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Inquiry-based Instruction: Not All Fun and Games

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Dedication

This work is dedicated to my niece Sarah Banas in recognition of her insight, inspiration, and constant encouragement.

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I would like to acknowledge my advisor, Dr. Jeremy M. Browne for his patience and knowledge which guided me throughout the completion of this project. I would also like to acknowledge the assistance of my niece Sierra Tardy who volunteered to check the results of my game evaluations.

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Abstract

This study seeks to examine the role of play in learning in order to define how games may be used as an effective tool for instruction in an inquiry-based classroom. Given the multitude of games that are available that purport to be educational, an effective means of choosing games for the classroom is explored. The connection between the use of inquiry-based instruction and games is investigated with an eye toward developing criteria for assessing games for use in the classroom. Numerous online games were evaluated from four different websites to determine the usefulness of these criteria for discriminating between games that were purely drill and games that involved inquiry-based instruction.

Chapter 1: Introduction

The call for reform in education has been widely publicized in the United States for decades. Newspaper articles and nightly news broadcasts speak of American students lagging behind their peers in other industrialized nations. *Time* magazine described a "crisis in the math and science classrooms" as far back as 1982 (McGrath, n.p.). In the intervening years, this disquiet has not abated. Despite the ongoing outcry, education reform remains a prevalent issue among educators, politicians and corporate executives with most citing a lack of any significant progress. In a more recent article about education in the United States, Craver (2008) of Kiplinger Business Forecasts highlighted several significant areas of concern. He cited a high school dropout rate of 30%, a disturbing statistic which included an even more upsetting minority dropout rate of 50%.

The author also claimed that countless high school graduates do not possess the skills needed for success in higher level education or in the workplace. This assertion was supported by the results of a survey conducted by the Organization for Economic Cooperation and Development. In this analysis, the U.S. ranked 21st in science achievement and 25th in math out of the 57 industrialized nations that were included (Craver, 2008). Given current statistics such as these, it is evident that meaningful education reform has not been successfully implemented in the United States.

Attempts have been made to address the issue of science education in our nation's classrooms. In response to a perceived crisis in 1991, the National Science Education Standards were written by the National Research Council and funded by the Department of Education and the National Science Foundation (National Academy of Sciences, 1995). Their rationale for the creation of the standards was that an understanding of science would be an essential tool for the skilled workers needed to fill the technically demanding jobs predicted for the future (National Academy of Sciences, 1995). They go on to cite continually increasing demands of the business community in the midst of global economic competitiveness. When defining the methods for teaching their standards they stated that, “inquiry into authentic questions generated from student experiences is the central strategy for teaching science” (National Academy of Sciences, 1995, p. 42). As a result of this publication and numerous research studies into best practice teaching, “inquiry” seems to be the buzzword in science education.

While inquiry learning appears to be widely accepted as best practice teaching, it is still not standard practice in most science classrooms. A survey conducted by the National Science Foundation discovered that few teachers had an adequate idea of what inquiry entailed and that even though most teachers felt that their science lessons were well grounded in inquiry, the actual survey results were contradictory (Jeanpierre, 2006). Perhaps one of the reasons for this is teacher unfamiliarity with inquiry practices.

Although the benefits of inquiry education have been touted as the basis for reform and its merits have been widely supported by the National Science Foundation (National Academy of Sciences, 1995), in my opinion, the implementation of inquiry practices in the classroom presents significant obstacles for the educator. Paramount among these obstacles would be their unfamiliarity with what real inquiry classrooms look like and how they function within the constraints of state and local curricula. It appears probable that those being asked to teach using inquiry methods have not had the benefit of this kind of education themselves. Even college level teacher preparatory courses are not usually conducted using inquiry practices, despite the fact that future educators are told to incorporate these enigmatic practices in their own teaching. Given their unfamiliarity with this approach to education, and an unclear definition of what inquiry instruction even entails, teachers may be reluctant to employ it in conducting their lessons.

It seems obvious to me that this unfamiliarity with the methods used in inquiry-based teaching also lead to concerns about classroom management. Teachers may see inquiry instruction as unstructured and time consuming. They may fear their classroom will become undisciplined and chaotic with little being accomplished that could be described as authentic learning. They might question its effectiveness in conveying basic concepts that will be assessed on standardized tests. In light of these perceived obstacles, it is understandable that teachers might teach in a way that is more traditional and familiar to their own experiences. Perhaps this is why I see many elementary science and math teachers who still use a lecture type format in their lessons. They instruct and provide the necessary information to students whose participation is often limited to note taking and the occasional raised hand in order to volunteer an answer in response to a teacher's questions. While this is not very engaging for most students, the teacher can be secure in the knowledge that all of the items required by the curriculum have been covered.

To reinforce memorization of any required details, student interest might occasionally be sparked by the announcement that a game in the form of a review exercise is about to begin. These games usually involve little higher level thinking with the winner or winning team being the one most successful at quickly recalling a litany of disjointed facts. In my experience, the winner's recall is most likely temporary and those facts will be forgotten soon after a test is given. Minimal authentic learning has been accomplished, and certainly not inquiry-based learning as prescribed by the National Science Education Standards (National Academy of Sciences, 1995).

So the questions remain. How can we implement teaching reform in the classroom? How can we encourage teachers to use inquiry-based instruction? And finally, is it even realistic for teachers to give up traditional lecture type instruction and expect to successfully use the inquiry model to teach core concepts when they are not familiar with this type of instruction themselves?

While inquiry instruction is uncharted territory for many, teachers might be amenable to using games in the classroom to enhance instruction especially if their role was not limited to that of a review strategy. The experience of playing games is familiar ground to most of us and most would not argue the fact that it is common for young children to learn through play and games, just as it is for young animals to learn the essential skills needed for their survival through play. Human beings may not need to learn to hunt or evade through games as we see animals learn to do in the wild kingdom, but young people can learn some necessary social skills through their participation in games, e.g. communicating, following rules, taking turns and sharing.

Because I accept the significance of play and games in learning, and I have seen games used successfully to teach the aforementioned social skills in pre-K and primary classrooms, and because I have observed how enthusiastically students react to the prospect of a game, I wonder if they can also be used in later grades as a model for instruction, specifically for inquiry-based instruction. In my experience, most games in the classroom are used primarily as rewards for good behavior or for content review.

While few would question the occasional use of games in the classroom for those purposes, and despite research into the role of play in learning which dates back to the times of Aristotle (Chambliss, 2004), the possible value of games as actual tools for learning core concepts that are aligned with state standards is not widely understood nor accepted. Fortunately, along with the increasing availability of technology in the classroom, new options for games and learning are now being explored and new research is being done into any possible benefits and downfalls (Elkonin, 2005; Foster, 2008; Hlodan, 2008; Nelson & Ketelhut, 2007; Simpson & Clem, 2008).

Problem Statement

This study proposes to examine traditional and emerging research into the role of play and learning in order to ascertain how games might be evaluated for use as full inquiry instruction in an elementary classroom, particularly in the areas of math and science. As a teacher, I am aware of the effort required to create lessons that are engaging for our students while staying within the boundaries of curriculum, time constraints, budget restrictions and classroom management issues. Therefore, I realize the necessity for defining any tools that could be an effective use of limited resources while adhering to the mandated state standards. Games that enhance learning may be one of these tools.

If one considers their entertainment value alone, games in the classroom might seem like an attractive option to both teachers and students, but it seems difficult to determine which types of games would be the most useful in teaching core concepts in a way that is cost and time effective, engaging, relevant, easily managed, and aligned with state standards, all while using best practice teaching methods, specifically inquiry-based learning. In this research, along with examining the role of play and games in learning, I hope to ascertain the effectiveness of games as tools to facilitate inquiry. In other words, can games be used to impart inquiry-based learning experiences to students? And if so, which games? Because of the myriad of options available when considering educational games for use by teachers, I propose to examine the prevailing literature on the subject not only to inform my own instruction, but also in order to develop a set of guidelines to be used by myself and others for the purpose of evaluating any games under consideration for use in the classroom.

Significance of Problem

Certainly, multitudes of options exist for any teacher interested in using games in their classroom as a teaching strategy. Indeed, a recent Google search by this author revealed over fifty million hits to the search terms “educational games”. These included links to the official sites for commercial entities such as Hasbro and LeapFrog®, and other nonprofit sites like PBS KIDS (sponsored by the Public Broadcasting Service), Smithsonian Education, and National Geographic.com which all offered free online games. The popular site *Funbrain*, which I have often seen used in elementary classrooms, appeared as the first link on the extensive listing with countless other pay-to-use offerings that followed.

Among the vast array of games advertised on these sites, there was a tremendous assortment that ranged from products as simple as flashcards, puzzles and building blocks to software creations as complicated as virtual reality simulations designed specifically for classrooms and popular off-the-shelf video games created for entertainment. With so many alternatives available, and all making some allusion to their educational value, the problem I experienced was a matter of discernment. I had no way of evaluating these games to determine if they were capable of providing worthwhile learning experiences for my students, especially those that would satisfy the recommendations of the National Science Foundation (National Academies of Science, 2005) regarding inquiry-based learning.

Rationale

My own unfamiliarity with the practices of inquiry has led me to search for effective ways to introduce inquiry-based lessons to my students. Before my undergraduate education classes, I had never heard the term "inquiry" used to describe instruction and it was certainly not anything I had experienced in my own education. By the time my college classes were over, I had heard the word bandied about so frequently by my instructors and peers alike that it had become something of a cliché, but in speaking with my peers, I realized that we all had different ideas of what inquiry involved. Some saw it as any hands-on task, while others defined inquiry as completely unstructured with the students all taking different tangents while satisfying their unique, individual needs. I assumed the path to inquiry lay somewhere in the middle, but I was definitely not comfortable with my vague understanding. I certainly had no idea what an inquiry lesson would look like in practice and I was more than a little apprehensive about implementing inquiry in my instruction. I suspected I was not alone.

I seldom saw inquiry methods being used in the classrooms I student taught in or the classrooms I eventually substitute taught in. It seemed like inquiry-based learning was an ideal that was spoken about in our education courses, but rarely put into practice in the real world of public schools. Jeanpierre's 2006 report concerning a survey by the National Science Foundation which demonstrated teacher unfamiliarity with inquiry methods affirmed my perception that authentic inquiry-based instruction was not common practice in most elementary math and science classrooms. Because of my own confessed unfamiliarity with inquiry, I needed to find a model for instruction that I could use in my lessons.

This model presented itself while I was designing a game to use with a group of 6th grade science students as part of a graduate school research project. The purpose of the game was to guide students through the use of the scientific method. I hoped to discover whether a game format could be used as a model for instruction while implementing full inquiry in an elementary science classroom. I also hoped to determine how effective a game format could be as a classroom management tool while encouraging higher level thinking *and* actively engaging students as they followed the conventions of the scientific method.

After using my game with five different sixth grade classes, the results of my informal study revealed that my game format was successful as a model for instruction and that the step-by-step game format I had employed allowed the students to explore in an inquiry-based setting while lending itself to structure in the classroom. I observed higher level thinking as it occurred and my students were actively engaged in their learning. The team structure made this an opportunity for constructivist learning and the lesson followed the mandates of the curriculum and national and state standards. If this was true of a game that I had created, it seemed obvious that other games must exist that would fulfill the same requirements.

This contention has led me to my current research which I hope other educators will find useful. I believe if we understand the natural learning that occurs during play, we can incorporate this type of learning into our inquiry-based lessons by using games as a model for instruction. By making teachers more familiar with the inquiry process, and showing them methods by which they can effectively integrate inquiry into their instruction, I hope we can create classrooms where full inquiry is presented to the students while keeping within the mandates of the curriculum. In so doing, I believe we will be providing the kind of science education that many are calling essential to our students' success according to the demands of this rapidly changing world.

Chapter 2: Review of Literature

Inquiry Defined

The National Science Education Standards (National Research Council, 1996) defined inquiry as such: “When engaging in inquiry, students describe objects and events, ask questions, construct explanations, test those explanations against current scientific knowledge, and communicate their ideas to others. They identify their assumptions, use critical and logical thinking, and consider alternative explanations” (p. 13). While this is the most quoted definition of inquiry-based learning that I have encountered, I prefer that of the American Association School of Librarians (1999) who also defined the teacher’s role in inquiry instruction:

- Inquiry-based Learning asks relevant questions that come from the higher levels of Bloom’s Taxonomy, which are comprehension, application, analysis, synthesis. Although, these are only different types of possible meta-cognition, when the questions teachers ask are classified, they become even more significant as the teacher moulds the learning environment and expectations (Bloom 1957).
- Inquiry-based Learning involves questions that are interesting and motivating to students. Real life forever poses problems, newer and more complex problems. By guiding students through those same scenarios we allow them to learn to solve problems in a supported environment with the help of their peers and their teacher.
- Inquiry-based Learning utilizes a wide variety of resources so students can gather information and form opinions. Because the Internet is not the safe place we would like it to be, teachers have the responsibility of keeping their students away from offensive material and safe from others users. We can do this by selecting the sites ahead of time. Reviewing the links on those pages and providing a “hotlist” of sites that students are allowed to look for information.
- Teachers play the role as guide or facilitator. The teacher uses their expertise to guide the inquiry lesson. The teacher is constantly evaluating the progress of the students and the direction the inquiry process is taking. (American Association of School Librarians 1999, p.43).

Clearly, and despite the misconceptions of many, inquiry-based instruction is more than any hands-on task that may be used in the classroom. It is also not a new philosophy that has just recently found its way into teacher preparation courses.

Foundations of Inquiry-Based Instruction

As far back as 1916, John Dewey was espousing the virtues of inquiry in the classroom. Building upon the research of Piaget and Vygotsky, Dewey (1916) believed that children constructed their own learning and that the role of the teacher was to provide them with the tools to do so. In his book *Democracy and Education* (1916) he made it clear that a student should not be a repository for information supplied by an instructor, but should instead take an active role in the learning process through inquiry and that "thinking is a process of inquiry, looking into things, of investigating. *Ac*quiring is always secondary, and instrumental to the act of *in*quiring" (p. 173).

As venerated as Dewey was as a philosopher and proponent of education, it seems that the idea of inquiry-based learning was not readily accepted. Subsequently, studies into education practices called for the implementation of new practices in the teaching of science. In 1940, Robert Mitchell (1940), a geology professor at Muskingum College in Ohio, was looking for an alternative to the standard lecture and experiment protocol used in his laboratory classes. He compared that standard format with a more student based experience where students were afforded with one-on-one conferencing and multiple attempts at completing and understanding their experiments before being tested. Mitchell was able to show that student success using this method overwhelmingly exceeded the success rate of the control group. The students had been allowed to explore at their own pace, and while the author of the study acknowledged the extra expense that would be created by providing such extensive individual attention, he concluded that the resultant learning justified any consequential expense.

More recent attempts have been made to address the issue of science education in our nation's classrooms. As stated previously, The National Science Education Standards were written in 1991 (National Academy of Sciences, 1995). These standards called for the use of inquiry-based learning in the classroom as the most effective way to ensure student success in an ever changing and technologically challenging world. In spite of this recommendation, Jeanpierre's 2006 study found it to be an uncommon practice and that many teachers were unclear about what inquiry instruction entailed. In fact, 51% of teachers in a 2007 study felt unprepared to use inquiry techniques in their science classrooms and only 39% reported having experienced this type of instruction in their teacher preparatory training (McComas). This unfamiliarity with inquiry-based learning by teachers in their own experiences seems to preclude its use.

The Trouble with Inquiry

Weld and Funk (2005) certainly found this to be true. They cited the need for inquiry-based college science courses to prepare prospective science teachers to present the same kinds of lessons in their own classes. Because most teachers tend to teach science in the same traditional way that they themselves were taught, and because most of their teacher preparatory courses were taught in that same traditional way, the authors contended that most teachers were ill prepared to follow the inquiry-based practices recommended by the standards. In order to alleviate this problem, the authors proposed to study the success of a fully inquiry-based curriculum in a biology content course that was required of all pre-service teachers.

Weld and Funk (2005) also discovered that many of their subjects had rated themselves as under confident in their abilities to learn or teach science at the beginning of the course. They did not see themselves as scientists. The authors claimed that great gains were made in these areas. By the end of the course, the study subjects felt much more confident in their learning and teaching skills. They also felt much more certain of their abilities to think as scientists. The same was true for their confidence in their knowledge of science and their beliefs that they could develop science lessons. Notably, the greatest growth was seen in these pre-service teachers' confidence in providing inquiry-based instruction to their prospective students.

Teacher confidence in their own abilities is not the sole obstacle to inquiry-based teaching. In an article written by veteran teachers Jackson and Boboc (2008) who also referenced recommendations by the National Science Education Standards for inquiry-based teaching of science, they explored many of the reasons their colleagues gave for not using these practices in the classroom. Among these were: time restrictions, material expense and availability, safety concerns, unequal sharing of workload by students, engagement of students and missed work by students. The authors found that their findings matched those presented in other studies. Given the importance of using good teaching practices in the science classroom in order to promote critical thinking by their students, the teachers collaborated with their colleagues to find solutions to the problems they had identified. The authors contended that there "will always be barriers to inquiry-based instruction, however, creative and resourceful teachers are able to conduct inquiry-based lessons in even the most unlikely situations" (p. 68). This article offered useful insight into providing student motivation along with proven methods of classroom management while allowing for scientific exploration.

Other studies have also found ways to alleviate teacher concerns about inquiry. Isabelle's (2007) study cited the same time restraints as Jackson and Boboc (2008) and proposed integrating science instruction with literacy. This author noted the many similarities between listening to a story and the study of science. Isabelle (2007) stated that both required "imagination, activation of prior experiences, knowledge, and imagery" along with a "community of learners, characterized by inquiry and discovery" (p.16). Other studies ((Fang et al. 2008, Zhihui, Lamme, Danling, & Patrick.,2006) have also proclaimed the virtues of integrating inquiry science with literacy instruction, but this is not always possible in middle school and high school classes where different instructors are responsible for the different curricula.

Jackson and Boboc (2008) also cited the need to follow mandated standards as an impediment to inquiry instruction. Concerns about this have been addressed by numerous studies inclusing those of Duran (2003), Brunsell and Hug (2007), and Pellathy, Paul, Cartier and Wittfeldt (2007). All found that inquiry-based instruction was useful in teaching students to use scientific methodology in the classroom as mandated by state standards, but they did not address the issues of limited time or teacher unfamiliarity with the use of inquiry-based instruction.

The use of scientific thinking and methodology are also the subject of a study conducted by the Better Learning through Adventure, Simulations and Telecommunication (BioBLAST) program, a collaboration between NASA and teachers and software designers (Carlson, Ruberg, Johnson, Kruas, & Sowd, 1998). The authors described this effort to bring technology and real life science together and gave glowing reviews on its efficacy as a teaching tool. Countless other studies have been done in an effort to introduce technology into the classroom. Some have described successes using virtual environments (Hutchison, 2007; Nelson & Ketelhut, 2007; Wagner & Ip, 2007) while other studies extol the virtues of digital games (Edelson, Gee, 2003., Hlodan, 2008., Simpson & Clem, 2008., Verenikina, Harris & Lysaght, 2003.,White, 1984). Unfortunately, as attractive as these learning experiences sound, most teachers do not have access to the extensive resources they require.

So, given the many difficulties involved in its presentation, is it really worth all of the time and effort? Segelken's study in 2007 exploring the power of inquiry-based instruction to influence student thinking cannot be overlooked. He was able to demonstrate that the use of scientific thinking is not a skill limited to the classroom. By affording our students with these skills, he showed how they could benefit from them outside of the classroom. In the article *Thinking Like a Scientist* he described a study which was designed by the National Science Foundation and the Cornell Institute for Research on Children. The aim of the program was to target children of lower socio-economic class who tended to drop out of high school science courses because of a lack of real world relevance. In light of this, the participants in the program were students considered to be at the highest risk level for dropping out of school completely. The students looked at issues that they felt were provocative and relevant, such as depression and its treatment, teenage pregnancy, and ESP.

This five week program focused on *Thinking Like a Scientist's* 4 R's of science "Revise, Reflect, Re-evaluate, and Review" (Segelken, 2007, p.21). Compared to control groups, and using the benefits of pre-test and post-test examinations, the research found significant gains in scientific thinking among the target group. These gains far outweighed those in the control group. The students of the *Thinking Like a Scientist* program also reported using the scientific thinking skills they had acquired in other aspects of their lives, such as analyzing personal problems.

While no one can negate the value of a good science curriculum in creating the scientists of the future, the results shown in Segelken's (2007) study showed that the benefits to society may far exceed those most obvious expectations. Creating children who can think critically outside of the classroom in all areas of their lives should be our primary goal as educators. Studies into inquiry education showed that it does just that. Given what is known about its benefits, the question remains, why don't we find it used more prevalently in our classrooms? I believe that the obstacles teachers encounter with its presentation are what prevent inquiry from being used. My research into the relationship between inquiry and play will attempt to address these issues while offering an accessible model for instruction.

The Study of Play

The significance of play in mental development has been recognized by philosophers and scholars since the days of Ancient Greece (Chambliss, 2004) and toy artifacts have been found in Asia that date back even further to 4800 B.C. (Brehony, 2006). Plato (n.d.) himself advised that "The most effective kind of education is that a child should play amongst lovely things." His pupil Aristotle expanded upon this thinking and argued that children learn best by doing. He recommended that teachers apply structure to student games in order to allow for the imitation of serious adult pursuits (Chambliss, 2004) while, much to Plato's consternation, Socrates argued that play was the ideal vehicle for learning and that education should never be forced on children (Brehony, 2008). Even though the philosophers disagreed on some points, they agreed that play was a valuable tool for learning.

Current thinking on the subject would agree with the assessments of those eminent philosophers, so much so that the American Academy of Pediatrics defined play as "essential to development as it contributes to the cognitive, physical, social and emotional well-being of children and youth" (Ginsburg, 2006). In fact, they cited the recommendations of the United Nations High Commissioner for Human Rights (1990) which asked that states "recognize the right of the child to rest and leisure, to engage in play and recreational activities appropriate to the age of the child and to participate freely in cultural life and the arts" (p. 9). It seems that Aristotle, Plato, The American Academy of Pediatrics and the UN would all agree that play is an integral component in the development of a child's thinking and that these thinking skills will prepare children to succeed as adults.

Play as Practice

For centuries, the view that play is practice for adulthood was widely accepted with a few notable exceptions. St. Augustine spoke of play as being wasteful and therefore sinful. These views appear to be shared by the Calvinists with their deeply rooted beliefs that a strong Christian work ethic, hard work and toil were necessary steps on the path to redemption. "Enlightened" thinking saw that these principles were rejected. John Locke supposed that education should be entertaining, and that the aim of education was to produce virtuous citizens. Locke's views became prevailing theory; that the purpose of play was to practice necessary skills (Brehony, 2008). Of course, he was not without his detractors. In the early 1860's, Herbert Spencer advanced the theory that play was the result of excess energy needing to be spent, and in the process imitative learning took place (Brehony, 2008, Elkonin, 2005).

While Locke and Spencer provided theories, no real studies were done into the role of play in learning until the research of German psychologist Karl Groos in the late eighteenth century. In his book, *The Play of Man*, Groos (1901) built upon the ideas of Italian philosopher D.A. Colozza. Like the ancient Greeks, Colozza believed that the purpose of play was to provide youngsters with the skills they would need to survive as adults. He likened human play to that seen in a litter of kittens. When the kittens became aroused by anything that moved, their resultant and seemingly frivolous antics ultimately served a useful purpose. This pursuit of random moving objects during play resulted in the acquisition of the essential skills (i.e. running, jumping, rolling) the kittens would need to become victorious hunters as adults. Colozza also theorized that since both kittens and human babies could rely upon the adults in their lives for sustenance, they had the excess time and energy needed to hone their skills through play (Elkonin, 2005).

Groos (1901) accepted the prevailing notion of play as practice and an essential component of learning, but he also argued that play was a biological tendencies and that "we play not because we are children, but we are given our childhood so that we can play" (1916, p. 72). Groos set out to prove the validity of this theory through a series of studies which became the foundation for most contemporary thinking surrounding play, but this foundation has been added to and detracted from continuously since his works were first published. It appears that while not universally accepted, Groos's writings have led to much thought and study, the results of which are countless divergent theories (Brehony, 2008. Elkonin, 2005. Lancy, 1980. Verenkina, Harris & Lysaght, 2003).

W. Stern, a student of Groos's work, added his theory of prematurity in the 1920's. He believed that there was a biological drive that required children to practice the skills that they would eventually need well before they were actually required. He explained the cooing and squirming of an infant in its crib as instinctive actions and precursors to other inherent instincts to speak and walk, both vital skills that could be perfected through play which was also an instinctual act. While Stern was attempting to build upon Groos's theories, others were not convinced with the validity of some of his ideas (Brehony, 2008, Elkonin, 2005).

Divergent Theories

Bühler accepted most of Groos's premises but argued that play was the result of what he termed functional pleasure. According to this theory, the activity of play brings pleasure, and because of this, play serves as a mechanism for practice and learning. While Bühler developed a following of his own and others began examining the functional pleasure aspects of play, Freud was examining play from a psychoanalytic point of view and espousing his theory that play was a symbolic manifestation of a child's desires that would otherwise be unfulfilled as the result of societal restraints. The symbolic reenactment of experiences through play resolved the tension caused by this repression and the resulting pleasure lead to what he termed a repetition compulsion, the need to recreate this pleasure over and over. Although Bühler and Freud differed on many points, they both saw pleasure as a driving force behind children's play. Divergent theories developed, but others chose to build upon the play as practice theory discussed by Karl Groos (Brehony, 2008. Elkonin, 2005. Lancy, 1980. Verenkina, Harris & Lysaght, 2003).

Piaget emphasized the development of social skills that occurred during play and identified a need for assimilation that could be realized through play (Brehony, 2008. Elkonin, 2005). Meanwhile, Vygotsky (1933) called play “the leading source of development in preschool years” (p.1). He insisted that play did not always contain an element of pleasure and cited the example of a losing team in a competition sport. To be considered play, Vygotsky (1933) required that there be an imaginary element and defined play as “essentially wish fulfillment” (p. 4). He also maintained that it was wrong to think that play was a purposeless activity. Instead he argued that play must always involve the acquisition of some goal, and in fact, “the purpose decides the game” (p. 17). This idea of purpose would become the topic of much debate (Elkonin, 2005).

Buytendijk was vehement in his assertions that the theory of play as practice was not supported by scientific evidence. Contrary to popular thinking, he proposed that play only occurred when life allowed it to and that this most frequently happened while one was young. Animals played because they were young, but it was not an imperative function of youth. Play did not have a purpose. It resulted from motor impulsivity and the essential lack of purpose differentiated it from mere physical exercise. As if these assertions did not run contrary enough to popular thinking, Buytendijk also insisted that another distinctive characteristic of play was that it always involved an object. Acknowledging the disparity in thinking on the subject, he proclaimed play as impossible to define and questioned the usefulness of any further studies unless some kind of consensus was reached. (Elkonin, 2005).

Defining Play

Indeed, the definition for play has proven to be elusive. An entry in *The Encyclopedia of Early Childhood* (2010) seems to agree with Buytendijk in their assessment that "play describes such a wide range of behaviours that the question of a definition precise enough to support a research agenda continues to be problematic" (n.p.). The Cambridge Encyclopedia of Child Development (2005) defines play as "an activity that is both done for its own sake, and characterized by 'means rather than end' (i.e. the process of play is more important than any end point or goal)" (pg.1). Although this definition is certainly in line with that proposed by anthropologist John Huizinga in the 1950's and Buytendijk might also agree with this limited explanation, it runs counter to the ideas of Vygotsky and others that play requires a purpose, and also defies the premise that there is an inherent purpose behind play (Brehony,2008. Gordon,2009. Elkonin, 2005).

Acknowledging the different scientific backgrounds of the many researchers, developmentalists Smith and Vollstedt (1985) described the definition of play as "one of enduring importance and controversy" (p. 1042). More recently, a factsheet entitled "What is Play?" written for the Children's Play Information Service by Britain's National Children's Bureau (2006) declared that "there is no neat definition" (p.10). Gwen Gordon (2009), in her comments on the issue, cited previous efforts to assign a definition and labeled any future attempts as "folly" (p.1). Perhaps the Early Childhood News (UEN,1999) put it best in their summation of the dilemma when it was stated that "while everybody knows play when they see it, academics have had trouble defining it" (n.p). Fortunately, it is not my intent to try to reconcile all of the different theories on play in order to arrive at a universally accepted definition. It seems more useful to admit that there are different types of play and common elements of play found throughout the research.

Elements of Play

Pleasure.

Despite the ongoing controversy surrounding the definition of play, there appears to be some consensus that pleasure is involved. Whether it serves as a motivation for play as proposed by Bühler, or exists as a means to satisfy the pleasure principle as espoused by Freud, play is generally perceived as an activity that brings pleasure (Brehony,2008. Gordon,2009. Elkonin, 2005. Lancy, 1980). Oftentimes, perhaps because pleasure is a difficult word to define scientifically, we find the term "positive effect" used to describe this element of play (Smith, 2005. Smith & Pellegrini, 2008. Smith & Vollstedt, 1985). Undoubtedly, this is what Early Childhood News (UEN,1999) had in mind with they told us that we know it when we see it and what Lancy (1980) was referencing when he remarked that play is "very easy to recognize" (p.

472).

Imagination.

Vygotsky (1933) was adamant that imagination was a necessary component of play and that "it must always be that it is imaginary" (n.p.). While there is more than a little dissension surrounding the topic, most accepted theories concede to its existence. Lancy (1980) prefers the term "transformation" (p. 473) when describing the shift between reality and fantasy and others refer to pretence, or the "use of objects and actions in non-literal ways" (Smith & Pellegrini, 2008). Still others speak of an element of flexibility (Gordon, 2009. Smith & Pellegrini, 2008. Smith & Vollstedt, 1985), which according to the Cambridge Encyclopedia of Child Development (Smith, 2005), involves the ability to put objects together into new combinations and the tendency to adopt new roles in place of those assumed in real life. Because there appears to be much overlap between the definitions of transformation, pretence and flexibility, we will group all three under the heading of imagination, a general term which seemingly encompasses all three perspectives.

Purpose and games.

The last element to consider would be purpose. Of course, as mentioned earlier, the notion of purpose in play has been hotly contested (Brehony,2008. Gordon,2009. Elkonin, 2005, Lancy, 1980). Fortunately, the widely accepted definition for games will suffice to alleviate any concerns. Smith and Pellegrini (2008) identify games as "organized activities in which there is some goal" (n.p.). Because we will be looking at the role of games in learning, the idea of a specific purpose in other forms of play is not pertinent to our discussion. Games as play with purpose also satisfies the notions put forth so long ago by the philosopher Aristotle (Chambliss, 2004) and newer theories regarding the role of play in social development put forth by Piaget, Vygotsky and others (Brehony, 2008. Elkonin, 2005. Hewes, 2010. Lancy, 1980. Verenkina, Harris & Lysaght, 2003. Vygotsky 1933). Certainly there are many forms of games, and to understand this, we must first understand the different kinds of play.

Forms of Play

The Cambridge Encyclopedia of Child Development (Smith, 2005) while acknowledging that other lesser known classifications may exist, lists three different categories of play as being "well recognized" (n.p.). These include: "object play, pretend play and sociodramatic play, and physical activity play" (Smith, 2005, n.p.). When evaluating the role of games in learning, specifically in a middle school classroom, object play and pretend/sociodramatic play will be our areas of concern.

Chapter 3: Methods

Evaluating Games for Use in the Classroom

While many educators recognize the value of games as skill building tools, and games have a long history of use in the classroom, not all games satisfy the requirements set forth by The National Science Education Standards (National Research Council, 1996) in regard to inquiry-based learning. Drill type games such as "Geometry Jeopardy" (Savko, 2001), "Biology Bingo" (McKenzie, 2011) or "Human Body Super Hitter Baseball" (Review Game Zone, 2011), all of which were found through a spontaneous search of the internet, only reinforce memorization of facts and do not encourage scientific thinking and reasoning or qualify as inquiry-based learning. In order to sift through the multitude of self-proclaimed "educational games" that are available to teachers, I developed a set of evaluation criteria that teachers could use to identify games that fulfill the mandates of state standards, and that would also alleviate the problems and concerns of teachers attempting to bring inquiry instruction to their students. These criteria needed to: ensure that basic elements of play were present, identify if inquiry-based learning was being utilized, and assure that state standards were being addressed; all while being easily implemented in the classroom.

Methodology

In my efforts to create a tool that teachers could use to gauge the value of different games for classroom use, I first constructed the following checklist which addresses all of the concerns I have identified involving games in the classroom and inquiry-based instruction (See Table 1.).

Table 1

Initial Evaluation Criteria

I.	**Elements of play that must be present:**			
	A.	Pleasure		
		1.	Assets to enhance pleasure	
			a)	*Ease of use*
			b)	*Graphics*
			c)	*Special effects (eg. Sound)*
	B.	Imagination		
II.	**Elements of Inquiry that must be present:**			
	A.	Asks relevant questions		
	B.	Uses higher level thinking skills		
	C.	Uses a wide variety of resources		
	D.	Teacher plays the role of facilitator (this could include the computer in role of teacher)		
III.	**Elements to satisfy curriculum:**			
	A.	Must meet state standards		
IV.	**Elements to satisfy teacher concerns:**			
	A.	Easily accessed		
	B.	Easily managed		
	C.	Free or inexpensive		

With my criteria determined, I next had to identify games for study. I needed games that were easily accessed and inexpensive so as not to preclude their use. With this in mind, I decided to concentrate my efforts to the study of online games, particularly those involving Math and Science and aimed at Middle School students. The vast array of educational websites and online games presented a challenge as it was not possible for me to appraise them all, but I hoped my criteria could also be used to evaluate any game in consideration regardless of the content area.

Choosing Games for Study

With the huge amount of resources available online, I had to determine which sites would be included in my study. Because I have seen two sites used frequently in middle school classrooms, I felt I needed to include both *Funbrain* (Family Education Network, 2011) and *Cool Math 4 Kids* (2011) in my research. Both sites had so many games to choose from that I elected to play every fourth game listed on their home pages. This decision to play every fourth game was determined by a roll of the dice which assured that a random selection was made. I played twenty-five games on each site and used my checklist to evaluate their worth as tools for instruction. I also chose to include two other sites that had been recommended to me in my education courses. These sites included *Sheppard Software* (Sheppard et al. 2011) where again, I chose to play every fourth game listed on the homepage because more than twenty-five games were available. *Quarked: Adventures in a Subatomic Universe* (University of Kansas, 2005) offered only twelve games, all of which were assessed.

It became apparent as I played the games for my study that I could easily eliminate the final criteria on my checklist which dealt with satisfying teacher concerns, namely: that these games were easily accessed and managed, and free or inexpensive. I only researched sites that were free and found that there was a wide variety to choose from. Additionally, the accessibility of online games was only impeded by lack of internet access. As most classrooms have at least one computer available for student use, this did not appear to be a valid concern when considering the usefulness of online games. Accordingly, I was able to eliminate both the cost and accessibility standards from my checklist. The only item left in my consideration of classroom teachers' concerns was that of classroom management which proved to be easily allayed.

Because these games were designed with children in mind, most presented clear instructions and progressive levels of difficulty through which a student could easily navigate with little instructor intervention. Given that classroom management issues appeared minimal and predominantly limited to providing and monitoring computer access, I felt justified in refining my evaluation criteria further by removing this specification.

With further exploration of the games, it became increasingly clear that the elements of inquiry that I chose to assess also needed some clarification. In the case of online games, it seemed appropriate to identify the website itself as the teacher/facilitator. The mere fact that the internet is a resource also satisfied an aspect of inquiry. The only two criteria remaining were that the games must ask relevant questions and encourage higher level thinking. With my criteria clarified, I played 87 games between all four sites and used my evaluation checklist to determine their usefulness in inquiry-based instruction. After rating the games myself, I had the results checked by a volunteer who performed a random sampling.

Chapter 4: Results

Results

Without exception, every one of the games that I examined would satisfy some state standard in one or more areas of curricula. I also found them all to be somewhat entertaining and well-constructed with colorful graphics and sound effects which satisfied my criteria for play. All also contained some element of an imaginary situation and the potential for success (winning) which further satisfied the requirements for elements of play. Having determined that these games were, in fact, "play" and that they all covered some mandated area of curriculum, the only question remaining was whether these games were "inquiry-based experiences."

I discovered that 38% of the games on the websites I examined would qualify as inquiry-based instruction (See Tables 2-5 below.) in that they asked relevant questions and encouraged higher level thinking. The majority would not be considered inquiry-based by any definition of the term. In fact, 64 out of 87 were games that could only be used as drills to reinforce facts that children had already learned. Unfortunately, the website with one of the fewest number of games that asked relevant questions and that entailed higher level thinking skills was *Funbrain* (Family Education Network, 2011), the site I have seen used by teachers most often (See Table 2 below.). Sheppard Software, a publisher of school texts and teaching materials fared even worse while *Quarked: Adventures in a Subatomic Universe* (2005), produced by the University of Kansas, had only three games that offered an inquiry learning experience. When it came to providing inquiry experiences *Cool Math 4 Kids* (Coolmath Inc., 2011) was by far the most successful of the sites I examined with roughly 50% of their games satisfying that criteria. What follows is an analysis of each of the four websites that I assessed.

Table 2
Funbrain (Family Education Network, 2011) *Evaluation*

Games	Asks relevant questions	Higher Level thinking	Satisfies State Standards
1. Math Baseball			x
2. Connect the Dots			x
3. Power Football			x
4. Line Jumper			x
5. Double Fun Match			x
6. Cookie Dough			x
7. Penguin Waiter			x
8. Stay Afloat	x	x	x
9. Word Confusion			x
10. Sign the Alphabet			x
11. The Translator Alligator			x
12. Order Me Around			x
13. Scramble Saurus			x
14. Bumble Numbers			x
15. Moon Rocks			x
16. Hillbilly Pig Toss	x	x	x
17. Math Basketball			x
18. Inkster			x
19. Proton Don			x
20. Piano Player			x
21. Dare to Be Square	x	x	x
22. Guess the Color	x	x	x
23. Change Maker			x
24. Math Car Racing			x
25. Shape Surveyor			x
Totals	4	4	25

Table 3

Cool Math 4 Kids (Coolmath Inc., 2011) *Evaluation*

Games	Asks relevant questions	Higher Level thinking	Satisfies State Standards
1. Abducktion	x	x	x
2. Primate Pile Up	x	x	x
3. Gluey	x	x	x
4. Map Snaps			x
5. Fraction Snaps			x
6. Castle Defense	x	x	x
7. Bloons Tower Defense	x	x	x
8. Civiballs	x	x	x
9. Construction Fall	x	x	x
10. Knight Slider			x
11. Parking Mania Zoo Escapes	x	x	x
12. Math Lines			x
13. Pool Geometry	x	x	x
14. Ball Lines			x
15. Compulse	x	x	x
16. Extreme Parking Mania			x
17. Feed Fribbit			x
18. Marble Lines			x
19. Maze Race 2	x	x	x
20. Orb 2	x	x	x
21. Coffee Shop	x	x	x
22. Snoreez			x
23. Fractone			x
24. Make 15			x
25. Math Man			x
Totals	13	13	25

Table 4

Quarked: Adventures in a Subatomic Universe (University of Kansas, 2005) *Evaluation*

Games	Asks relevant questions	Higher Level thinking	Satisfies State Standards
1. Quarked Rummy	x	x	x
2. Matter Mechanic			x
3. Word Sleuth			x
4. Shape Sleuth	x	x	x
5. Baryon Blaster			x
6. Quarked Catcher	x	x	x
7. Subatomic Match			x
8. Height Chart			x
9. Quark Quiz			x
10. Ushi's Ruler Game			x
11. Word Crossword			x
12. Proton Invaders			x
Totals	3	3	12

Table 5
Sheppard Software (Sheppard et al. 2011) *Evaluation*

Games	Asks relevant questions	Higher Level thinking	Satisfies State Standards
1. Cell Games			x
2. Life Cycle			x
3. Matching			x
4. Name a Saurus			x
5. Math Madness			x
6. Build a Dinosaur			x
7. Dino Might	x	x	x
8. Animal Characteristics			x
9. Chemical Element Quiz			x
10. Astronomy Games			x
11. Picture Math			x
12. Number Balls			x
13. Fruit Shoot			x
14. Multiple Frenzy			x
15. Math Mahjong	x	x	x
16. Math Man			x
17. Arithmetic Game	x	x	x
18. Quick Calculate			x
19. Order Equations			x
20. Equivalent Fractions			x
21. Reduce Fractions Shoot			x
22. Prime Numbers			x
23. Decimal Models			x
24. Order Decimals			x
25. Compare Fractions and Decimals			x
Totals	3	3	25

Independent Review of My Results

Given the results of my analysis, I was curious as to what another perspective on these games would provide. The world of online gaming has become a major component of life in mainstream America, and while some may be concerned that our youths seem preoccupied with these games, it seems as though they are here to stay. Renowned education researcher James Paul Gee (2007) has long held that many commercial video games have an intrinsic educational value in that they promote the development of problem solving skills that can be transferred into real life experiences. Having accepted the ubiquitous nature of video games in mainstream American culture, Gee goes as far as to prescribe design elements that can make video games more efficient vehicles of learning. He appeals for active research into methods teachers can use to infuse gaming into their instruction (2008). Being a newcomer in the world of video games myself, I thought it would be beneficial to have a veteran gamer's scrutiny in addition to my own.

Sierra Tardy is an aspiring game designer. She is a student of graphic arts at a local university and is an active member of the school's increasingly popular gaming guild. She has been immersed in the world of video gaming from a young age and has a stated preference for MMO's (Massively Multiplayer Online games). In the interest of full disclosure, I need to say that Sierra is my niece. Despite our relationship, or maybe because of it, I felt she could provide me with candid and impartial judgments of the games in my sample. She was unaware of what I had already determined during my own experiences and she only had a general impression of the nature of my study.

Allowing for the fact that Sierra is not an educator, I did not ask her to consider the issues of specific education standards being met or relevant questions being asked, nor was I asking for the precise classifications of higher level thinking that any of the games might incorporate. Likewise, I could not ask her to apply the American Association School of Librarians (1999) definition of inquiry-based learning in order to cull the herd and verify which games fit into that realm. Instead, I found it more useful to have Sierra play the games while ascertaining whether an eventual success was due to use of "problem solving skills", as opposed to the memorization of previously known facts (drill). I felt the use of this terminology satisfied my accepted definition of what constituted an inquiry-based learning experience and what did not. Thus armed with a simplification of my criteria, and one that I began to see was much less cumbersome than my original delineated checklist, Sierra volunteered to play two of the games that I had already assessed from each of the four sites. The results of Sierra's explorations were in accordance with my own.

Funbrain's (Family Education Network, 2011) "Hillbilly Pig Toss" was the first game Sierra evaluated. While attempting the pig toss challenge, she ascertained that success in the game depended upon the use of problem solving skills though she bemoaned the necessity for many "hit and miss" attempts and claimed it was not an accurate portrayal of the physics that would realistically be involved in the task. At the same time, she found that "Math Basketball", also a *Funbrain* (Family Education Network, 2011) offering, was solely a skills drill with no new information being presented. Although she was not asked to comment on the quality of the site, she could not help but offer that she found the graphics and special effects to be rather crude. While

I may have wrongly discounted my own original concerns about those same creative elements in my criteria for instructional games, our findings on their educational aspects were the same. One was drill; the other used some aspects of problem solving skills. Using this distinction, Sierra's determinations matched my own on the remaining three sites.

At Sheppard's (2011) site, Sierra chose "Name a Saurus" and "Multiple Frenzy." She deemed both to rely on fact memorization. The same was true of "Photon Invaders" and "Matter Mechanic" which were found on the *Quarked* University of Kansas (2005) website. Again, these findings were in agreement with my own. This continued to be true with Sierra's conclusions using the *Cool Math 4 Kids* (Coolmath Inc., 2011) website. Here, we both identified "Primate Pile Up" and "Civiballs" as games that required the use of problem solving skills in order to be successful. In my own estimation, I believe that these two particular games would satisfy even James Paul Gee's more stringent requirement that "in good games, the presentation of problems is carefully sequenced, with earlier parts always looking forward to later parts" (n.p. 2005).

Chapter 5: Discussion

Conclusions

Like Gee (2005), I believe that there are “good games” (n.p.).With my study, I set out to ascertain if there was an easy method to separate the wheat from the chaff with an eye on inquiry-based learning in games. What I found was that the majority of “educational games” available online could be separated into two categories: those where success depended on problem solving skills and those where success depended upon pre-existing knowledge (drills). While my study did not involve actual student learning, it did identify the possibility that real inquiry-based instruction is available through the use of online games. It also became apparent that I am not alone in my opinion.

John Paul Gee is a noted authority on the educational aspects of mainstream, commercial, video games and has become a vocal proponent of utilizing these “non-educational games” (2005, p.15) in the classroom as educational tools. Through his extensive research, Gee (2005) has been able to identify thirteen “principles” (p.6) he believes are essential when creating “good video games as learning machines” (p.5). Among these principles are the admonitions that “good learning requires that learners feel like active agents (producers) not just passive recipients” (p.6) and that “the problems learners face early on are crucial and should be well designed to lead them to hypotheses that work well, not just on these problems, but as aspects of the solutions of later, harder problems, as well” (p.9). Challenges should be “pleasantly frustrating” with an accompanying sense that inevitable failures are “paying off” (p.10). Because of the challenges involved, games require a commitment to succeed that may be achieved through individual investment in an alternate identity and that this alternate identity permits humans to feel empowered through the manipulation of "powerful tools" that grant them the ability to "extend their area of effectiveness" (p.8). Games need to grant opportunities for repeated cycles of skill practice – expertise – failure, which causes learners to rethink and relearn in a safe environment where failure is acceptable.

If all of his principles are adhered to, Gee (2005) believes it is possible to create authentic learning experiences where skills are transferable to the real world. Moreover, these games would fit the description of inquiry-based learning that I have adopted for this study. If this is possible with games that do not purport to be educational, it is certainly possible with games that claim that descriptor. Through the course of this study, I have established this premise to be true at least to my own satisfaction though I defer to Gee's (2005) more precise specifications as to what constitutes a "good game" (2005, n.p.). Correspondingly, while acknowledging Gee's (2005) expertise, I will hereafter refer to games that fit my criteria for inquiry-based games as "good" games.

Availability of Good Games

Almost 40% of the games in my study would fulfill all of my criteria and most of Gee's (2005) mandates. With many of the games, I could ascertain within the first few levels if it was a simple drill or something that would require more complex thinking. Among the latter were a few that captivated my attention; most notably among them Coolmath's (2011) "Primate Pile Up" and "Civiballs" games. I felt that they both provided an accurate portrayal of the Newton's laws of motion while requiring the player to utilize skills obtained in previous levels. Additionally, I experienced failures that were "pleasantly frustrating" (p.10) as Gee (2005) would describe them, while understanding that my failures would pay off on subsequent attempts to solve the problems being presented. I certainly felt a sense of satisfaction that increased proportionately to the degree of challenge. Sierra confessed that she had played through all of the levels of both games and that she had needed to make multiple attempts. This is something I should have foreseen given the gamer mentality. Even given the effort of multiple attempts and the frustration of inevitable failures, gamers will continue to play in the realization that their success is possible and because of the sense of achievement that they know their success will provide (Gee, 2005, 2007).

The inherent drive to succeed that a well-constructed game can sustain should be an enormous incentive for teachers seeking to implement games in their classrooms. Any time a child is driven to achieve should be cause for teachers to applaud. Add to this the opportunity for engaging lessons in which students feel invested, all the while fulfilling state mandates without spending precious amounts of time and money. It seems a no-brainer that educators would jump at the chance to enhance their teaching with these available resources. What then precludes their use?

Obstacles to Games in the Classroom

While all of the games I played fulfilled some academic requirement or learning standard, in most cases, I had to play them to determine what those were. Although it was usually easy to quickly discern which games incorporated inquiry-based learning, I had to play the games to ascertain that. Some might see this as an impediment to their use, but I see it as part of the same due diligence that any teacher would exercise when introducing a book or video to their students. However, a teacher usually has an idea of the content when considering a book or video. This was not the case with the games I played; most websites were broken down into the different content areas, but specific state standards these games would incorporate were not available.

After playing Coolmath's "Civiballs" game, I conducted a Google search using the terms "educational games and Newton's laws" from which I received about 2,110,000 results. The vast number of games available that claim to be educational is exactly what renders a good one hard to find. As it is, I stumbled across two games that did provide quality inquiry-based experiences in that specific content area concerning Newton's laws of motion, but this was impossible to establish beforehand from the information given on the website. Neither of these games appeared in the first five pages of my Google search, but both were on a website that had been recommended to me. Without that recommendation, I would not have found a number of other games that fit my "problem solving" criteria. Indeed, good games are not easy to find especially if one is looking for games pertaining to a specific content area, but recommendations from colleagues can prove to be a valuable resource. Granted, a concerted effort is required, but given that, the sheer numbers of games available shouldn't eliminate them as possibilities for effective instruction.

I cannot help but think that the reason good games are not used more often in the classroom is largely due to the fact that they are games. It seems that there is a stigma attached to the use of games in the classroom. Unless they are used as drill or skills reinforcement, games are often perceived as frivolous and a waste of the already limited time available. I can only imagine how many parents would cringe if their children responded to the query "what did you do in school today?" with "we played games." Yet, the notion of learning through games is an old one, and one employed to this day by training officers in the military.

Recommendations

When speaking with longtime friend Col. Jerry Buckman of the USAF about the subject of my thesis, he responded that the use of full mission rehearsals, while not referred to as games, were really very similar to some of the commercial games available to the public albeit much more sophisticated. The sense of this seems obvious and in the words of the colonel "bottom line: This type of 'gamesmanship' is a very cost effective and realistic way to maximize combat effects while lessening risk to our warriors" (Apr 4, 2011). Throughout the course of this study, I have found games that could be used in an inquiry-based classroom as an actual tool for instruction. Perhaps it is time that educators look at games in the same way as the military, as cost effective tools where learning is easily transferred to real life situations. Given the current crisis in American education, it seems the more tools in the toolbox, the easier the fix.

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