be a part of a larger pedagogical discussion that works to define the scope of teaching methodology with regards to the child's role in the world today. Our educational system needs to direct its focus on the children of today in order to create a successful classroom curriculum. To achieve this we must examine their environment. Today, a large part of their

environmental stimulation is recreational technology. Theory, research, and practice must be examined in many ways—and often. This meta-analysis invites an amalgamation of different areas of research in order to better understand today’s child and to grasp a firm idea of a successful classroom curriculum.

Step 4: Examine the Material

After each source is presented, correlations, links, and consistencies and/or inconsistencies will be examined. As I predicted I found key terms that overlap; therefore I present a chart of the key terminology before I discuss the material. This chart shows the larger terms and places the “target words” within specific categories. The target words are actually key terms used to search for relevant material. Table 1 is presented as a brief example.

Step 5: Present the Material

Charts make links, trends, and other information easier to follow and show the relationship of the information collected from the sources to the research questions.

Step 6: Recommendations

Based on the written summary of the sources and the graphs and/or charts created, recommendations will be made to modify the current classroom structures.

Conclusion

I think it important to reiterate that this is not a traditional meta-analysis. We must incorporate theory and practice as well as research in this study. In order to do this we must use charts and graphs to highlight links and trends. I adapt the “traditional” meta-analysis to fit my subject matter. This study actually has elements that oppose the idea of analysis—instead of simply breaking down research we are bringing together, synthesizing, different types of research. In a manner of speaking, we are conducting a “meta-synthesis.” Although this study does not strive to defend a new type or understanding of research, I feel it important to note that in fields that must constantly adapt to their environment (i.e. technology and education) research methods must be used that not only capture and study but also promote adaptation and change. Finding ways to bring together different fields of research and theories may be the only way to become a contributive force in our society.

A meta-analysis is only the beginning. Researchers and educators can use a meta-analysis of this nature to determine the direction of future research. Since video and computer games are constantly shifting in content and design, it may be important to perform future meta-analyses using similar material but different research questions. Uncovering a common link amongst a variety of video games that is directly related to learning may help determine a solid approach to new pedagogical discussion.

Table 1: Chart of Various Key Terms Used in the Search Process

Concept:		Concept:	
Key terms	target words	Key terms	target words
Curriculum	Lessons Teaching practices Instructional materials Elementary Education Educational Standards Classroom tools Classroom environment	Recreational Technologies	Handheld games Hand-eye coordination Interactive games Game design Video Games Online Games
Child Development	Brain development Physical development Skills (motor, language) Cognitive Skills Cognitive Development Child psychology Early Childhood Development	Computer Games	Gaming Entertainment technology Video games Interactive Environments Interactive Software Role-Playing

CHAPTER 4: THE MATERIAL AND THE SYNTHESIS

The Brain and Learning: The role of the brain and cognition in the learning process

The first four articles focus on the brain and learning. They come from the fields of developmental psychology and neuroscience. Some of the articles cover a wide range of topics while others narrow their focus on specific educational methodologies and research questions. They all discuss cognitive development and learning, all but one focusing on the specific skills that are also developed through computer games.

Copple, Carol. "Fostering young children's representation, planning, and reflection: A focus in three current early childhood models." Journal of Applied Developmental Psychology 24.6 (Dec 2003): 763-771

Copple gives her audience an overview of different educational programs that target the development of symbolic and representational skills in young children as they enter the classroom. The three specific programs she discusses focus on different pedagogies, yet encourage a "strong development of children's representational capacities" (765).

The first program she examines is the High/Scope curriculum created by David Weikart in 1962. High/Scope focuses on cognitive skills generally attributed to Piagetian theory. It is

“based on the constructivist view that the child is an active learner who learns best through direct personal interaction with the world and through opportunities to reflect on this interaction” (767). Planning and reviewing are critical parts of High/Scope as this enables the child to become an active participant in his/her environment thus “engendering a sense of control over the environment and one’s ability to transform it” (qtd from Epstein, 767).

Copple also examines Tools of Mind founded by Elena Bodrova and Deborah Long in 1992. This approach is Vygotskian in nature focusing on the cognitive benefits of play (768). Children plan and reflect on their play, “Such play, in turn contributes to their language skills, problem solving, self-regulation, and appreciation of others’ play efforts” (769).

Lastly, Copple examines Reggio Emilia programs (operating in Reggio Emilia, Italy). Loris Malaguzzi, founder of Reggio Emilia programs, used many theorists to strengthen and support his educational programs, e.g. Erikson, Piaget, Dewey, and Vygotsky (769). Through documentation, the teachers and students examine and reflect the process used to complete long-term projects (769). The documentation itself is a part of the process in that it “expands children’s understanding of representational systems including language and visual representation in various media” (770). This enables the child to shift successfully between different modes of symbolic representation (770).

Copple: Relevance and Implications

Copple uses many sources to describe the overall frameworks of the different educational programs. She establishes the importance of understanding the relationships between the theory and the practical application of these programs. This study does not examine any technology nor its impact or role in symbolic representation however it does examine critical aspects of cognitive development in young children. It provides terminology that is relevant to existing curricula and supplies a viable link between educational foundations and actual educational practice.

It is important in this meta-analysis to recognize the important theories upon which both education and cognitive psychology are developed. It is even more important to understand their relevance to early learners. We need to understand how a child learns in order to determine the role video games play in the learning processes of children. With this understanding, we can examine different approaches to classroom curricula.

Salomon, Gavriel. "Technology's Promises and Dangers in a Psychological and Educational Context." Theory Into Practice 37.1 (Winter 1998): 4-10

Salomon argues that our ways of thinking and our new technologies have a "reciprocal" relationship. They depend on each other. They stimulate each other. By understanding their relationship we can better understand ourselves and our learning.

The article begins by discussing constructivism. Salomon claims that currently “learning is seen as an active, intentional, and somewhat idiosyncratic process” (4). He examines certain aspects of constructivism: knowledge acquisition and utilization, understanding and the nature of knowledge (5). He shows how each relates to learning. For example, information must be used in order to be acquired and vice versa. Understanding depends on context and connections—it depends on “relating” (5). And, knowledge is not just *possession*, it is *access* to information (5-6).

Salomon then moves to technology, discussing the different types of technologies that have affected communication, access, and understanding of information. He mentions that technology has two functions: as a tool for constructive learning and as a “novel” approach to teaching and learning (7). He discusses ways in which technology enables the development of certain cognitive skills through “new learning environments” (8). He also discusses the negative impact of a relationship between technology and learning. For example, he claims that searching for information is good, but with today’s technology the information is abundant and much of it is irrelevant. Thus, desensitization to all information could occur. Information becomes cheap. Salomon also argues that alienation occurs; communication, though fast, is distant.

In conclusion, Salomon argues that teaching must change. It must incorporate certain constructivist principles and grow. The educational system can turn to technology. New technologies can support the development of constructivist teaching practices. In order to do this teachers must take on a new role, they must change the way they teach. Most importantly, teachers must experience what they expect their students to experience in order to grow and become effective teachers.

Salomon: Relevance and Implications

This article links a specific learning theory (constructivism) to learning through technological environments. Gavriel Salomon is thorough in his discussion, defining the technologies and the type of learning they stimulate. He also provides a brief discussion of constructivism so the reader can easily follow his argument. In addition, he examines some of the setbacks of “new learning environments.”

He brings up another very important argument: the teacher’s role is changing. Teachers must adapt to and familiarize themselves with the new technological environments. Constructivist philosophy defines the role of the teacher as a guide. Thus, applying constructivism to the classroom would entail changing the role of the teacher, a role which already may need to shift to adapt to the new learners in the new environments.

Subrahmanyam, Kaveri, Patricia Greenfield, Robert Kraut, and Elisheva Gross.

“The impact of computer use on children's and adolescents' development.” Journal of Applied Developmental Psychology 22.1 (January-February 2001): 7-30.

This article examines existing research on computer games and their impact on child development. It focuses on children and their computer use within the home. This examination of computer games includes interactive games such as Nintendo, Sega, and Gameboy.

Included in this article are statistics from studies concerning the amount of computer use among children and adolescents in school and at home; the preferred type of computer use

among different age groups (e.g. games, communication, homework); and gender differences within the types and amount of computer use.

A significant portion of this article is dedicated to a discussion of computer games and cognitive development (Section 3). The authors list various cognitive skills that are related to computer games including spatial representation which actually covers a variety of very specific spatial skills, e.g. “mental rotation, spatial visualization, and the ability to deal with two-dimensional images of a hypothetical two- or three-dimensional space.” They mention that the video game will only “enhance a particular spatial skill if the game utilizes that skill.” They also point out that research shows development of spatial skills is not limited to a particular age group—all groups display improvement in specific spatial skills.

This article also examines iconic skills (analog representation), defined as “the ability to read images, such as pictures and diagrams.” With the increased use of graphics in media and entertainment, this has become a necessary skill. It is also important for “scientific and technical thinking.” The authors also mention “visual attention, the skill of keeping track of a lot of different things at the same time.” They claim that research suggests that video game players “have developed better attentional skills than less skilled players.” They suggest further research in this area.

Also discussed in this article are the effects of computer use on academic performance. Much of this discussion focuses on internet use and computer as an educational resource.

The authors explore the impact of computer use on social relationships. They discuss research that shows “game playing did not impact the social networks and characteristics of interactions among children.” Furthermore, some studies show that “frequent game players

actually meet friends outside school more often than less frequent players.” Family relationships are also examined. Teenagers’ use of internet as communication is explored.

A large portion of this article also focuses on the perceptions of reality that are shaped by interactive, role-playing games, and a section addresses violent video games and their influence on children.

Subrahmanyam et al: Relevance and Implications

This article examines specific effects of computer games upon their users. This article is a bit vast—covering an array of topics related to home computer game use. In depth looks at the effects are not presented. However, it does provide a large amount of research, giving the reader a chance to explore further in specific areas.

Most relevant for this meta-analysis is the authors’ discussion of cognitive skills and computer games. Since this study, graphics included in computer games have increased in sophistication; thus, the impact on certain cognitive skills such as spatial representation may be even greater. Another discussion important within this article is about perceptions of reality. Children entering kindergarten use role-playing within play and within the classroom on a regular basis. Examining the impact of role-playing in a virtual environment may be important for curricular goals and development.

Greenfield, Patricia M. "Cultural Tools and Learning Processes in a Changing World." Final Report to the Spencer Foundation. 1995. ERIC Document Reproduction Services ED 392 SO 025 204.

This report focuses on two different studies. One of the studies was done in Mexico (with the Zinacanteco population), the other in the United States. The purpose of both studies was to examine the impact that popular technologies used by children have on the culture as a whole. The study performed in Mexico focused on weaving, a popular activity among the isolated Zinacanteco people and has less relevance for this meta-analysis. The second study, however, focuses on the cognitive affects of video games.

Findings from the U.S. study demonstrate that “video game practice improved spatial performance” (7). The author claims that girls generally have weaker spatial skills. Therefore, she suggests that video games could be “quite useful in narrowing the gender gap in spatial skills” (7).

Greenfield: Relevance and Implications

This study suggests that video games have an impact on cognitive development—specifically spatial performance.

Matsuda, Goh and Kazuo Hiraki. "Sustained decrease in oxydenated hemoglobin during video games in the dorsal prefrontal cortex: A NIRS study of children." Neuroimage 29 (2006) 706-711.

This article discusses research performed to determine the effects video games have on the brain activities of children ages 7-14. Matsuda and Hiraki had performed similar research with adult subjects (2004). They used "a near infrared spectroscopy (NIRS) technique to measure hemodynamic responses within the brain" (706). They used this technique because it seemed best suited for active games with multiple stimuli and did not infringe on the natural movements of the subjects, thus making it "suitable for brain imaging studies of children" (706).

The authors discuss in detail their methods and report their results in a variety of ways, using charts and graphs to demonstrate the study as it pertained to subjects used and methods implemented. Their results suggest that oxyHb in DPFC and rCDF in DPFC decrease during the use of video games (709). They cannot conclude exactly which stimuli cause this decrease since video games are made up of multiple stimuli (709). Because of previous studies (Ghatan et al. 1995; Calhoun et al 2002; Walter et al. 2001) the authors speculate that the "oxyHb decrease in DPFC during video game play was not induced by specific aspects of each game, but rather by common aspects among many video-game-like tasks" (709).

The authors also mention that the results of this study reflect those of another study done with adults. This suggests that the age has less to do with the brain activity than the stimuli that are part of the video game. Matsuda and Hiraki conclude that the "attention demand required for visual stimuli" may be the common factor between the adult and child groups.

Matsuda and Hiraki: Relevance and Implications

This article uses subject specific terms that may be difficult for a reader unfamiliar with neuroscience to decipher. However, the study specifically examines brain responses within children. It also uses two different types of video games (puzzle and action), thus enabling the researchers to examine changes that are constant among a wide range of video games and/or specific only to a particular game.

This study gives solid evidence to demonstrate that video games physically affect the brain activity of their users. It also suggests that attentional skills are a strong component of video game play. Furthermore, it shows that age is not a contributing factor to certain responses within the brain. This could imply that a child's brain responds the same to certain stimuli present in video games as do adults. If this is true then more studies should be conducted to examine what type of learning processes respond better to the changes that occur in brain activity when using video games.

Discussion and synthesis of relevant information

The articles in this section, although different in many ways, indicate a strong tie between spatial and symbolic representation and learning. The first article by Copple demonstrates that many widely accepted educational programs focus on the importance of symbolic representation. These programs encourage play and exploration of the environment. Through play, a child can learn skills necessary for the development of language, memory and logical reasoning (Copple

765). As a child's mental capacities develop they are able to plan and reflect upon their actions (765). Dramatic play and environmental explorations are critical components in the development of symbolic representation.

The second article, like the first, focuses on learning theories. However, Salomon identifies similarities in a learning theory (constructivism) and in "new learning environments" (computers). Salomon discusses constructivism and cognitive development, claiming that we need to examine and incorporate constructivist philosophy into the classroom in order to grow with the technologies around us.

The third article focuses on a variety of ways computer games affect cognitive development. Most commonly attributed to computer games is spatial representation. The authors also discuss the importance of role-playing, a critical component of dramatic play—lending support to Copple's discussion of play. The authors also discuss visual representation, "the skill of keeping track of a lot of different things at the same time," which is reinforced through video game playing.

The fourth article focuses upon specific cognitive skills developed using video games; most importantly spatial representation. The final article examines physical changes in the brain resulting from video game playing. The study suggests that these changes lead to greater "attentional" skills because the player is forced to concentrate on one area, even though multiple stimuli may be present.

Most important to this meta-analysis are

- the concept of dramatic play and role-playing as important components of cognitive development,

- similarities between constructivism and learning with new technologies,
- visual representation and symbolic representation as important components of cognitive development, specifically memory and planning/reflection,
- multiple stimuli as a tool to develop certain attentional abilities.

Video Games As Learning: The ties between video games and learning

The articles in this section represent a variety of disciplines: child psychology (psychotherapy), educational leadership, educational technology, and technology in general. Clinical studies as well as theoretical explorations are examined in relation to video games and learning. These articles give a more in-depth examination of the specific skills developed through the use of computer games and how they contribute to both an educational/learning environment and the learning process.

Bertolini, Roberto and Simona Nissim. "Video Games and Children's Imagination." Journal of Child Psychotherapy 28.3 (2002): 305-325 EBSCO PsycInfo 4 Jan 2007 <<http://web.ebscohost.com>>.

This article is a discussion of the role of video games within a clinical environment. These video games were used as part of the clinical process and notes and observations were made concerning the emotional and intellectual impact these video games had on the patients.

The authors introduce their article with a discussion of play and its relevance to the development of the child. They examine different theories of play, focusing on the debates prevalent within the pedagogic discussion of play. Important, however, is the therapist's attitude towards play and the way in which he or she incorporates it within the therapy (307).

The discussion quickly shifts to new types of play seen in clinical sessions—those in the form of technology, specifically video games (307). The authors claim that initial reaction to video games by therapists was negative, but "...gradually did we realize that children's interest in video games was far more complex than we had thought previously" (308). The purpose of this study was to determine if video games could be used as a tool in psychoanalytic psychotherapy (309).

This study follows the psychoanalytical development of two patients, a thirteen-year-old boy and a six-year-old boy. Both children exhibited extremely abnormal social behavior. The video games enabled the therapists to enter the world of these children. They were able to stimulate communication and trust. In the final discussion, the authors mention the importance of control for their patients—particularly when exploring "severe anxiety" (322). The video games enabled the children to "control, dominate, and communicate" (322).

Bertolini and Nissim: Relevance and Implications

This article focuses on case studies of children who are not representative of the majority of children their age because of their abnormal psychological behaviors. However, the studies do demonstrate possible roles video games can play in the mental and emotional development of children.

Although the case studies in this article do not represent “normal” children, there is a relevant discussion of video game use and its impact on the user. Most significant to this meta-analysis is the brief discussion of the Game Boy. While observing his patient, Bertolini states “One thing I noted immediately was that there was no way in which he could cheat and sidestep the rules” (311). The child would become frustrated when he could not win, especially since he could not manipulate or cheat the game. Bertolini would encourage the child to try again. “Andrea [the child] managed to reach the end of several games without resorting to cheating, and for the first time in his life he experienced the satisfaction of winning a game without any sort of trickery or fraud” (311).

An important part of the kindergarten classroom is an adaptation to rules within class time and playtime. An understanding of the rules is necessary if the child wishes to participate and succeed.

Jenkins, Henry. “Getting Into the Game.” Educational Leadership 62.7 (April 2005): 48-51.

Jenkins claims that video games, whether violent, educational, sport, or fantasy, have qualities that make them productive learning experiences for the user (48). He begins his argument by supplying statistics that demonstrate the amount of time students, of all age groups, spend playing games. He then disputes the counterargument, that too much time playing games has a negative impact on children, by providing examples of research that directly oppose this counterargument. He does mention that despite possible ramifications of video game use, they

are unlikely to go away. Therefore, he suggests, “Instead of swimming against the tide, educators should consider the lessons that the gaming revolution can teach us” (48).

Jenkins addresses the issue of motivation in regards to video game playing. He proposes the concept of “intrinsic motivation,” positing it as the reason children are willing to spend so much time mastering a game, yet are unwilling to expend the same effort on homework (48). Intrinsic motivation enables the player to learn by “engaging in something they want to do—an activity that their peer culture values” (49).

Jenkins also discusses Seymour Papert’s concept of “hard fun” (49). Children want games that are challenging, that demand learning.

Jenkins then discusses specific ways in which games benefit the player in a learning context. He claims, “games lower the threat of failure” (49). If they lose, players can simply try again. Games also “foster a sense of engagement through immersion” (50). The student has a say in the direction of the game. They become part of the environment rather than an outsider looking in. The procession through the game stimulates the student, keeping them challenged and motivated so that they want to move forward (learn more) (50). Jenkins claims, “Games link learning to goals and roles” (50). They can use what they learn within the virtual environment. Games also “create a social context” and are multimodal (50).

After establishing how the games stimulate different types of learning, Jenkins examines specific games discussing how they can be used in the classroom.

Jenkins: Relevance and Implications

Jenkins uses statistics and research to support his claims. He gives clear reasons as to the benefit of video games as learning. The reasons could be considered a bit superficial. No discussion is presented on how this type of learning affects the student on a deeper level—psychologically and/or physically. This would be relevant because he opens his discussion by providing statistics that show children spend a significant amount of time playing video games.

This article points out specific ways in which video games enhance the learning process of students. It examines statistics that demonstrate the amount of time students spend playing video games. One of the more important concepts presented in this article is “intrinsic motivation.” Motivation is a major component of learning, thus examining motivational strategies is relevant for the classroom curriculum. In addition, another important issue within this article is his discussion of games being multimodel. This is especially important in the context of Howard Gardner’s theory of multiple intelligences and Mel Levine’s theory of individual learners.

***Prensky, Marc.* “Digital Natives, Digital Immigrants, Part II: Do They Really Think Differently?” On the Horizon 9.6 (Dec 2001) 29 Sep 2007 <<http://www.marcprensky.com/writing/default.asp>>.**

Prensky opens his article with statistics showing the amount of time children interact with different technologies. He briefly mentions his preceding article Digital Natives, Digital Immigrants in which he claims that differences between today’s student and today’s teacher is

one of the greatest concerns of our educational system. The differences lie in the technologies that the children interact with on a daily basis. He suggests that children's "brains are likely *physically different* as a result of the digital input they received growing up" (1). In this paper he states that he will provide evidence that supports his theory that children's brains are "physically different."

Prensky then discusses the term "neuroplasticity." Neuroplasticity is the brain's ability to reorganize itself, to replenish cells, throughout life (2). The brain changes based on outside stimulation. He provides a list and brief description of different experiments that demonstrate neuroplasticity within the brain.

Prensky's discussion then moves to social psychology when he discusses the term malleability. He claims that recent research in social psychology "shows that people who grow up in different cultures do not just think about different things, they actually *think differently*" (3). The brains are malleable, changing because of outside experiences and the environment.

He then mentions that brain plasticity requires hard work and concentration on certain tasks to occur. He equates this kind of hard work and concentration to video game play. He also compares this rewiring of the brain to the human's adaptation to the written word (reading and writing) and to television. Now, he claims, our brains must once again change to accommodate the video game—which is even more drastically different than the linear thought processes our current educational system is accustomed to (4).

Prensky mentions a couple of concerns that educators have with today's student. Attention spans seem to have decreased—but Prensky argues that this is not necessarily so. He claims that children can pay attention to games; but the classroom is built upon a foundation that

demands attention that is not interactive (4). Children are familiar with an interactive, virtual environment. The classroom is far from this.

Prensky also discusses “reflection” which seems to be lost in the fast-paced environment typical of the video game (5). He does claim that this is a necessary component of learning and it needs to be addressed.

Prensky supplies the reader with samples of research done showing how video games enhance learning in different areas. He claims that with good design video games can become a positive force in our educational system.

Prensky: Relevance and Implications

Prensky’s argument is clear and easy to follow. He discusses the terms neuroplasticity and malleability in ways that individuals not familiar with these terms can grasp their relevance to his argument. He gives accounts of specific research and experiments to strengthen his claims.

He discusses the brains as being different, but other than offering the video game as solution, he gives no suggestions as to the future of our classroom. Are there other ways to address our digital natives within the educational system? This is a question that merits some attention.

This article is relevant to this meta-analysis because it develops a solid argument, backed by evidence that shows how video games have such a dramatic impact on our children and their learning processes. It does make me wonder, however, in what ways we should address these new learners. Do we throw out our traditional concepts of learning or can we still use traditional

means to address the student? Maybe we simply need to be creative as we explore our alternatives. Video games may change the brain; does that mean that only video games can teach the brain? These are relevant questions that seem to be ignored by Prensky as well as others who argue that video games have created a new generation of learners.

Dickey, Michele D. & Sid Meier. "Engage by Design: How Engagement Strategies in Popular Computer and Video Games Can Inform Instructional Design." Educational Technology Research and Development 53.2 (2005): 67-83.

This article begins with an extensive discussion of the foundational theories that underlie game design and use. The authors first discuss "engaged learning," claiming that it is extremely important because it characterizes the type of learning representative of game playing and design. Both cognitive and constructive theories provide the foundational framework of engaged learning and the authors claim that both are evident in game use and design.

A brief history of the development of games is presented, demonstrating how the two-dimensional games such as Pac-Man (representative of traditional game board games like Sorry) gradually evolved as new technologies developed and became accessible to a larger audience. The newer games immerse the user into the simulated environment on multiple levels. The user becomes an active part of the environment, not an outsider moving game pieces, but actually one of the game pieces. Space takes on new meanings.

The authors claim that this positioning in space/environment is more representative of "the design of constructivist learning environments than for design from a behaviorist perspective." The users are now engaged in a three dimensional environment. This type of

learning supports the constructivist ideals that the learner is exploring and creating their own environment. Research is presented to demonstrate the value of this type of learning, specifically in the area of “conceptual understanding of content.”

The article examines specific elements of game design, demonstrating their possible relevance for instructional design in the classroom. Narrative is used to engage the learner and keep them actively involved with the process; “Looking at how narrative is woven into and at times supports the design of gameplay will likely inform instructional designers of how this device can be incorporated into learning activities and thematic units to sustain and enhance engagement over periods of time.” However, the use of narrative holds far larger implications for the future of instruction because the three dimensional element provides an environment that enables the *reader*, the *explorer*, to be an active participant in the story.

The interactive design of games further engages the players. The authors discuss the use of “hooks...the types of choices a player makes in the course of the game.” These hooks keep the player involved and challenged. Educational simulations have historically used choice and decision-making to further learning. By recognizing which hooks are most successful at engaging and challenging the player, we can adapt these game playing hooks to work in an educational setting.

The authors move back to a discussion of engaged learning and game design. They present both elements of engaged learning and game design to demonstrate similarities. They then introduce questions that game designers could use to support a learning environment.

In conclusion, they suggest that elements of game design (narrative and interaction) could be used to guide the design of learning environments—specifically to benefit education and the

classroom. They make it clear that they are not making an argument that popular games should be a part of our educational system, simply that elements of their design may be helpful to instructional design.

Dickey and Meier: Relevance and Implications

This is a very clear argument supported through theory and examples. The authors use a wide variety of research to back their claims. Unless you are in the education field, however, the concept of engaged learning and constructivist teaching may be a bit vague. Also, the article focuses more on constructivist concepts, less on cognitive theories. A brief summary of constructivism may make the article easier to understand.

This article directly supports the theory that video game designers use successful learning techniques to draw and teach the players. The goals of the designers are similar to the goals of instructional models used in education. The difference is that video game designers target a three dimensional, interactive environment while instructional designers focus on standards and materials supplied through the educational system. Will these new learning techniques work in a different environment?

Shaffer, David Williamson and Kurt Squire, Richard Halverson, and James P. Gee.

“Video Games and the Future of Learning.” Wisconsin Center for Education Research 2005. 6 Oct 2007 <<http://www.wcer.wisc.edu/publications/workingPapers/papers.php#05>>.

In this article, the authors explore the different ways video games stimulate learning. They claim that video games offer new ways to learn. At the beginning of the article they do make it clear that there are also negative ramifications of video games (violence, stereotyping), but they argue that we can still shape the way we look at video games and make them powerful learning tools. They suggest that we look at learning as most effective when it is active and meaningful. By framing video games within this theory of learning we can view video games as a powerful force within the educational system.

In order to understand the power of video games the authors explore different ways the games enable the player to learn. They use specific games to examine the learning involved in playing these games. First, they use games such as Lineage to demonstrate how the virtual worlds “are powerful because they make it possible to develop situated understanding.” They also discuss how these virtual worlds encourage the player to develop “effective social practices” (4). They examine gaming communities claiming that they promote meaning and learning outside of the classroom.

Another way the games stimulate learning is by creating an environment in which the player “learn(s) by doing.” For example, Full Spectrum Warrior is an army simulation video game in which the player is given a context, with rules, must be understood and followed in order to participate (5). The players are not left alone, they are given guidance.

The authors suggest that if we put more effort into creating meaningful social communities through our video games then students can explore and learn about the world and values in a context that enables them to understand and function in our society. By using knowledge instead of simply memorizing it the student learns “for free.” Also, by creating these communities students can view their ideas and actions in different frameworks—they are not restricted to the virtual world. The authors discuss a few games that have created rich meaningful communities (e.g. Rise of Nations and Railroad Tycoon).

The article does claim, however, that educators have a different view, and different, or often no, experience with video games. The authors argue that video games “cut against the grain of the social mores valued in the school” (10). It is a difficult challenge using video games as a model and a tool for learning. We must reshape the traditional ways of thinking we have towards education. They discuss the classroom as stagnant, not adapting to the technologies that are shaping our world. A change in the classroom, however, will not happen by simply implementing new technologies into the classroom, but by creating solid theoretical foundations upon which to build our classroom; foundations that address both today’s children and today’s technologies.

Shaffer et al: Relevance and Implications

The article uses specific games to support its argument, giving examples from these games of how they promote different ways of learning. This makes it easy for the audience to identify quickly and relate to the learning involved in playing these games. The authors also discuss the counterargument and examine obstacles that stand in the way of their suggestions.

However, the specific game examples are the majority of concrete evidence used to support their theories. A bit more explanation of relevant learning theories would make their support of video games more credible.

This article discusses video games, not only as a tool for learning, but also as a force within the environment that shapes and expands our ways of thinking and learning. It directly supports the notion that the educational system is addressing a new type of learner and needs to adapt the curriculum to reflect and benefit this learner.

The article defines specific ways in which the video game shapes and defines the learning experience. Most important to note are:

1. Player is “learning by doing.”
2. Player develops a “situated understanding” of concepts and ideas.
3. Player develops meaningful social practices.

Gee, James Paul. “Good Video Games and Good Learning.” Phi Kappa Phi Forum 85.2 (Summer 2005): 33-37. EBSCO Host. University of Central Florida. 7 May 2007 <<http://web.ebscohost.com>>.

Gee argues that “good video games incorporate good learning principles, principles supported by current research in cognitive science” (34). He presents sixteen learning principles upon which “good” video games are built.

The first he mentions is identity. He claims that the players' use of their virtual identities enables them to understand more fully the value of the world in which they exist, thus understanding the importance of specific roles people "play" in life (34).

The second learning principle discussed is interaction—a term also equated with an active learning environment. The player and child interact, responding to and growing with problems and developments within the virtual world.

The third and fourth learning principles are production and risk taking. The players "produce" their environment through choices they make (35). They take risks because failure is less of an issue than in "real life"; they can save games and they can learn from previous failures thus becoming better players (35).

Gee discusses the importance of "customization" (his fifth principle), claiming that players can choose levels and styles. He mentions that a good curriculum should cater to different learning needs and styles (35).

Agency is a briefly mentioned sixth principle. It is important, Gee argues, because "players feel...a real sense of ownership over what they are doing" (36). Principles seven and eight have to do with the order and challenge of problems respectively. Gee discusses the importance of well-ordered and challenging problems that use repetition to create mastery but introduce new sets of problems to help the player reapply their learning (36).

Gee presents a new perspective on information with his ninth principle, "Just-in-Time" and "On-Demand" (36). He claims that textbooks present material "with lots of words out of context; that is why textbooks are so inefficient" (36). Video games, however, give the player information as soon as they need or desire it. They also provide "situated meanings" (principle

number ten) for words by giving the player a way to understand and relate to the words (through the virtual environment) (36).

The eleventh and twelfth principles deal with the player's desire to play the game (pleasantly frustrating) and the player's way of viewing the game (system thinking). They stick with the game because it is challenging but not so much as to be a deterrent. And, the game encourages the player to look at the relationships of actions and reactions (36).

The thirteenth, fourteenth, and fifteenth principles explore different ways of learning; e.g. lateral as opposed to a more traditional linear style, knowledge distribution, and team work (37). In his final principle, Gee discusses the importance of performing to learn, even before the player is fully competent (performance before competence) (37).

Although Gee shows how these learning principles are reinforced in video games, he claims that video games are not the only answer. What is relevant, however, is the way they enable a player to learn. Determining how to incorporate these ways of learning within our schools should be of major concern to our educational system.

Gee: Relevance and Implications

Some of Gee's principles seem repetitive; two or three at a time may be more accurately tied to one principle instead of many. For example, principles five and six (customization and agency) both seem to be directly related to different learning styles and preferences. By acknowledging different learners, the classroom can help the learner develop confidence and a sense of control over his/her learning. The article does cite numerous sources that are directly

related to learning and education, thus giving the video game a more solid link to the learning process.

The article ties video games directly to popular learning principles that are generally accepted in modern primary education. This makes it clear the possible role video games play in learning development. It also highlights important issues in the modern day classroom (the role of textbooks, the role of the teacher, different learning styles, etc.). What is most important from this article is the idea that by understanding the principles that make video games strong we can examine and create learning tools for our current classrooms. Gee, of course, advocates the use of video games; but understanding the principles may help teachers and educators successfully adapt their classrooms to cater to the modern student, with or without the video game.

Simpson, Elizabeth S.. "Evolution in the Classroom: What Teachers Need to know about the Video Game Generation." TechTrends 49.5 (2005).

This article is a critical examination of research, specifically statistics, that demonstrates video games affect all students without regard to race or financial status. Simpson uses these statistics and research to examine the current classroom. She claims that the classroom has not accepted the "new learner," the child who is a product of a "gamer's world."

She first establishes her underlying claim that video games affect an increasing number of individuals by giving the reader a variety of facts and statistics from numerous sources (i.e. Entertainment Software Association, National Center for Educational Statistics, Kaiser Family Foundation). She then discusses problems that need to be addressed in light of these statistics.

Teachers are experiencing technology in different ways than their students. They use technology that is representative of a traditional teaching style, whereas students are more familiar with video games and “fast-paced” action. Because of interactive games children are accustomed to being in control—of interacting at their own pace. Teachers, however, feel a need to maintain control. Without the experience and knowledge of video games and the type of learning that video games stimulate, the teacher may find maintaining control a struggle (18).

Simpson discusses critical characteristics representative of video game users. Some important to note are:

- *Motivation*—The storytelling upon which the video games are based put the user in incredible situations and allow them to visit amazing places. Thus, the user is highly motivated.
- *Trial and error*—The games encourage the user to learn by trial and error.
- *Competition and collaboration*—Both of these are critical to the success of most video games.
- *Rule-based*—Rules are the same for each player.
- *Effort influences outcome*—Time and effort often leads to success and/or better ability.

In conclusion, Simpson recommends that video games be recognized as a possible educational tool, “Teaching with video games can open new avenues of communication between teachers and students” (22). She claims that students see the world differently than parents and teachers. It is better to recognize their world than to struggle to mold them into traditional teaching practices that do not address their needs and strengths.

Simpson: Relevance and Implications

This article links many well-known learning concepts to specific characteristics of the video game. For example, she discusses motivation, a critical component to learning, and links it to the storytelling, the narrative, that makes-up the video game. Trial and error is another way of learning found both in the “traditional” classroom and in video game play.

For this meta-analysis it is important to recognize the links between video game design and the learning that takes place in the classroom. Simpson does a good job of highlighting these links. However, like many of the other authors examined in this section of the meta-analysis, she looks at the video game as the solution. Instead of focusing on the learning principles, she focuses on the tool used to develop the learning. Is there a way to single out the learning principles and search for different tools to support them? This is a question we may need to examine further.

Discussion and synthesis of relevant information

A recurring topic among the majority of the articles in this section is motivation. Even in Bertolini and Nissim’s article that discusses specific case studies, a desire to play and succeed at the video game is a critical component of video game play. Jenkins specifically discusses intrinsic motivation, claiming that this is the key to children desire to learn even if it is difficult and challenging. Dickey and Meier explore the concept of “engaged learning” in which the learner desires to continue—they are motivated and thus put forth the effort to succeed.

Motivation appears linked to 1) challenging material (Jenkins and Gee), 2) interaction and control over the environment (Bertolini and Nissim, Jenkins, Dickey and Meier, Gee, and Simpson), and 3) narration/storytelling that make the learning interesting and fun (Simpson) as well as “situated” (Schaffer and Gee),

Another important aspect of video games that is tied to learning is rules. One can not succeed at a video game without understanding and following the rules (Bertolini and Nissim, Schaffer, and Simpson).

Space also takes on new meaning as the linear thought processes traditionally associated with the classroom are criticized. Children are more familiar with a three dimensional environment and this may change the role that space plays in learning. A virtual, three-dimensional environment is also often multimodal which stimulates different parts of the brain.

Another important concept reinforced by most of the articles in this section is that of a “new learner.” Prensky discusses how children’s brains are actually different because of video games. Thus, the child in the classroom is not the same as she was twenty years ago. Schaffer et al also examine the “new learner” claiming that traditional teaching strategies are not effective for children familiar with an interactive environment where they learn by doing and exploring. Information is reinforced through situated understanding, not memorization. Simpson also explores the concept of the “new learner.” She specifically examines the environment in which the child is learning. She focuses on the methods used to succeed in the game (e.g. trial and error, competition/collaboration, understanding and following the rules, and control of the environment).

Text and literacy: new definitions changing the parameters of learning

When discussing technology and learning, the text cannot be ignored. Literacy is generally thought of as an understanding of the text. Without an understanding of the text literacy will not develop and learning in the formal educational system will not begin. Therefore, the basics that shape an understanding of text are present in early childhood education, and most prominent in the kindergarten classroom.

The following articles discuss literacy and its relationship to new technologies. They explore a change in the definition of literacy because of the shape of the text that surrounds us. These articles also examine the impact that this *new literacy* has on learning and the classroom.

Labbo, Linda. "Literacy pedagogy and computer technologies: Toward solving the puzzle of current and future classroom practices." Australian Journal of Language and Literacy 29.3 (2006): 199-209. EBSCO Host. Academic Search Premier. 7 May 2007 <<http://web.ebscohost.com>>.

Labbo discusses many questions about traditional and new literacies that directly affect classroom and learning. She claims that new modes of text demand new concepts of literacy (200). Yet, she also argues that existing guidelines for teaching literacy development are critical and do not need to be eliminated. Adapting the instructional techniques does not mean dismissing the foundations upon which they were developed. Solid foundations should still be used to develop literacy that encompasses new technologies.

She bases her paper on the exploration of concepts and questions. She discusses the concept of “new literacy” claiming that “meaning making in new literacies environment includes learning how to read and write with multiple modalities...in ways that are significant within particular cultural groups (Andrews, 2004)” (200). New literacies expand upon the definition of traditional literacy thus demanding new definitions and instructional modules.

She discusses underlying pedagogy that can be applied to both traditional and new literacies. She primarily focuses on Osborne and Wittrock’s Generative Learning Model (202). The model focuses on how “learners acquire and continue to use new knowledge to keep on learning” (201).

She discusses how certain computer technologies support traditional literacy development. She specifically examines how computer technologies affect writing development, phonological abilities, and independent reading.

She addresses her overall claim: that “new literacies require instructional transformations” (204). She covers the issue of internet as information. She also explores the practical aspects of interpreting text on a screen: “Visual literacies in electronic environments include the ability to interpret, recognize, critically evaluate, and utilize visual graphics...as tools for thought, as avenues for learning, and as modalities for communication” (205).

Labbo: Relevance & Implications

The paper discusses her interpretation of the questions. She chooses research that supports her point of view. However, she does link traditional concepts to current needs. She uses many examples of research to discuss the different concepts.

This paper examines literacy, a term that has become a critical issue for our educational system. If we continue to develop classroom instructional practices without regards to a shift in the traditional concept of literacy, we may be not only be neglecting the needs of our children, but ignoring their strengths as well. Labbo makes a clear argument that demonstrates the critical impact interactive technologies have on their user. Text and literacy itself become evolving entities, demanding a new approach to their role in the classroom.

Smith, Cynthia R. "Click on Me! An Example of How a Toddler Used Technology in Play." Journal of Early Childhood Literacy 2.1 (2002): 5-20.

This article discusses a case study and its implications. The subject is a toddler (2 ½ - 3 ½ years of age during this study). The researcher, also mother of the toddler, examined the toddler's interaction with CD-Rom storybooks. She explores his literacy development, communication skills, and use of dramatic play as a result of his interaction with the CD-ROM storybooks.

Smith used a revised method of traditional field studies to conduct and record her research. For example, she used a videotape to record the toddler's (James) interaction with the CD-ROM as well as other playroom activities (spontaneous play and traditional storybook reading). She also kept a journal/diary and "prompted summaries" (written observations of specific recorded activities). She created data sheets after reviewing her prompted summaries to "categorize and code the data" (6).

Smith discusses research done in traditional literacy development (i.e. Sulzby & Teale, 1991). She demonstrates how James' literacy development is similar to traditional literacy development—yet it incorporates more. “The stages of independent functioning observed in James' interaction with CD-ROM storybooks followed a similar path [emergent reading], yet allowed for more complex interactions with pictures and supplementary text due to the hypertext component” (11).

She also examines the role of play as a critical component of literacy development. Play is built upon certain mental processes that are shared with literacy development (Roskos 2000). As in traditional storybooks, the CD-ROM interaction promotes play and exploration of “abstract symbols necessary to develop literacy when he [James] engaged in decontextualized play...” (13). Book related dramatic play is also examined and Smith points out how James engaged in “similar [dramatic] play behavior when he created a second game that he called the ‘CD-ROM Game’” (14). She summarizes his dramatic play by stating, “James's decontextualized computer play behaviors are similar to the types of play that typically results from sharing books with children. His play revealed an understanding of the technology as well as the story” (15).

Smith also provides a brief summary of research pertaining to technology and its impact on emergent literacy. For example, she discusses The New London Group which claims that “literacy pedagogy must account for the vast variety of textual forms made possible by multi-media technologies” (17).

Smith: Relevance & Implications

This article focuses on a child 2½ to 3½ years of age. However, the author also discusses literacy development and emergent literacy with regards to school-age children. She examines research done on CD ROM Storybooks in the pre-k and kindergarten classrooms (16). She argues that CD ROM storybooks could help increase literacy development within the classroom and at home.

The advantage of such research is that she was able to record James's experiences in his normal daily routine that reflect an influence of technology (i.e. his comments while eating dinner, his play while riding in the car). Her observations are 24 hours and James is able to interact within a familiar environment.

The disadvantage of such research is the limited number of subjects. Also, the mother's relationship with James is difficult to "objectify." In order to establish her credibility in lieu of these disadvantages, Smith bases her study on previous larger study (Smith 2001).

Smith discusses the relationship between play and literacy, which is a topic repeatedly examined in early childhood education. She examines the strong element of play and interaction that is associated with computer games and suggests that CD-ROM storybooks affect a child's literacy development and need to be fully researched. They may in fact enhance and expand literacy development.

Leu, Donald J. "Our Children's Future: Changing the Focus of Literacy and Literacy Instruction." Reading Teacher 53.5 (2000): 424-430.

Leu begins this article with a brief discussion of the importance of the book: "The book has been a wonderful technology for literacy, permitting us to record and exchange important ideas for more than 500 years" (424). He mentions other forms of text that are traditionally recognized as "part of our literacy worlds," for example, newspapers, reports, graphs, and magazines (424).

He continues his discussion by examining the role of the Internet within the classroom. He argues that because of the rapid emergence of the Internet we need to "redefine our understanding of the literacy curriculum" (425). He urges the classroom to embrace the Internet and prepare children for the real world, a world where networking and communication is critical for success.

He also examines a shift in the structure of our economy based on access and communication available through the Internet. Children must be equipped to navigate and survive in this world of immense information and communication accessibility. He examines governments' responses to this "age of information" suggesting that they are aware of a need to revamp the education system to respond to new technologies (427).

Leu discusses the importance of the role of the teacher. Many may not have technological knowledge that their students have, therefore they cannot understand ways in which literacy needs to be explored. He argues, however, that everyone has "information that is useful to others" (428). He claims that communication is the key to understanding and progress.

He ends the article by once again establishing his concern that our focus on the book must expand to include new definitions and understandings of literacy.

Leu: Relevance and Implications

This article focuses primarily on the Internet. It does not discuss other technologies that may affect literacy. Leu does use many statistics and examples to show how the classroom is quickly incorporating the Internet.

Although this article focuses primarily on the Internet in the classroom, it specifically examines a shift in the definition of literacy based on new technologies. Leu urges the classroom to acknowledge and adapt to this shift.

Leu strongly advocates the use of the Internet within the classroom; but he first suggests an understanding of the changes in literacy that occurs because of Internet use. Without this understanding, incorporating new technologies into the classroom may prove inadequate and ineffective.

Discussion and synthesis of relevant information

The text is changing. All of the articles in this section discuss how we should address these changes. Both Labbo and Smith strongly support traditional concepts of literacy development. They encourage, however, an expansion of literacy development, claiming that it should encompass new texts. For example, text is presented in different modes, visual/graphic,

mobile, fixed, auditory, etc. All of these modes must be included in literacy development. Leu adds networking and communication as critical components to literacy development, specifically the literacy curriculum. Making meaning of texts incorporates all these new features, thus demanding new definitions of literacy.

Smith also discusses the relationship between literacy acquisition and play. Play is a way to understand abstract symbols, to reinforce an understanding of the meaning behind the text. Play is an important part of computer games. Thus, through play the child reinforces an understanding of both the technology and the narrative, the story.

The current kindergarten classroom: curriculum and controversial issues

This section focuses on today's kindergarten classroom. These articles, reports and books present an overview of concerns and standards within the educational system. They provide the reader with an understanding of how the classroom is run. They also address concerns that have developed specifically because of the current classroom curriculum. Although some may disagree with the author's opinions in a couple of these works, the authors do explore issues that are common today and should be addressed.

***National Association for the Education of Young Children. “Still Unacceptable Trends in Kindergarten.” Entry and Placement Position Statement 2000. 6 May 2007
<<http://www.naeyc.org/about/>>.***

The National Association for the Education of Young Children (NAEYC) is a “national organization of early childhood specialists who work in state education agencies.” With a history that dates back to the 1920s, the NAEYC has been a leading force in the development of quality educational programs for young children. They encourage research and communication as a way to promote change and development within the educational system. Their affiliates include local and state organizations such as The Central Florida Association for the Education of Young Children (CFAEYC) and The Early Childhood Association of Florida (ECA). They publish books, magazines and scholarly journals. They have also developed respected accreditation systems for associate, baccalaureate and graduate degree programs throughout the country.

In 2001, the NAEYC issued a position statement concerning kindergarten entry requirements. The report also reflects the NAEYC’s position on the current kindergarten classroom curriculum.

For several years, members of the association representing all sections of the country have observed with concern the persistence of practices which narrow the curriculum in kindergarten and primary education, constrict equal educational opportunity for some children, and curtail the exercise of professional responsibility of early childhood educators.

The report provides an overview of their position and then presents a list of recommendations (principles) upon which kindergarten entry and placement should be determined.

In their overview, the NAEYC claims that the requirements for children entering kindergarten are often extreme and unreasonable. They state that teachers have little control over curriculum design and implementation. The NAEYC attributes this to an increase in the use of standardized tests. Administrators are forced to implement programs that guarantee high test scores.

In order to guarantee that kindergarten children are ready for rigorous academic demands, stricter entry demands are enforced. Unfortunately, the child must adapt to the academic standards instead of the classroom accepting and adapting to the child's needs. The NAEYC believes that delayed entry, or special "readiness" programs for those deemed "unready" could be detrimental to the child's mental health, labeling them as "failures" at an early age.

The educational community can no longer afford to ignore the consequences of policies and practices which: 1) assign the burden of responsibility to the child, rather than the program; 2) place the child at risk of failure, apathy toward school, and demoralization; and 3) fail to contribute to quality early childhood education... (NAEYC)

The NAEYC provides a list of six principles for the teachers, parents and administrators to follow that they hope will help protect the child and, overall, benefit the educational experience for both child and teacher. The principles recommend

1. that teachers do not fall prey to a “narrowly focused curriculum”
2. that all children of the legal admittance age are permitted to enter
3. that teachers and administrators have a strong knowledge of the assessment tools and their content for kindergarten screening
4. that retention is not allowed
5. that tests used for kindergarten entry are only used as guidelines and to benefit curriculum planning
6. that diversity should be welcome—the classroom should incorporate multiple needs and strengths instead of grouping children and separating them.

After discussing each principle in detail, the NAEYC presents a “Call for Action.” They suggest that class size be reduced, that teachers be qualified, and that children be given access to a curriculum based upon their developmental needs.

NAEYC: Relevance and Implications

This report delivers a well-researched examination of our current kindergarten classroom. The concept of a curriculum highly focused on “failure” is repeatedly discussed. The NAEYC condemns this approach to education, and their position statement presents a well-organized and easy-to-follow argument. Furthermore, the NAEYC provides concrete suggestions that will better the educator and the student.

The issue is not whether to keep children with age-mates (Heterogeneous multiage grouping can stimulate and support children's development.) It is whether we can continue to uphold practices and program(s) predicated on failure. Failure by any name does not foster success for any students.

Brigman, Greg A. and Linda D. Webb. "Ready to Learn: Teaching Kindergarten Students School Success Skills." The Journal of Educational Research 96.5 (May/June 2003): 286-292. EBSCO Host 7 May 2006 <<http://web.ebscohost.com>>.

This article discusses the Ready to Learn (RTL) curriculum, a kindergarten based curriculum that focuses on developing certain skills amongst the students. The curriculum is designed for the entire classroom, not for specific students who show a lack of development in certain areas. RTL should be integrated into an existing curriculum. By developing certain skills, social and cognitive, the authors believe that kindergarten children will improve in school achievement (286-7). They also hope to demonstrate that the RTL curriculum can be effectively used as part of the existing classroom curriculum instead of simply used for students exhibiting a need to develop certain skills. This would save time and energy for the school system and the teacher.

Three skills are taught in RTL: "(a) attending (paying attention, being on task, and following directions); (b) listening comprehension...and (c) social skills (learning to be encouraging to self, to increase persistence, and to increase ability to work cooperatively)" (287). Well-researched teaching strategies are used to help the students master the three skills.

The study specifically examines 260 kindergarten students in three schools divided among experimental and control groups. The authors discuss in detail their methodology and measurement procedures. Their results are reinforced with numerous tables.

The study supports the author's predictions, demonstrating that the entire classroom benefited from the RTL. It also shows that teachers can use specific teaching strategies to implement the RTL program without readjusting their entire curriculum.

Brigman and Webb: Relevance and Implications

This study focuses on developing certain skills (attention, social, and listening) deemed necessary to succeed in kindergarten. These skills were chosen based on extensive research in the area of school achievement (286). If these skills are not developed it becomes difficult for the teachers to teach and the students to learn. Many teachers agree that without these skills children are not prepared for school (286).

Although the study focuses on a specific curriculum, it does give the reader a general idea of the skills that a kindergarten student needs to develop in order to be academically successful. And, the article is recent enough (less than five years) to be relevant to our current classroom. If video games and other computer games impact the development of these skills (positively or negatively) the kindergarten classroom will need to adapt to the new learner while acknowledging the importance of these skills.

Leuenberger, Constance J. The New Kindergarten: Teaching Reading, Writing and More. New York, NY: Scholastic Inc., 2003.

This book is a “how to” for kindergarten teachers. It also discusses obstacles the teachers will face and provides examples of lesson plans and activities.

Leuenberger’s first chapter provides a brief look at a “Typical Day” for kindergarten classroom. She provides a daily schedule and discusses the different activities in more detail. The first activities begin before the children arrive at school—with the teacher’s preparations. Every activity, every visual is linked to a specific goal that will enrich the child’s environment and learning experience. For example, Leuenberger has a sign-in book. The child signs in every day. The sign-in book gives the child an opportunity to write their name every day, improving their letters, staying on the line, and gradually including their last name. Furthermore, “A sign-in book is a way of making a child feel a sense of belonging” (10).

Chapter 2 examines the beginning of the year. The first few weeks are about establishing routine while building trust and comfort. It is also time to establish behavior expectations. She briefly discusses curriculum standards and simple ways to meet these standards.

Chapters 3-5 explore the different activities on the daily schedule. Chapter 3 examines the Morning Meeting and Message. The class meets to discuss the Morning Message during their Morning Meeting. This time permits the teacher and students to establish trust and a sense of community. The Morning Message helps the students become familiar with print. As the school year progresses the message can become more complex and the students can take a more active role in exploring it.

Chapter 4 examines Calendar Time providing many suggestions on how to use the calendar to improve different skills. The children can keep record of how many days they attend school (children can place a tally mark each day they are in school). Or, children can make a weather graph to keep track of the weather. From the calendars the children can begin to count and add, using early mathematical skills.

Chapter 5 discusses Choice Time (often known as Center Time). The design of the space is crucial to the success of Choice Time. Boundaries need to be set. Comfort is a factor in centers for reading or listening. Noise becomes an issue. For example the book center should not be beside the dramatic play center. The centers provide the child with the opportunity to explore and develop specific skills. In her discussion of Choice Time she also examines different stages of play and how the child moves through these stages as they develop and grow.

Chapters 6-7 discuss Reading and Writing. Leuenberger presents many activities to help the student develop certain skills. She also discusses different stages of development for both reading and writing. In addition, she points out that the students are often at different stages of development and their needs must be met in order for them to progress.

Chapter 8 explores the Math Standards. Leuenberger examines the standards (using the Principles and Standards for School Mathematics) and provides specific activities to help meet these standards.

Chapter 9 explores themes. Leuenberger claims that “Children learn best when skills and concepts are taught and used in a meaningful context” (176). Themes also provide a way to develop skills across the curriculum. For example, living things is a theme that may be scientific

“but within the topic are many opportunities for the children to read and write far beyond the area of science” (178).

The final chapter discusses relationships between teacher/classroom and home. Leuenberger gives examples of ways to keep communication with the family constant and productive.

Leuenberger: Relevance and Implications

Leuenberger discusses the needs and expectations of kindergarten children in a simple yet thorough manner. She provides the reader with many examples of activities and she discusses the developmental needs of kindergarten children.

Leuenberger’s constant references to the curriculum standards are important to note. She does not condemn the current educational system; however, she does recognize that the classroom today must follow curriculum standards. Although she holds no objections to curriculum standards, she mentions that it is a source of stress for many educators (22).

Leuenberger’s discussion of Choice Time establishes that a child’s development is strongly linked to exploration and environment. And, her general discussion throughout the book demonstrates that children are at different stages of development and each child must be addressed accordingly. Individual needs and desires should be respected and accommodated.

Campbell-Rush, Peggy. I Teach Kindergarten. Peterborough, New Hampshire: Crystal Springs Books, 2000.

This book is a hands-on book that discusses the developmental issues of kindergarten children. It also presents a variety of curricular activities appropriate for kindergarten children. At the time this book was written, the author was an active kindergarten teacher with over twenty years experience teaching at the primary school levels. This is a book intended for kindergarten teachers and is filled with suggestions and practical information.

In the first chapter Campbell-Rush discusses developmental expectations: social, emotional, cognitive, and physical. She demands a respect for playtime and encourages teachers to make playtime an important component of the kindergarten classroom (14). She claims that academic expectations should not override the developmental needs of kindergarten children (14-15). Some of the basic developmental expectations are:

- following rules (15)
- “interacting with peers” (15)
- taking turns (15)
- expressing choices (15)
- forming friendships” (16)
- accepting corrections (16)
- knowing right from wrong (16)
- engaging in social problem-solving (15)

The first chapter also discusses academic expectations: reading, listening, and speaking, oral language, writing, phonological awareness, and math. Critical points within these expectations are:

- using pictures to create stories (23)
- recognizing letters and understanding the difference between letters and words (23-24)
- retelling stories and identifying the main parts of stories (25-27)
- knowing the difference between uppercase and lowercase letters (29)
- counting to thirty (31)
- completing patterns (31)
- identifying basic shapes (31)
- sorting items (31)
- understanding basic addition and subtraction (32)

The second chapter is dedicated to classroom environment. The environment should invite the children to learn in a fun, bright, and comfortable manner. By interacting with the environment, the students are able to develop the social, emotional, cognitive, and physical skills appropriate for their age level.

Chapter 3 focuses on assessment. The author presents many ways to successfully assess a student's progress in different areas. Most importantly, she claims, "Students will gain from the assessment process only if there is immediate positive or constructive feedback" (57).

Chapters 6-8 present different activities and suggestions for classroom activities. The author ties these activities to the developmental and academic expectations of the kindergarten child.

Campbell-Rush: Relevance and Implications

This book is written for the teacher and by a teacher. It discusses the important skills a kindergarten child must master and recommends ways to help the child achieve these skills. This book is very general, a good resource for almost any kindergarten teacher. It addresses the needs of today's students giving the reader an idea of what a kindergarten classroom should look like.

A number of issues are very relevant to this meta-analysis. For example, Campbell-Rush stresses the importance of environment and exploration. She also claims that academic needs should not take precedence over developmental needs (14-15). The children may have different needs based on their developmental stages and individuality. In order for a child to progress, these needs must be met.

Ohanian, Susan. What Happened to Recess and Why Our Children Are Struggling in Kindergarten. New York: McGraw-Hill, 2002.

This book is a comprehensive discussion of the standards imposed upon children throughout the current education system. The author uses personal experience as well as specific representative examples to create an argument against the current education system. She also presents facts and statistics to strengthen her argument. She has written many books and

articles and has over twenty years experience teaching multiple grade levels. Although this book is biased, presenting a strong, passionate argument against state standards and standardized tests, it does present a realistic view of the contemporary classroom and educational concerns.

Chapter 1 examines the unrealistic expectations imposed upon children because of standardized testing. Ohanian uses specific examples to help the reader empathize with the children and their unique, individual situations. She also discusses the standards that exist in a variety of states. She compares the standards with military and work expectations generally intended for adults; “Funny thing. The U.S. Army acknowledges a need for a ten-minute break every hour during training sessions” (2). Yet, she points out that recess has been eliminated in many school districts. Furthermore, recess is often restricted to those who score higher on tests; those that do not score high enough for their grade level must stay inside to study more (3).

Ohanian also examines the power that many distributors and test-designers have. They stand to benefit greatly as standardized tests become a critical part of the school system. Contracts for test-prep software and internet sites become necessities (14-20).. Teachers are treated unfairly, expected to sit back, ask no questions, and share no information with respect to test content (19).

In Chapter 2 Ohanian compares the new kindergarten, one based on academic performance related to standardized tests, to a kindergarten that focuses more on exploration and development of multiple skills; academic, social and physical. She discusses other studies, such as Carl Washburn (1930s), who demonstrated that while children who were given “formal reading instruction’ in first grade at first outperformed those who received formal reading

instruction in second grade, in later academic years those who received formal reading instruction in second grade “had a greater enthusiasm for reading than the other group” (32).

Ohanian also discusses homework and its “build-up” in the past 20 years (37-39). She gives specific examples to demonstrate how homework time essentially eliminates most, if not all, free time for children. Furthermore, she claims that test scores show no drastic improvement because of increased amount of homework (38).

Chapter 2 also gives an in-depth look at benchmarks and standards for kindergarten children. She compares these benchmarks to college-level history courses (47). She suggests that there is much more to learn and develop than academic skills. She uses the philosophy of those such as Mr. Rogers to demonstrate a need for a change in how we approach formal education (50-52).

Chapter 3 compares standardized testing to child abuse. Ohanian opens the chapter by discussing the opinions of experts (educational and political leaders and child psychologists) who believe that standardized testing is unfair and cruel to young children; and believe it is not an accurate way to determine ability and knowledge (53-57). Ohanian goes on to discuss specific ways standardized testing is cruel and abusive. Children who perform well on tests are often exclusively and publicly rewarded which could lead to shame and embarrassment for those whose performance is “below level” (57-60). Mistakes are often made on the grading of the tests which can lead to children being held back a grade or high school students not able to graduate (until the mistakes are corrected). By the time the mistakes are corrected irreversible psychological damage could have occurred (60-64). Questions and answers are often arranged

as “bait” to lead the student away from the correct answer (67-71). This can lead to a misunderstanding of the meaning of reading and comprehension.

Recess and playtime have declined in light of the new standardized tests and academic expectations. Ohanian discusses the necessary benefits of recess (76-79).

Overall, this chapter demonstrates that the academic expectations are unrealistic and unfair. They arguably can be interpreted in various ways and often even parents would have trouble determining the correct answers.

Chapter 4 examines the many ways in which a curriculum based on standardized tests places others in unfair positions. For example, teachers are restricted in their creativity and, in a sense, their humanity—especially if it interferes with test preparation. Often teachers are admonished and/or suspended for voicing their true opinions of the standardized tests.

Many claim that standardized tests are influenced by culture and family-income. Schools in higher income areas can afford pre-tests and extra tutoring, while schools in lower income areas must focus on using money for necessities, like breakfast (110-114). Furthermore, money that could be used for actual school improvement (repairing old buildings, maintaining a safe physical environment) is often used for “questionable bonuses for improved test scores” (117). In addition, school priorities seem mixed up when schools turn to parents to supply necessities (soap, toilet paper, art supplies, etc.) (110-120).

One of the most common arguments against standardized tests is that it does not address all learning styles and needs. Ohanian examines the learning potential and successes of those children in her special classroom for “low readers” (122-130). She discusses how these children

“out-perform” many students considered high readers. And, some of these students are now enjoying successful careers, making twice as much money as their elementary school teachers.

Chapters 6 explores, in even more detail, the actual setbacks of an educational system based on standardized tests. Children are often viewed as statistics, many needs ignored because they do not improve test scores. Many claim that standardized tests are more difficult than the SATs (183-185). In addition, the material on standardized tests does not reflect real-world needs and expectations. Ohanian uses algebra as an example of the math requirement that is often irrelevant in the real world (186-191). Ohanian also discusses the fact that those designing the tests are not “experts;” basically, they do not work with children. How, then, can they determine a child’s academic needs and the way they look at the world (199)?

The final chapter examines parent, teacher, and children’s responses to these tests. Many parents are angry for a variety of reasons.

- Homework time takes away from family time (203-205).
- Book-bag weight is now a health concern (207-208). The amount of material needed to take home each day is excessive and causes the weight of the book-bags to become a valid concern.
- The tests place too much stress on children (212).
- The test “narrows and restricts the curricula” (217).
- Ohanian examines the organizations that have developed to fight standardized tests and a standards-driven curriculum. She mentions that many teachers are resigning (227-230). Furthermore, many students are fighting back (234-237).

Ohanian: Relevance and Implications

Although this book is primarily a call to action, it does portray relevant issues that face most educators, students and parents. Our educational system is based heavily on state standards and those standards are reflected on the standardized tests. Controversy exists over this type of system. Many argue that we need some way to determine if our children are learning, and, how much they are learning. Standardized tests are the best way to do this. Others argue that the disadvantages of standardized tests outweigh the benefits and that we need to base our educational system on a more inclusive curriculum that better addresses a child's needs in many areas. We cannot discuss the future of our classroom without understanding the frameworks surrounding it.

Discussion and synthesis of relevant information

This section gives us a look at today's kindergarten classroom. Both Campbell-Rush and Leuenberger discuss the different ways to help children develop specific skills. Visuals (bright colors, pictures, large objects) are an important part of the classroom. Recess and play are considered crucial for developing different skills. Exploration of the environment (Choice Time, centers/stations) is critical to the kindergarten classroom. Although neither author condemns the educational system and they both acknowledge the importance of adhering to curriculum standards, they also find it important to consider what the child needs at different periods of cognitive development. And both authors stress that children develop at different rates; thus the classroom should be set up to stimulate different stages in different children.

Ohanian reinforces much of what Campbell-Rush and Leuenberger claim is important for the healthy development of the kindergarten child but she is stronger in her insistence that the heavy reliance on state standards has hurt the classroom. Important necessities in the classroom curriculum (e.g. recess and play) are declining. The child must fit the standards instead of the standards accommodating the child. Ohanian believes this creates an unfair and stressful environment for the child. A kindergarten classroom should be just the opposite—inviting and warm. The NAEYC’s position statement strengthens Ohanian’s argument. They believe the standards based classroom unjustly labels the child—it does not leave room for individual needs and different stages of development.

The Ready To Learn (RTL) program discussed in Brigman and Webb’s article identifies specific skills necessary for success in kindergarten. Like the other authors in this section they maintain that children achieve these skills in different ways depending on their individual needs. The classroom should adjust to help these children. Brigman and Webb advocate programs such as RTL that will help the children develop certain skills in the regular classroom (therefore possibly reducing the need for retention and separation).

All of the material in this section shows us that the physical environment is important for the kindergarten child. It also demonstrates that the classroom is built upon specific standards and the teachers must adjust their curriculum according to these standards. And, most importantly, all of the authors in this section show a respect for individual needs among the children and encourage the classroom curriculum to reflect a similar respect.

CHAPTER 5: DISCUSSION AND ANALYSIS

The Process

The material examined in this meta-analysis is but a small sample representative of research and theory pertaining to children and learning with regards to technology. But even a small sample accentuates issues and concerns that merit attention and respect. By following certain guidelines, the meta-analysis provides a basis from which to present and create important questions as well as determine future paths to explore. We will look at the information gathered from the meta-analysis and present different ways of interpreting its meaning and relevance.

Each section of the meta-analysis contains clues that help identify key issues within different disciplines. A broader look at the full meta-analysis discloses concepts recurrent among different disciplines. (See Table 2 for a display of the different disciplines and journals represented in this meta-analysis.) Using the terminology and databases discussed in Chapter 3, over 125 articles, reports and books were examined. Of these 125 articles, sixteen articles were selected that fit the parameters. One report and three books were also included that deal with current classroom curricula and educational concerns. The disciplines represented in this meta-analysis are a result of the meta-analysis, not of any specific interest on my part. The disciplines represented in the final meta-analysis are Developmental Psychology, Neuroscience, Child Psychology, Educational Technology, Educational Leadership, Multidisciplinary, Technology, Language and Literacy, and Classroom Curriculum (see Table 2).

In this section of the meta-analysis, we will explore the concepts that make up the different articles and books and we will discuss their relationships, their relevance, and their perseverance across disciplines. The following concepts (with some variation in wording) are repeated more than once within different articles (see Table 3a-c):

- 1) Challenging problems and engaged learners; “hard fun”
- 2) Linear thought process and traditional learning
- 3) Interactive environments
- 4) Constructivism
- 5) Spatial representation in virtual environments; spatial performance and skills
- 6) Narratives; stories; role-playing
- 7) Active learning; Learn by doing
- 8) Relevance and meaning within learning; situated learning
- 9) Multiple learning styles
- 10) Control and exploration of environment
- 11) Intrinsic Motivation
- 12) Play as learning (including recess); dramatic play
- 13) Attention demand; attentional skills
- 14) Multiple stimuli, multimodal
- 15) Rule-based, following rules
- 16) Failure, retention
- 17) Standardized tests

18) Developmental stages (cognitive development)

19) New Learners; new literacies

Using these concepts we will examine their “story;” their relationship to learning and computer games. We will start with questions and demonstrate how these concepts shape the answers.

Modifications to the Initial Research Process

After an extensive exploration and retrieval of material related to the research questions, a few minor adjustments were made. The most crucial pertains to curriculum. An extensive amount of material is available about elementary school curriculum. For the purposes of time, clarity, and focus the section of the meta-analysis dedicated to curriculum was limited to kindergarten curriculum. Kindergarten was chosen for two reasons: 1) Kindergarten is the transitional grade for children from informal to formal schooling, and 2) the ages represented in kindergarten are 4-6 which covers 3 of the 5 years targeted in this research. The books chosen for kindergarten curriculum fit these guidelines:

- 1) Popularity: Books chosen were the in the top ten of the lists for books on kindergarten curriculum for Amazon.com.
- 2) Credibility: They were written by teachers of kindergarten classrooms with over ten years of experience in the classroom. The publishers are respected leaders in educational field (Scholastic, Crystal Springs, and McGraw-Hill).
- 3) Practicality: They are written primarily for teachers and educators.

What makes learning a successful experience?

A critical part of the learning process for young children is *play*. The concept of play is repeated numerous times and in numerous articles (Ohanian, Campbell-Rush, Leuenberger, Bertolini and Nissim). Play is an important part of the kindergarten classroom (Ohanian and Campbell-Rush). It helps the child adapt to her environment and it helps the child learn social skills critical for success in the classroom. Play is also an important part of *motivation*; and *role-playing* and fantasy are ways to explore and understand important information.

Another important part of the learning process is the *environment*. This not only means an environment that contributes to and stimulates the learning process, but also an environment in which the learner has *control*. Gee in both the article “Good Video Games and Good Learning” and his book *What Video Games Have to Teach Us About Learning and Literacy*, reinforces the importance of control in relation to learning and the video game. The learner should be able to *interact* with the environment. The environment also plays a critical role in *cognitive development* and certain learning theories such as constructivism (Salomon 5-7). The environment should encourage the development of certain *cognitive skills*.

Attention is also critical to learning. Not only does attention mean the ability to listen but also the ability to divide attention to retain more information. Many argue that attention skills are declining because of over-exposure to computer games (Healy). Others argue that the child must develop more and different attention skills in order to succeed in a virtual world (Prensky, Labbo, and Subrahmanyam et al).

Also important to learning is the way in which information is presented. Children have different *learning styles* and may respond better to one type of *stimulus* over another (e.g. Simpson, Jenkins, Gee, Smith, and Labbo). Different learning styles may require different presentational modes. In other words, learning is most effective when it is presented in a *multimodal* manner. Some of today's most prominent educational leaders (e.g. Howard Gardner and Mel Levine) reinforce the importance of different learning styles and needs.

Many believe that a deeper type of learning occurs when the content is *challenging* and fun (Jenkins, Dickey and Meier, and Gee). "Hard fun" is a concept explored by Seymour Papert who believes children want to be challenged. If the content is too easy the learner cannot grow.

Many also believe that learning should be *active* (e.g. Schaffer et al, Leuenberger, and Copple). Learners *learn by doing*, by constructing (Salomon). These are all concepts pertinent to the theory of *constructivism*.

Another crucial part of the learning process is *motivation*. Many argue that a learner is apt to learn more quickly and eagerly if the content is *meaningful* and/or *relevant* to their own lives and experiences (e.g. Gee, Leuenberger, Salomon, and Dickey and Meier). Many educators also discuss the idea of *intrinsic motivation* claiming that the learner will be more persistent and successful if the motivation is actually intertwined with the mode of learning (e.g. Jenkins).

Why are computer games relevant to the learning process?

Computer games are relevant primarily because they are a part of the child's *environment*. Statistics and research not only show that most children in the United States are

familiar with computer games but that this familiarity is increasing (Rideout, Vandewater, & Wartella 12). Studies in early childhood development show that the child must be comfortable and familiar with her environment. Ignoring a critical component of their existing environment simply does not follow the foundations upon which early childhood development is based.

Computer games also rely on *narrative and storytelling* to engage the user. *Role-playing* within the story is a prominent part of the computer game. Role-playing as a part of storytelling is not new to the classroom, specifically the kindergarten classroom where role-playing is a critical component of the learning process.

Computer games introduce a new *space* in which the child can learn. This space is often three-dimensional and encourages the development of skills that may not be needed in a more *linear-based*, traditional classroom. For example, because a computer game incorporates sound and animation (visual) the child must learn to develop *attentional skills* that allow for selective attention. In a traditional classroom in order to succeed at a spelling test the child must be able to focus on writing the word, usually in a quiet environment, while the rest of the class also takes the test. In a computer game, in order to succeed, the child may have to cope with rapidly moving objects and loud sounds while staying “on task.”

The *space* of the virtual environment also demands the development of certain *spatial skills*. The child is not watching the environment; she is part of the environment. Her place in the learning space is different. She must develop a sense of continuous movement that allows her to deal with other objects in her space.

How can a better understanding of the learning promoted through computer games help the current classroom?

The current classroom is based on *standards*. These standards are “state specific” but must adhere to federal guidelines (No Child Left Behind Act). Although there exists much controversy over the No Child Left Behind Act (NCLB) and a standards-driven curriculum, this is the root of our current educational system. Furthermore, all states must issue a content oriented assessment exam (*standardized test*) upon which the schools are evaluated. This has encouraged the classroom to focus heavily on the specific material presented in the exam.

The criticism against the NCLB and standardized tests focuses on these major issues:

- 1) Failure is commonly associated with low scores on standardized tests.
- 2) Retention is often linked to low test scores.
- 3) Different learning styles and needs are ignored in favor of a one-size-fits-all, drill and skill curriculum.
- 4) Recess and play is limited and sometimes eliminated because of the need to prepare for the test.
- 5) Creativity of both students and teachers is stifled because the arts and more creative subjects are phased out.

Computer games can provide a means to address these issues without revamping the whole educational system. For example, research in computer games show that they are multimodal; they address multiple learning styles. Children do not focus on failure within video games because they can keep trying until they succeed. Role-playing is encouraged in computer

games giving the material relevance and meaning. A child has control over the environment helping them develop a sense of importance and a desire to move forward.

Although simply placing computer games within the classroom surely would not be the answer, understanding what and how these games are successful may help educators develop tools that incorporate certain aspects of the computer game. This understanding may also guide future test designers.

Rules are also very important to both computer games and classroom environments. Without rules the game can not be played; and, likewise, in the classroom, without rules the child can not advance. Understanding and respect for the rules are critical in both environments, but *not* following the rules results in different consequences for each environment. In a traditional classroom if a child breaks the rules he could 1) be alienated from his peers (e.g. they do not want to play with him anymore because he cheats), 2) be punished, or 3) fail to learn the material (e.g. he used a calculator to do his addition for homework, so when he took the test without a calculator he could not solve the problems). However, in a computer game, if the child does not follow the rules, she simply cannot perform. There is no failure. There is no punishment. There is no alienation. None of this can occur because the child cannot participate until she follows and understands the rules.

How do we “change” the classroom to address the needs of our children?

It is important that one thing remains clear: all of the articles that deal with technology in this meta-analysis and all of the research related to technology examined during the process of

this meta-analysis (including but not limited to the material in the works cited list) support the idea that computer games play a large role in the lives of children. Whether or not the influence of the computer games is positive or negative is another story. The material discussed in the actual meta-analysis provides us with a picture of the current kindergarten classroom, an understanding of cognitive skills that are important to the learning process of kindergarten children, and a connection between traditional classroom learning and the learning provided through computer games. Upon examining all of the material in this meta-analysis, I have identified two different schools of thought related to computer games and the classroom:

- 1) Bring computer games to the classroom. Tailor the games to the specific curricular goals.
- 2) Identify elements of learning within the computer games that makes the learner successful and incorporate them into the curriculum.

How and why should we bring the computer game to the classroom?

One of the most obvious arguments for bringing computer games to the classroom is that it makes the learner want to learn. This is apparent in Jenkins' discussion of intrinsic motivation and Dickey and Meier's discussion of engaged learning. If the child wants to learn they will continue to learn. The computer games are designed to catch and keep the interest of the user.

Another strong argument for the computer game is that it develops certain skills necessary to succeed in the "real world." For example, Leu discusses a change in the way information is presented and accessed. The computer game provides the child with a familiarity of new text, surrounded by graphics and movement. Choices must be made in this environment.

Learning to select information in a virtual environment is a necessary skill that most will need to acquire in order to succeed in education and in many work environments. Labbo stresses the importance of being able to manipulate different modalities in order to communicate.

What seems to be a favorite argument for the use of computer games in the classroom is that they can be adapted to incorporate relevant material. Shaffer et al discuss specific video games arguing that the communities we create through the video game are a crucial component to their value as a learning tool. Prensky argues that good video game design can make a game an important tool for the classroom.

Another important argument in defense of the computer game as teaching tool is that children are familiar with it. They know the video game and use it regularly. They are not afraid of it. The child should find meaning and relevance in their learning—this would be easier to do if the child could use tools that were familiar and friendly.

Actually bringing the computer games to the classroom, re-designing them to fit curricular goals and cognitive needs, is a huge task. Much research and testing would be needed to determine which games would work. The schools would have to pay for the games. And, the teachers would have to train on the games.

Why should we re-adjust the curriculum to address specific learning skills associated with computer games?

We should change the curriculum because it is currently designed for children that are no longer part of the educational system. For example, computer games are re-defining text and the

literacy required to interpret the text. Leu, Labbo, and Smith all urge that we readjust current classroom teaching methodologies because they do not account for shifting definitions and new modes of learning. Shaffer et al, Simpson and Prensky also discuss the concept of what they believe are new learners. If we have new learners, then we should have a new curriculum.

Another reason to adjust the curriculum is that it does not work for everyone. Individual needs and multiple learning styles arguably make the current curriculum ineffective. Ohanian avidly supports this position. Many others side with her. For example, Gee advocates a need for a change in the classroom arguing that the traditional classroom simply does not and cannot address children on an individual level. The NAEYC claims that children are often termed “failures” because they are not at the same developmental stage as other students of the same age or grade level. They argue that children do not all learn the same way—their individual learning styles and needs should be respected.

Learning through computer games promotes an interactive environment with multiple modes of stimulation. It encourages the development of certain visual, spatial and symbolic skills. It demands attentional skills not always represented in a traditional classroom. It creates a situated learning environment. Motivation is incorporated within the learning experience (intrinsic motivation). If we accept these as definitive components of computer game learning and we accept that children are spending a significant time playing computer games, then we may want to consider capitalizing on the learning that is already taking place in homes across the country. Changes could be as simple as helping the teacher define and focus on important areas of concentration within the curriculum. Or, they could be more complicated, such as creating new standards for the entire school system. Most of the changes would be represented through

the tools and materials used in the classroom. For example, if interaction is an important part of the way a child understands and pays attention to narrative, then a teacher may choose story-time to be more interactive. She could read a story and ask a child to shake a tambourine every time they hear a certain word. This would be a simple adjustment and it would make story-time more interactive instead of passive. Asking questions as the children interact would help maintain a higher level of comprehension while the child listened for the “word.”

The strongest reason to change the curriculum to address new and/or necessary learning skills is that the curriculum is for the child—not the teacher, not the parent, not the government. This is an ethical argument that we as a culture should respect. We, as conscious citizens, should take time to examine the children as individuals affected by their environment. The educational system should be designed to benefit the child, to help her develop skills necessary not only for survival but also for success in our society. Unless we truly believe that learning should always be the same, no matter the culture, the environment, the individual, then the curricula should reflect changes, cultural differences, and adaptations. This argument is theoretical but is reflected in many of the articles (e.g. Gee, Shaffer et al., and Simpson).

Visual Representation of the Meta-Analysis

The following charts provide a visual representation of the meta-analysis. The first chart (Table 2) lists 10 different fields and links them to the different articles. The next set of charts (Table 3a-c) shows the frequency of the different concepts that were chosen as part of the analysis. The shaded regions demonstrate the different sections of the meta-analysis into which

the articles were divided (The Brain and Learning, Video Games as Learning, Text and Literacy, and The Current Kindergarten Classroom respectively).

Table 2: Various Disciplines Represented in the Meta-analysis

DISCIPLINE/FIELD	JOURNAL TITLE	AUTHORS
Developmental Psychology	<i>Journal of Applied Developmental Psychology</i> <i>Theory Into Practice</i>	Carol Copple Subrahmanyam et al Gavriel Salomon
Learning and Cognition	<i>Report for Spencer Foundation regarding Learning and Cognition</i>	Patricia Greenfield
Child Psychology	<i>Child Psychotherapy</i>	Roberto Bertolini and Simona Nissim
Neuroscience	<i>Neuroimage</i>	Goh Matsuda and Kazuo Hiraki
Educational Leadership	<i>Educational Leadership</i>	Henry Jenkins
Educational Technology	<i>Educational Technology Research and Development</i>	Michele Dickey and Sid Meier
Multidisciplinary	<i>PhiDeltaKappan Independent (WWW)</i>	David Williamson Shaffer et al James Paul Gee Marc Prensky
Technology (general)	<i>TechTrends</i>	Elizabeth S. Simpson
Language and Literacy	<i>Australian Journal of Language and Literacy</i> <i>Journal of Early Childhood Literacy</i> <i>Reading Teacher</i>	Linda Labbo Cynthia R. Smith Donald J. Leu
Current Classroom Curriculum and Issues	<i>Books</i> <i>NAEYC Report</i>	Peggy Campbell-Rush Constance J. Leuenberger Susan Ohanian NAEYC

Table 3a: Frequency of Concepts

	Challenging problems engage learners	Linear thought & traditional learning	Interactive Environment	Constructivism	Spatial Representation & Performance Visual & Iconic Skills	Narratives, stories Role Playing	Active Learning- Learn by doing
Copple				√	√		√
Salomon			√	√			√
Subrahmanyam et al					√	√	
Greenfield					√		
Matsuda & Hiraki							
Bertolini & Nissim						√	
Jenkins	√		√				
Prensky		√			√		
Dickey & Meier	√	√	√	√	√	√	√
Shaffer et al						√	√
Gee	√	√	√			√	
Simpson						√	
Labbo							
Smith						√	
Leu							
NAEYC							
Brigman & Webb							
Leuenberger						√	√
Campbell-Rush							√
Ohanian							√

Table 3b: Frequency of Concepts

	Relevance & Meaning Situating Learning	Multiple Learning styles	Control & exploration (Environment)	Intrinsic Motivation	Play as Learning	Attention demand & skills	Multiple stimuli-Multimodal
Copple			√		√		
Salomon	√						
Subrahmany an et al						√	
Greenfield						√	
Matsuda & Hiraki						√	√
Bertolini & Nissim			√		√		
Jenkins	√			√	√		√
Prensky						√	
Dickey & Meier	√		√	√			
Shaffer et al	√						√
Gee	√	√	√				√
Simpson			√				√
Labbo						√	√
Smith					√		√
Leu							
NAEYC		√					
Brigman & Webb						√	
Leuenberger	√	√	√		√		√
Campbell-Rush			√		√		√
Ohanian		√	√		√		

Table 3c: Frequency of Concepts

	Rule based	Failure/Retention	Standardized Tests	Developmental stages (Cognitive)	New Learners/New Literacies
Copple	√		√	√	
Salomon					√
Subrahmanyam et al				√	
Greenfield					
Matsuda & Hiraki					
Bertolini & Nissim	√				
Jenkins		√			
Prensky				√	√
Dickey & Meier				√	
Shaffer et al	√				
Gee		√			
Simpson	√	√			√
Labbo					√
Smith				√	√
Leu					√
NAEYC		√	√		
Brigman & Webb					
Leuenberger	√		√	√	
Campbell-Rush	√		√	√	
Ohanian		√	√	√	

CHAPTER 6: CONCLUSIONS AND IMPLICATIONS

The following sections examine future implications of the meta-analysis. This examination will lead to suggestions and directions for our current educational system. We will step beyond the questions and parameters used for this research so that new directions may unfold. What knowledge we have about recreational technology should be applied to the classroom, especially since so much of what helps a “user” learn in the video game is relevant to learning development and classroom curriculum (e.g. interaction, rules, and multiple modes of stimulation). Examining what works in different learning environments can only help us create a productive environment that successfully addresses the new learner.

We will examine relevant educational foundations (such as constructivism) that seem to have much in common with the learning related to recreational technologies. We will also expand the discussion to include different multi-dimensional environments. This meta-analysis focuses primarily on recreational technology. However, many of the articles used in the meta-analysis also discuss the Internet. We will delve deeper into the discussion of the Internet while we examine its influence on learning. The Internet may not now be a large component of a 5-year-old child’s entertainment, but more and more children are exposed to the Internet at early ages.

The role of the teacher is also a subject explored repeatedly in the material used for this meta-analysis. We will expand upon this topic. Finally, we will suggest specific ways to address the learning needs of our students.

The Future—the Past: Constructivism

After examining the articles in this meta-analysis, common elements can be identified. The most interesting to me is the link between much of the learning related to computer games and constructivist concepts. I believe this to be extremely important because it reinforces the value of solid educational foundations. Constructivism is not a new educational theory, yet its similarities to the type of learning found in video games are remarkable. Many of the arguments that support video games as a positive influence on learning cry out for change in the educational system, for a new way of learning. They criticize traditional learning theories, explaining that they cannot be applied to the new learner. They discuss new literacies and new environments in which the learner must become fluent and familiar. Some scholars claim we must throw away everything and start over. Others, perhaps more realistically, ask that we incorporate new technologies into the curriculum to address new learning needs. Some support the value of previous learning theories and suggest that we focus on what works instead of what does not. I believe that too many similarities exist between constructivism and learning related to computer games for us to ignore (see Table 5.3). We need to examine these similarities and decide the directions our classroom should take.

Constructivism can be identified by two schools of thought: social constructivism and psychological constructivism (Richardson 1624-1625, Olsen 347, Huitt). For the purposes of this meta-analysis we will focus on psychological constructivism as its roots are in cognitive psychology and we are focusing on cognition and learning. John Dewey is often considered an early founder of constructivism. His theories view the child as an active learner. Seeds of

constructivism can even be seen in Rousseau's work (child as active participant in the learning process). Piaget also built his theory of cognitive development on constructivist concepts. Constructivist concepts have persevered because of their broad nature, but also because of the focus on cognition and development (specifically Piaget's theory of cognitive development). Prominent contemporary theorists such as Howard Gardner and Seymour Papert have drawn from constructivist theories. Generally, psychological constructivism claims that the learner, the child, learns by doing—by constructing. The environment is critical to the learning process. The “individual's processing of stimuli from the environment” is a crucial aspect of constructivist learning (Huitt).

After examining the work represented in this meta-analysis it is apparent that much of the learning found in computer game design and play is constructivist in nature (see Table 5.3). Salomon's article specifically identifies the similarities. Other authors also mention constructivism and/or concepts that are traditionally associated with constructivism. For example, Dickey and Meier discuss the concept of engaged learning, a theory that has both constructivist and cognitive aspects, when they argue that engaged learning is a critical part of computer games. Copple's discussion of the High/Scope curriculum mentions that this curriculum is “based on the constructivist view that the child is an active learner who learns best through direct personal interaction with the world and through opportunities to reflect on this interaction” (767). Although her article does not examine technology, it does examine teaching strategies that are successful and she defines what makes them successful (e.g. reflection and interaction with environment). These terms are repeated in other articles. For example, the term “active learner” (or some form of this term) is repeated in several articles with regards to

learning and computer games (e.g. Shaffer et al, Dickey and Meier, Gee, Prensky and Salomon). Using Salomon (whose article is examined in the meta-analysis), and psychologists and educators associated with constructivism (e.g. Jerome Bruner, Howard Gardner, Seymore Papert) we will examine different constructivist concepts and the role they play in learning and computer games.

The Environment

The environment is a critical part of the learning process. Piaget encourages the child's interaction with the environment. Gardner discusses Spectrum, a new approach to assessment that provides a rich environment filled with different activities/stimuli. The children explore and develop at their own pace, choosing what appeals to them. The teachers serve as guides, helping the students become familiar and adept with the different activities (Intelligence Reframed 135-138). He claims that in this environment "Most children found it comfortable and inviting to explore the range of materials, and over the course of a year or more, they became more sophisticated with these materials" (Intelligence Reframed 137).

The environment is also a critical part of computer games. The games provide an environment with multiple stimuli. The user must read text, listen to sounds, follow movements. Their interactions with these components of the environment result in mastery of certain skills and/or an understanding of concepts.

Motivation and Engaged Learning

Motivation is an important part of learning. Gardner discusses ways to engage the student; e.g. narration, hands-on, aesthetic (Intelligence Reframed 136-138). Bruner argues that meaning is an integral part of the learning process. It is a necessary part of motivation; “Ideally, interest in the material to be learned is the best stimulus to learning, rather than such external goals as grades or later competitive advantage” (14).

Jenkins discusses intrinsic motivation in his article, claiming that this is why the individual continues to learn, to progress, even when the material is difficult. He refers to Seymour Papert’s discussion of “hard fun.” The important thing about intrinsic motivation is that the reward does not come only at the conclusion of the activity—the activity itself is the reward. This is important in constructivist theory because the child responds to her environment and actively seeks to progress—they choose to master the activity and/or the material because they are motivated and it has meaning/relevance.

Active Learning and Interaction

The child constructs her learning. She is an active participant of the learning process. Learning is not passive, nor is it linear. It moves in many directions based on the relationship of the individual to the environment. These are all basic ideas associated with constructivism (Huitt, Salomon, Copple). Likewise, learning in computer games follows the same ideals. The user is active, making choices based on her relationship to the environment. Learning in computer games is not linear—it involves actions and reactions, relationships, and multiple modalities. The user must interact in order to learn. This learner does not passively receive

information and “remember” it. This learner actively creates and defines information as she develops skills and knowledge through active participation.

The Present

I have only listed a few concepts that are generally associated with constructivism; there are more (see Table 5.4). research supports these associations and reveals many more similarities between constructivism and computer game learning. I believe it is extremely important to recognize the constructivist concepts because it demonstrates value in solid educational foundations and research. It also points to a strong relationship between cognition and educational practice. In addition, it reveals a link between learning within computer games and learning within formal education. (We must remember, however, that even though much research has been done in the area of constructivism our current educational system is more representative of a linear, passive type of learning.)

We should learn from our past. Maybe what works with the learning that takes place in computer games is not so new, so innovative. It may be another way of looking at our past—of understanding how to use our past to create a meaningful future.

Furthermore, this meta-analysis reveals a need to accept new definitions. By accepting new definitions, by understanding what makes them important, we respect our future generations. However, the strong links between constructivism and the learning in computer games also demonstrate the importance of examining and respecting the past. The text may be shifting, expanding; but it is still *text*, our way of communicating and understanding the world in which we live.

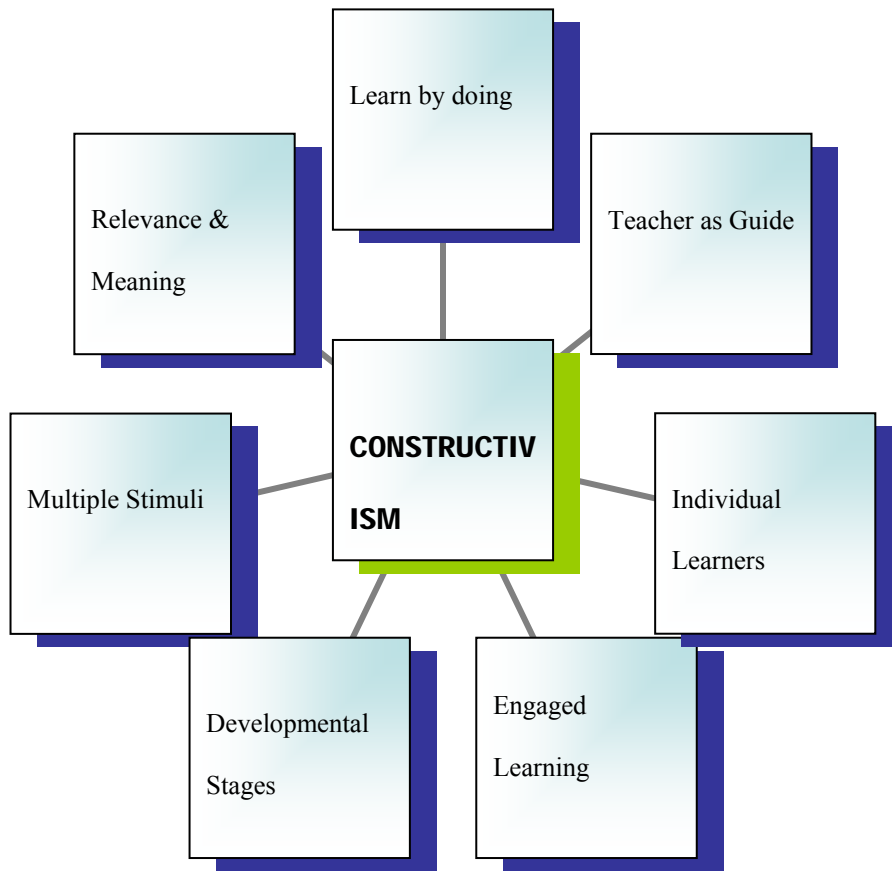


Figure 1: Concepts Related to Constructivism

Other Concerns—Future Directions

The Internet

At the beginning of my research, I chose to focus primarily on computer games and their impact on learning. This led to a discussion of learning in today's world, and a focus upon formal elementary school education. Although I intended to limit my research and discussion to recreational computer games, I now feel it necessary to expand the discussion. Future research on how technology (outside of the classroom) affects learning should focus on two areas: 1) video games and other recreational technologies, and 2) the Internet (World Wide Web). We have discussed how technology affects learning, focusing specifically on spatial skills, multimodal learning, engagement, environment, multiple learning styles, etc. How does the Internet affect learning?

Like recreational technologies, the Internet incorporates text, graphics, and sounds within its arena. A user can manipulate and explore the environment through the mouse, a pad, or direct touch to the screen (and in some cases through vocal commands). The user can choose his or her direction from a variety of locations on the screen, including shifting images and graphics. In other words, the Internet is multi-modal and can easily address multiple learning styles. It promotes the development of skills that are unique to an interactive, fast-paced environment. However, the Internet expands its influence on learning by shifting the parameters often associated with communication and information. Understanding and communicating information is a crucial part of education. Traditionally, text, speech, and visuals are used to communicate information. The Internet adds the elements of time and space. The ability to change and manipulate the format of information forces us to deal with the questions of meaning

and relevance. It also adds room for more interpretation and access to a seemingly endless amount of information. This leads us to the question of how we prepare our students to deal with the kind of information and communication that is currently dominating our culture.

Video games and the Internet provide an arena in which the user is faced with multiple forms of text. Video games and the Internet demand a fluency in reading through text as an inscribed code, as a flashing picture, as a sound, as a detailed graphic image--each of these must be understood both individually and as a part of the whole. An understanding of the content is necessary if the reader wishes to decipher meaning and relevance. In order to understand meaning and relevance the user must also be able to determine credibility. In a video game meaning and relevance is determined by success in the game. However, on the Internet content and an understanding of its relationship to the user's goals determine meaning. Without a means to decipher meaning and relevance throughout the expanding texts available on the Internet, the user thus loses her own understanding of truth--of what matters--of herself in relation to the world.

Many studies and organizations have critically examined media, specifically the newer media framed by the Internet and simulated environments. A new kind of learning is encouraged, one often termed as media literacy and/or media awareness.

Media literacy seeks to empower citizens and to transform their passive relationship to media into an active, critical engagement—capable of challenging the traditions and structures of a privatized, commercial media culture, and finding new avenues of citizen speech and discourse. (Wally Bowen, Media Awareness Network)

Non-profit and educational research organizations provide an enormous amount of information for educators, parents, and concerned citizens about how to successfully understand and interpret meaning through an immense volume of information. The Media Awareness Network is a non-profit, award-winning Canadian Organization dedicated to the promotion of media awareness. One of their main goals is to promote media awareness as an integral part of education. The Center for Media Literacy (United States) is a web-based organization, whose goal is to promote media literacy through education and research.

The Center for Media Literacy is dedicated to a new vision of literacy for the 21st Century: the ability to communicate competently in all media forms, print and electronic, as well as to access, understand, analyze and evaluate the powerful images, words and sounds that make up our contemporary mass media culture. Indeed, we believe these skills of media literacy are essential for both children and adults as individuals and as citizens of a democratic society.(Center for Media Literacy)

The Internet is not the primary focus of this meta-analysis, but it is critical to acknowledge its impact on learning and the classroom. Future research may uncover similarities and differences between the learning necessary for video games (engaged learning and simulated environments) and the learning necessary for Internet navigation (communication, access, and meaning). These discoveries can lead to more suggestions for curriculum development and classroom structure.

The Teacher

This meta-analysis focused primarily on the child and the classroom, with some discussion of the teacher. After my findings, I feel that changes will be limited and minor unless an understanding and respect for the role of the teacher is achieved. The role of the teacher is shifting; new definitions are surfacing. For example, in a magazine produced by the National Association of Elementary School Principals (NAESP) the teacher's role moves from one of "arbitrator of knowledge" to "connector." The teacher helps connect the student to the information. Marc Prensky considers the teacher a facilitator, a guide. The larger issue, however, is the difference that technologies play in the lives of our teachers and students. How do we bridge this divide—or do we? Prensky specifically discusses the divide when he defines today's children as digital natives. The teachers are not fluent in the language, the world, that our children have grown up with. How do we teach our children in a language we are unfamiliar and uncomfortable with? And, what of our traditional language do we preserve?

Unless we ask these questions and create specific goals and instructional models for our teachers, we risk losing communication and understanding between student and teacher. This could lead to the fall of the classroom. How can a child learn without communication? The teacher is the link between the child and learning. True, many may argue that the technology has now become the link; but how does the student learn to understand meaning and structure without some idea of meaning and structure in our culture? The teacher provides a relationship with the child that is not available within the technology—the teacher represents the culture, the morals, and the standards of our society.

A major obstacle that faces our teachers is the technology. Many students are more fluent with technologies than are the teachers. Furthermore, the students are spending an abundant amount of time interacting with new technologies that do not share a place in the teacher's life. How, then, does the teacher learn to understand the needs (and strengths) of her students?

Yet their [teachers'] students learn from being engaged, doing, gameplay, random access, exploring options, multitasking, having things personalized to them, and going online. So, when dealing with their students teachers often feel like immigrants, who speak a different language. (Prensky To Educate)

As the teacher struggles to communicate with her students she must help them develop skills necessary in their world. As mentioned earlier, in the discussion about the Internet, critical thinking skills are important in a high-tech world. These skills help students decipher meaning and make choices that lead them to desired and credible information. Perhaps a focus on teaching strategies that help a student develop critical thinking skills is a good place for our classroom to start.

Personal Recommendations

“Thus re-constructing the classroom as an interactive interface opens up a realm of possibilities that encourage active learning and the development of higher cognitive skills” (Templeton 32).

In earlier research I discuss the classroom as an “interactive interface” that can better address the needs of our children. Although I used this term as a part of the theory of Fun-Time Education; a concept that uses interaction and play to teach elementary school students, I feel it particularly relevant to my current research. Johnson defines the interface as “a kind of translator, mediating between two parties, making one sensible to the other” (14). Using this definition of the interface we can begin to see how critical the interface becomes in many environments—in this case the classroom environment.

Like the computer screen, the classroom should present itself as an interface, a screen leading to an exciting world that stimulates the student through visuals and graphics, sounds and music, shifting text and pictures. The students can make choices as they explore this world, deciding to click on the text, or changing their minds and clicking on the blinking picture instead. The teacher’s role is to create an exciting interface while staying true to meaning, relevance, and content. The interface does not have to be in the form of a video game or the Internet. For example, let us look at ecosystems—more specifically the Rainforest. It is a common subject in elementary school science classes. As students enter the classroom they see pictures on the walls of different rainforest species. Maps are displayed with large red circles to show where the rainforests are located. After lunch the students watches a video about the rainforest. Later the

students make costumes for a play about the rainforest. Different students choose specific animals and plants to represent in the play. During reading time, books and magazines are available about the rainforest. The teacher even brings in a CD that has sounds of the rainforest to listen to during quiet time!

By paying attention to detail the teacher can create an interactive interface that addresses multiple learning styles, individual preferences, and state standards. The teacher also stimulates the development of critical thinking skills—the student learns by doing, by creating (e.g. the play and the costumes) and by reflecting upon elements of the rainforest that they see and hear in their immediate environment.

What is important about the interactive interface is that it helps develop skills necessary to survive in a fast-paced, easy-access culture. While it is important that we understand how the child learns and what skills they must develop, it is not necessary to turn to video games or other technologies for all the answers. The answers may already exist; it is learning how to mold and adapt them to our “digital natives” that becomes the hurdle.

Another important aspect of the interactive interface is that it *is* the text. We must teach our children to interpret the meaning and relevance of this text. In order to succeed in our world, they must be able to communicate using this text. The child enters the classroom already affected by technologies of which we, as educators, may have little knowledge. We cannot expect the child to adapt to *our* past, to become fluent with *our* text. Instead, we must accept that the *idea* of text remains the same—a means of communication. And, in order to communicate effectively, a true understanding of the existing text, whether it be static, shifting, expanding, and/or electronic, is imperative.

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