ADULT LEARNING: COGNITIVE FOUNDATIONS FOR LEARNING A COMPLEX COMPUTER-BASED TASK

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INTRODUCTION

The Information Revolution

Few trends have changed learners lives as profoundly as computer-based technology. The United States along with other countries is rapidly moving toward a one-world information and knowledge-based technology system. In the future learners will be required to use critical thinking skills to conceptualize a problem and access resources that will immediately enable the learner to interact with other learners around the world. Learners are now living in an era of human history where it is possible to communicate with anyone at any time in any place through the international World Wide Web of computers.

However, there is a dynamic tension between people and technology. The ability to learn technology bewilders some adults even though the integration of technology into daily life surrounds them. For those who fail to learn technology, their skills become more antiquated daily. Some fear technology while others embrace it as it provides an economic, political, social, and educational resource that meets their need. For example, there are some learners in the general population who fear using the remote control to change channels on the televison, adjusting the VCR to watch

a movie, or owning a computer. The remote control technology is just too new for them, and the baffling thing is that they do not want any assistance.

> The desire to learn, like every other human characteristic, is not shared equally by everyone. To judge from casual observation, most people possess it only fitfully and in modest measure. But in a world, which sometimes seem to stress the pleasures of ignorance, some men and women see the rewards of knowledge -- and do so to a marked degree. They approach life with an air of openness and an inquiring mind. (Houle, 1961, p. 3)

The intersection of technology and learning affects both the delivery medium and the tools that are part of the learning process. Computer technology has become increasingly valuable for participating in numerous learning activities. "From ordering pizza by computer, to making the telephone calls from one's car, to faxing a request to the local radio stations, everyday life has been irrevocably influenced by technology" (Merriam & Caffarella, 1999, p. 15). The world has become increasingly more technology driven as access to information through computer technology becomes a way of being in society. This technology forces learners to approach many things in learning, business, economics, government, and education differently than in the past.

Some of the names used in the past and currently for this new advanced technology trend are the Information

Revolution, Information Age, or the Age of Technology. This metamorphosis of data gathering and exchange has created a world of computer-based knowledge (Ghost Bear, 2001, p. 1). Computer-based knowledge has spawned this Information Revolution. It was estimated that in the year 2000 personal computers would be as common as a television or a radio, that nearly 70% of all U.S. citizens would have a computer, and that 90% of those would have direct access to the Internet (Brewer, Campbell, & Petty, 2000, p. 63). "The Information Age has allowed faster discovery, more rapid application, particularly with computer simulation, instant communication and the subsequent improvement that follows when people share ideas" (p. 66).

Information is coming at the learner with incredible speed. People are living through a fundamental turning point in history and are now participants in the Information Revolution. The Information Revolution is presently at the point where the Industrial Revolution was in the early 1820's. That period was about 40 years after James Watt improved the steam engine, an invention that had a tremendous effect on how people lived their lives during the Industrial Revolution (http://theallantic.com/issues/99oct /9910drucker.htm, p. 2). "Just as previous revolutions inalterably changed people's way of life over time, the

current revolution is transforming the daily source, volume, and quantity of information that is available at lightning-quick pace" (Ghost Bear, 2000, p. 1).

There is a parallel revolution in learning that supports the Information Revolution. The combined Internet, World Wide Web, and computer revolution is preparing the learner to access information that will enable the learner to determine such things as vacations, learning environments, places of employment, entertainment, and earnings. This technology, which has been the impetus for Information Revolution, allows the learner to receive information and acknowledge it instantaneously. Consequently, adults learners use technology as the perceived need arises (Lively, 2001). Most adult learners engage in learning activities under no compulsion except that which is generated from within (Elias & Merriam, 1995, p. 127).

In the parallel of learning and technology, learners must see themselves at the center of learning. Information is important when it is internalized and alters the learner's perceptions and gives the learner the ability to transfer it to a different context. When people have the opportunity to learn by taking some initiative and perceiving the learning in the context of their situations,

they will internalize more quickly, retain more permanently, and apply more confidently (Knowles, 1992, p. 11).

Adults are lifelong learners, who are driven to live in a global continuum, as real-life technology learners. A person cannot purchase an airline ticket, catch a train, make a bank withdrawal, or cook a meal without interacting with technology. This rapid changing advanced technology requires learners to cope with educational changes that allow for institutions, private industry, and businesses to reach into relatively isolated communities, towns, cities, and countries using technology as a learning tool. The adult learner is no longer isolated from other learners but has unlimited access to information and knowledge.

The field of education does not stand apart from the pervasive invasion of computer technology in the classroom. Computer technology has been in the classroom since the early 1960's. The National Science Foundation (NSF) in the 1960's supported the development of 30 regional computing networks, which included 300 institutions of higher education and secondary schools(http://www.thejournal.com/magazine/vault/articleprintversion.cfm?aid=1681, p. 4). By 1974 over two million students were using computers for instructional purposes, and by 1975, 55% of the schools had access to computers (p.4).

The cutting edge technology of today in the classroom includes the World Wide Web, the Internet, video conferencing, distance learning, and virtual reality; these are all part of the computer-based learning system. In the field of education, the computer is no longer a luxury but a necessity. Preparing learners for the world they live in today is a challenge. Without the benefit of a home-based computer, the learner is bound to completing assignments in the classroom. Some people will only adopt new technology when it is imperative to their survival. Some learners struggle with the idea that technology is changing so rapidly that a computer will be obsolete within 18 months. In 1996 Gordon Moore, the founder of Intel, stated that the power and complexity of the silicon chip would double every 12-18 months, and it has been proven true (http://lessons 4living.com/info.htm, p. 1). The computer chip of today is four million times as powerful as its predecessor of 30 years ago, and it has ushered in the Information Revolution. While it seems new innovations are developed daily, there appears to be no end to discovery of the next advanced device. Thus, in the computer revolution the adage has changed "necessity is the mother of invention" to "in a computer world, invention is the mother of necessity" (http://www.thejournal.com/magazine/vault/

articleprintversion.cfm?aid=1681, p.1). Training, education, and skills development content is added to lessons plans which elicit the use of the computer as an instructional tool to facilitate the process of learning. Not only can adults learn content through technology, but they can also learn about technology itself and develop the skills to use it competently (Merriam & Brockett, 1997, p. 113). Therefore, as learners are afforded experiences with technology that enable them to analyze and understand their learning, they approach learning as a process of inquiry.

Adult Learning

As the Information Revolution evolves, adult learners will have numerous occasions to learn. There was a drastic shift in 1970's and 1980's to move toward a technologically driven global society because of the infusion of computer technology. There was also a shift from adult education to adult learning because adults were becoming the new learners (Fellenz & Conti, 1989, p. 1). Adult learning is defined as the process of adults gaining knowledge and expertise. Because of current gaming technology there is a demand for computer skills, entertainment, travel, and interaction with people around the globe via Internet. Adults are challenged to become lifelong learners by constantly updating their knowledge foundation.

To further establish who an adult learner is there are four viable definition of adult. The first is the biological definition; the learners reaches the age at which they reproduce. The second is a legal definition; the learners reaches the age at which the law says they can vote, get a driver's license, marry without consent, and the like. The third is a social definition; the learner starts performing adult roles, such as the role of full-time worker, spouse, parent, and voting citizen. Finally, the psychological definition; the adult arrives at a self-concept of being responsible for their own lives of being self-directing (Knowles, 1998, p. 640). An adult learner is one who has assumed the social and psychological role of adulthood. Because of their previous exposure to varied subject matter, numerous experiences, skills, motivation, intelligence, and abilities, adults see the world in a different framework than children.

Learning takes place when the learner considers the subject matter relevant. The learner is responsible for participation in the learning process; in this situation, self-evaluation is primary, and formal evaluation is secondary (Shoemaker, 1998, p. 159). The adults' ability to learn is also related to their lifestyles, attitudes, social roles, and the desire to learn for a specific task. "The

central dynamic of the learning process is thus perceived to be the experience of the learners; experience being defined as the interaction between individuals and their environment" (Knowles, 1988, p. 50).

Technology in Gaming

This technology that is being used in education is also being used in the gaming industry. "Indian-sponsored gambling, from bingo parlors to Las Vegas-style casinos, exploded onto tribal lands during the 1980s" (Evan & Hance, 1998, p. 298). Tribal communities have turned the gaming industry into a 9.6 billion industry in 28 states on Indian Reservations, which is growing three times faster than the non-Indian gaming (http://proquest.umi.com/pqdweb, p. 1). One such tribe is the Cherokee Nation who owns the Cherokee "Bingo Outpost", located just off Interstate Highway 44 in Tulsa, Oklahoma. This beacon of entertainment and amusement sits on a hill just north of Interstate 44 exit 193. It is adorned with neon signs that light up the night and can be seen from a distance. It is a place where adults spend hours interacting with the computer-based electronic gaming devices of contemporary time. Adults play video bingo, slot machines that resemble the Las Vegas style gambling devices, regular bingo, and blackjack. The casino boasts of progressive jackpots that climb into the thousands with more

than $50,000 in daily prizes possible (http://www.cherokeecasino.com, p. 1). The Cherokee Nation also maintains two similar casinos in Oklahoma at Roland and Siloam Springs and promotes themselves as Northeast Oklahoma's Premier Entertainment Centers (p. 1). Casinos have a potential to include a myriad of gaming opportunities for adult players who want to learn how to play the games for monetary gain and amusement.

Gaming is an international phenomena, and current technology is driving the industry. New technologies and product innovations also affected the allure of the continuance of commercial gaming. "Video and computer games are one way of creating more immersive environments and perhaps changing people's perceptions of the real world" (http://students.washington.edu/jpo16/game.html,p. 1).

Gaming is a term that is derived from the field of gambling. Gambling can be defined as an activity in which a person submits something of value, which is usually money, to risk involving a large element of chance in the anticipation of winning something of greater value, which is usually money (Thompson, 1997, p. 3). "The term gaming is usually associated with the activities found in casinos" (p. 3). Casino industries prefer the term gaming to gambling because it sounds acceptable. Gambling in the United States

has been experiencing a period of unsurpassed growth since the end of the 1980's when the Cabazon Band of Mission Indians won its case in the U.S. Supreme Court in California vs Cabazon or the "Cabazon Decision" (Lane, 1995, pp. 126-128). During the litigation of the case, other tribes started to conduct bingo and card games. In response to the court ruling, Congress passed the Indian Gaming Regulatory Act in 1988, which gave the state a role in the conduct of the tribal gaming on reservations (Evans & Hance, 1998, p. 2).

The two pieces of legislation that regulate the tribal gaming industry are the Indian Gaming Regulatory Act (IGRA) and the Johnson Act. The IGRA, which was designed to promoted tribal economic development, self-sufficiency, and strong tribal government, provides a regulatory base to protect Indian gaming from organized crime, and it established the National Indian Gaming Commission (McCulloch, 1994, pg. 99-113). The act defines three classes of gambling and gaming:

> Class I - a social game solely for a prize of minimal value or traditional forms of Indian gaming. Class II - all forms of bingo, which include pull-tabs, lotto, punch boards and instant bingo and other games. Class III- all forms of gaming that is not included in Class I and Class II, such as: blackjack, slot machines, pari-Mutual racing, electronic games of chance and porker. (State Legislative Report, 1992, p. 4)

In broader terms, the Johnson Act, 15 U.S.C. #1171, 1951, currently defines the terms of a gambling device (http:///www.usdoj.gov/criminal/oeo/gambling/infosht.htm, p. 1). However in 1951 the act was passed to prohibit the shipment of gambling devices or component parts across state lines to any area where it was considered not legal. The two states the were determined legal destinations were Nevada and part of the State of Maryland. The legal definition of gambling requires three elements: chance, consideration, and prize. The Johnson Act defines gambling as (1) a so-called slot machine or any other mechanical device with an essential drum or reel, which is operated by a person that delivers an element of chance for the purpose of winning money or property, (2) any machine including, but not limited to, roulette wheels and similar devices designed and manufactured for use in gambling, and (3)any subassembly or essential part intended to be used in connection with a machine is a gambling device (http://www.usdoj.gov/criminal /oeo/gambling/11171.htm, p. 1).

Games are proliferating and have several advances. These include such things as free-play lines, sounds to enhance the players experience, new graphics, and a game within a game. According to GamingLicense.com., game equipment makers have been encouraged to create more

entertaining player-interaction games (http://www.gambling licenses.com/articlesFull.cfm?Aricles_IDp5,1). The industry has sought to stay ahead of the player's desire for entertainment by employing the latest technology in the industry.

Amusement Games

Amusement game arcades date back to the 1920's and are the forerunner to video games. The definition of an amusement arcade is any place other than premises licensed pursuant to the Liquor License Act where four or more amusement devices are provided and a fee is charge for the use of the machines (http://www.municipalworld.com/ brantford/330.htm, p. 1). Currently amusement games are often part of the family entertainment center such as Atari's Chuck E. Cheese, which is a arcade and restaurant with electronic games. "Game manufacturers are producing simulation games that appeal to women and older adults, spurring the rise of urban entertainment centers like Dave & Buster's, a combination nightclub and high-tech arcade" (http://web7.infotrac.galegroup.com/itw/informark, p. 2). The most popular arcade game of all time with over 300,000 unit sold worldwide is Namco's Pac-Man with more than 100,000 sold in the United States alone (http://www.

videogames.com/features/universal/hov/hov05.html, p. 5). However these are not the kind of games found in gaming casinos.

A recent machine that has been manufactured for the casinos is the Reels and Deals Skills Stop Game, which is computer-based and designed by Ron Mach in the State of Florida. The game is housed in a upright metal cabinet that stands about 6 feet tall that is similar to an amusement game. The interior of the game is protected by a security door that has a lock located on the right side of the door. It is designed with a bill acceptor which allows the player to insert bills in dominations of $1, $5, $10 and $20. However for this study money was not used. The participants were given a total of 2000 credits to use at the beginning of each hour played. To start the game, the player depress the "play one" or "max play" buttons located on the front of the device and play one to 10 credits. Once the credit or credits are applied to play the game, participant depress the "spin" button to start the reels spinning in a top to bottom rotation. To qualify for the Jackpot the player must play the maximum coins, which is 10 credits. The credit can equal 5 cent or 25 cent. The Jackpot equals 2500 credits or larger.

The reels will continue to spin unless or until the

participant depress the "stop1" button, at which time the first reel will stop on an icon. The reel stops immediately upon the activation of the button. The second and third reels continue to spin until the participant either depress "stop2" or "stop3" buttons, at which time the reel stop immediately. The "stop" buttons can be depressed in any order. The participant decides the length of time to shorten or prolong the play. The reels will not time out. Each reel contains the same number of icons, although the sequence on each reel is different. The speed of the reels is constant and the same for each reel.

If the participant through a strategy or skill gets a winning combination, the credits won are added to the existing credits. The player can decide to continue or end play. If the participant decides to end play, the participant depresses the "ticket" button and the device will issue a ticket for the amount of credits to be paid to the participant. The participant is challenged to stop the wild icon on each reel with a button so that the wild icons on all reels match. Since the icon stops immediately when the participant pushes the button, the participant has full control over the outcome of the game. Since the icons are presented in a consistent pattern, it is possible for the operator to develop a strategy for stopping the icons so

that they match. However, the speed of the machines and the large number of possible combinations may be too large for the operator to learn. As adults play this particular video device, it is possible that if they could learn the patterns on the reels, by incorporating their particular learning strategy, they could develop the ability to win by stopping all the reels in a determined way.

Problem Statement

"We do not know how strategies are learned, and the matter does not concern us for the present. Presumably they are learned" (Bruner, 1966a, p. 55). This statement made by Bruner in the 1960's has become a statement that drives this researcher to answer the question of how strategies are learned in the context of gaming. Since 1988 casino-style gaming has expanded rapidly across the United States on Indian reservations. One area of big business is the Indian gaming industry.

Adults are going to gaming casinos in record numbers. While some games that they played are based on random results, others are skills based and consequently should be able to be learned. However, because of the speed of these machines adults are placed in a real-life situation where there might be human limits on what they can learn. The issue of adult learning is important and has been explored

in depth, but the real-world issues in the gaming industry are forcing the learner to know something about how technology works. Gaming devices speeds move at an incredible rate. Using the computer in and of itself is a learning experience for learners. Games that have the learner manipulate a joystick or other such devices can improve eye-hand coordination. Any challenging game can quicken ones's reasoning and decision process (Rafferty, 1985, p. 62). Computer speed may one day exceed the conceptual achievement of mental function in the learner.

> Computers can address ever more complex problems at a never greater speed, and their reliability is now close to optimum. So the machine, thus capable of performing operations at speeds far beyond a human's capacities, is endowed with performance. (Ifrah, 2001, p. 310)

Gambling has had its ebbs and flows throughout history. Churches, schools, and private industry have used lotteries to finance development. A large number of states have lotteries which supplement the state treasuries. What is legal in one state may not be legal in another. Restrictions have been imposed on gambling almost since the beginning of Colonial times. Court cases have been fought and won since the turn of the century. In Uston vs. Resorts International, 445 A. 2nd 370 (N.J., 1982), the case involved a learning strategy a person used to win at gambling.

Ken Uston was a "card counter". He memorized

> cards as they were being played in blackjack games. He then calculated in his mind the odds that certain remaining cards (ones not yet dealt) would favor the players or the dealers and bet according. Good card-counters can have the odds in their favor. Several casinos told him to leave their premises. The New Jersey Supreme Court agreed with Uston. They found nothing in the New Jersey gaming law that allowed the casinos to exclude him because he used a strategy to try and win a game. (Thompson, 1997, p. 139)

There is currently a federal court case involving a specific computer-based machine people play at the Cherokee Bingo Outpost from a learning prospective. A critical element in the court case is whether the game can be learned or not. The Cherokee Nation tribe used the Reels and Deals Skill Stop Game in their casinos. The machine is built to the specifications of Texas gaming device industry. However, the National Indian Gaming Commission is challenging the tribe because they believe the Reels and Deals Skill Stop Game should be classified as a gambling device based on Category III of the Johnson Act rather than the manufacturer's claims that it is a skills game according to the rules of amusement games.

An article in the Vending Times magazine stated that the National Indian Gaming Commission proposed regulations do not spell out the standards with which skills games must comply and that it is virtually impossible for the manufacturers and operators to assure beforehand that their

equipment does not get classified as a gaming device (http://vendingtimes.com, p. 1). The National Indian Gaming Commission decides on a case-by-case basis whether a particular game is a game of "chance" or a game of "skill." One of the concerns of the amusement game industry is the National Indian Gaming Commission could wrongly classify skills-based games and tournament games under the Johnson Act, in the Class III category.

Learning to play the Reels and Deals Skill Stop Games at a level beyond chance is an example of real-life learning. Real-life learning is learning that is "relevant to the living tasks of the individual in contrast to those tasks considered more appropriate to formal education" (Fellenz & Conti, 1989, p.3). Real life learning stems from the learner's real life circumstance and is contextualized; they cannot be solved in isolation from other variables. If the project or learning task is important, learners will turn it into a self-actualizing process whereby they gather the necessary information and solve their problem. Sternberg (1990) asserted that the real-life learning requires adults to (a) recognize a problem in the real-world, (b) define the problem, © accept the unstructured and decontextualized nature of the problem, (d) assess the relevance of the information available, and (e) view the

problem from multiple perspectives (Conti & Fellenz, 1991, pp. 64-65).

As they engage the Reel and Deals Skill Stop Game in the casinos, adults can try to learn the game in order to enhance their chance of winning at it. From an adult learning perspective, this raises the question of whether the technology can be learned by the player or can the learner be so bombard with information the game cannot be learned. In the court case, the National Indian Gaming Commission is arguing that the game cannot be learned. However, no research has been conducted to determine if the game can be learned. This issue of whether the game can be learned will have a major effect on the court decision and the use of this game by the Cherokee Nation. For educators, this case raises the issues of the physical limits at which human learning is possible.

Purpose

The purpose of this study is to describe the approach adults use when playing the Reels and Deals Skill Stop Game. One focus of the study is to determine if the game can be learned. Another focus is to describe the strategies adults use in trying to learn the game.

Research Questions

The research questions, which will be addressed in the study, are:

1. Does the performance of the participants on the Reels and Deals game differ from chance?
2. What strategies do novice participants use for learning the Reels and Deals game?
3. What strategies do expert participants use for learning the Reels and Deals game?
4. How do participants describe their strategies?

Both quantitative and qualitative data will be collected. Quantitative data will be gathered from novice playing the game. Their success in playing the game will be compared to chance expectations for playing the game. Qualitative date will be collected form both novice and expert players of the game. This data will be used to describe the strategies used by each group in their attempts to learn the game.

Definitions

Adult --Someone who has left the role of full-time student (the principal social role of childhood and adolescence) and assumed the role of worker, spouse, and/or assumed primary responsibility for his or her own life (Darkenwald & Merriam, 1982, p. 8)

Adult Learning -- The process of adults gaining knowledge and expertise. (Knowles, Horton & Swanson, 1998, p.

124)

Andragogy -- The art of helping adults learn. (Darkenwald & Merriam, 1982, p. 13)

ATLAS -- Assessing The Learning Strategies of Adults. An easy to administer and complete learning strategies assessment instrument developed using the international database complied using SKILLS date. (Conti & Kolody, 1998b, p. 109)

Gaming -is a term that is derived from the field of gambling.

Engager --ATLAS grouping of passionate learners who love to learn, learns with feeling, and learn best when actively engaged in a meaningful manner. Engagers seek out learning activities that provide opportunities for interaction and collaboration. (Conti & Kolody, 1999a, p. 14)

Learning-How-to Learn -- Is a matter of the adult having and acquiring the knowledge and skills essential to function effectively in the various learning situations in which the learner finds himself. (Smith, 1976, p. 5)

Learning Strategies -- The techniques and skills that an individual elects to use in order to accomplish a specific learning task. Such strategies vary by individual and by learning objective. Often, they are

so customary to learners that they are given little thought; at other times much deliberation occurs before a learning strategy is selected for a specific learning task. (Fellenz & Conti, 1989, p. 1)

Navigator -- ATLAS grouping of focused learners who chart a course for learning and follow it. Navigators favor making logical connections, planning and organizing activities. They rely heavily on planning, attention, identification and critical use of resources, and testing assumptions. (Conti & Kolody, 1999a, p. 9)

Problem Solver -- ATLAS grouping of learners who rely heavily on all the strategies in the area of critical thinking. Problem solvers test assumptions, generate alternatives, and are open to conditional acceptance of outcomes and keep an open mind to learning. (Conti, Kolody, 1999a, p. 12)

Real Life Learning -- Real-life learning is relevant to the living task of the individual in contrast to those tasks considered more appropriate to formal education. (Fellenz & Conti, 1989, p. 3)

Self-directed Learning --A learning activity that is self-planned, self-initiated, and frequently carried out a lone. (Knowles, 1975, p. 18)

CHAPTER 2

REVIEW OF THE LITERATURE

Adult Learning

Information technologies are rapidly becoming available to make learning more effective, interesting, fun, and convenient. Learning is an active process of constructing meaning for the learner. These concept are fundamental to understanding the approach adults use when working through real-life situations that involve learning. There are two notions which learners universally want to have control over, their learning and that learning increases are the results of adult education (Knowles, 1998, p. 124). Adult learning is rooted in the concepts of (a) andragogy, (b) self-directed learning, © learning how to learn, and (d) learning strategies.

Andragogy

An adult educator, Knowles was one of the first to propose a framework for adult learners that included a new method, which he called Andragogy. Knowles discovered that andragogy had been coined by a German teacher in 1933, it was reintroduced by a German social scientist in 1920's and then was more or less forgotten until 1957, when it was picked up by adult educators in Europe (Lee, 1998, pg. 50). Knowles presented the andragogy model in 1950 but settled on

the name in the 1960's (Houle, 1966, p. 27). Knowles (1984) defined andragogy as the art and science of helping adults learn (p. 43).

Andragogy was distinctly different from pedagogy, which is a method of instruction for children (Darkenwald & Merriam, 1982, p. 76). Pedagogy is also referred to as the art and science of teaching children, the term is derived from the Greek words "paid", meaning "child" and "agogus," meaning "leader of" (Knowles, 1998, p. 36). In this model the teacher is assigned full responsibility for making all decisions about what, how, when, and if the child has been learned. It is teacher-directed education, which leaves the learner in a submissive role of following the teacher's instructions (Knowles, 1998, p. 61).

Adults make decisions on whether or not learning is relevant to their circumstances. Andragogy is a learner-centered philosophy that focuses on adult learning principles, appraises the learners needs, and considers resources other than the teacher (Knowles, 1984, p. 14). It can also be characterized as a set of assumptions about learners. The following are six assumptions premised about an adult's maturity. These differentiated adult learners; the fifth and sixth assumptions were added at a later date:

1. The need to know. Adults need to know why they need to learn something before undertaking a task.

So providing a reason and context for learning is important. (Knowles,1998, p.55).

2. The Leaner self-concept. Adults have a deep psychological need to be self-directed. They like being responsible for their own decisions. (pp.56-57).
3. The role of learners' experience. Adults have accumulate a reservoir of experiences that serves as a resource for learning, as well as a broad base to relate new learning (p.57).
4. Readiness to learn. Adults become ready to learn things that they need to know or to be able to do in order cope with their roles in real-life situations in society (p.58.)
5. Orientation to learning. Adults tend to have a problem-centered orientation (p.59).
6. Motivation. Adults are more motivated to learn by external factors which are frequently barriers to self-direction (p.61).

The assumptions listed above places emphasis on the roles of problem-solving and the value of learning. These qualities are valuable assets that are critical in computer learning tasks. For Knowles, the learning process involves the whole person, emotionally, psychologically, and intellectually.

As a learner matures, their need and capacity for self-direction, to use their experience in learning, to identify their own readiness to learn, and to organize their learning around life problems increases. There are four assumptions about the mature learner. (1) The self concept moves from one of dependency toward self-direction. (2) The learner has a growing reservoir of experiences that becomes a rich resource for learning. (3) the readiness to learn moves

toward that of developmental task of their social roles. (4) They move from postponing the application of new knowledge to one of immediate application. The learner orientation moves from one of subject-centeredness to performance-centeredness.

It is the mission of adult educators to assist adults in developing their full potential in becoming self-directed and mature adults. Adults are active learners involved in all steps of the learning process of selection to evaluation and that is andragogy. Learners are the directors of their learning processes and needs (Ghost Bear, 2001, p. 10). Tough 1979 found that learners if given a choice would assume the responsibility for planning and directing their learning activities (Brockett & Hiemstra, 1991, p. 9). When learners assume responsibility they general learn at their own pace. And they start at a point or cognitive level of knowledge that is even to or below the new knowledge they want to learn. The participants in the Reels and Deals study volunteered for the project. Most stated they were just curious about the machine and the research, Nonetheless the $100 was an motivational incentive. It is not uncommon for adults to spend 700 hours per year involved in learning activities, which may be motivated by realistic reasons such as interest, curiosity, and enjoyment (Tough, 1971).

Andragogy places emphasis on the importance of experience as well as self-direction and intrinsic motivation.

Knowles emphasis was on a learner centered framework that shifted his philosophy from that of teacher-centered to learner-centered is well documented in literature (Rogers, 1969; Knowles, 1973; O'Banion, 1997). Both Dewey (1916) and Lindeman (1926) laid the foundation for the learner-centered philosophy proposed and implemented by Knowles about of adult learning. "Our academic system has grown in reverse order: subject and teacher constitute the starting point, students are secondary"(Lindeman, 1926, p. 6). Lindeman also specifies in conventional education the learner must adjust to the curriculum but in adult education the curriculum should be built around the learner's needs and interest.

When principles of andragogy are translated into a process for planning and operating educational programs, the process turns out to be quite different from the curriculum planning and teaching processes traditionally employed in youth education. Knowles later recanted his beliefs about Andragogy and expressed the framework could also be used in teaching children.

There are 7 assumptions of andragogy that needs to be implemented when developing a model for adult education

programs, which is comprised of: (1) creating a climate conducive to adult learning, (2) establishing of a organizational structure for participative planning, (3) identification of needs for learning, (4) objectives of the learning process, (5) development of a proposed plan of activities, (6) procedures of the activities and finally (7) the re-evaluation of the needs for learning (Knowles, 1980, p. 59).

The economic churning of the past 50 plus years has placed an enormous amount of pressure on adults to invest in educational updating and lifelong learning strategies. There has been a systematic change in the thinking and behavior of learners seeking to improve their lives for themselves and their families and technology has made a significant difference. On human nature and education in life Lindeman (1926) states:

> they (adult learners, ed.)are searchers after the good life. They want to count for something; they want their experiences to be vivid and meaningful; they want their talents to be utilized; they want to know beauty and joy; and they want all of these realizations of their total personalities to be share in communities of fellowship. Briefly, they want to improve themselves; this is their realistic and primary aim. But they also want to change the social order so that vital personalities will be creating a new environment in which their aspirations may be properly expressed. (p. 14)

Self-directed Learning

Learning means taking advantage of all of the resources available for personal growth. Knowles (1975) was an advocate of self-directed learning and described self-directed learning as

> A process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs. The learner formulates goals identifying human and material resources for learning, then chooses and implements the appropriate learning strategies, and evaluating learning outcomes. (p. 18)

Self-direction allows the learner to focus upon personal goals and interest. In self-directed learning, the learners control the settings, the resources, and the matter in which they critique the learning process. They undertake the role of governing their own learning as problems arise. "People who take the initiative in learning (proactive learners) learn more things, and learn better, than do people who sit at the feet of teachers passively awaiting to be taught (reactive learners)" (Knowles, 1975, p. 14). Self-directed learning is more in tune with the natural process of development from infancy through adulthood. As adults, learners must assume the role of making decisions and accepting the responsibility for the

outcome. Self-directed learning can be described in numerous ways such as "self-planned learning," "inquiry method," "independent learning," "self-study," or "autonomous learning" (Knowles, 1975, p. 18). No matter how it is described, it must occur for the betterment of the learner. Self-directed learning is a term that describes the way individuals seek out learning.

> Self-directed learning starts with learners becoming aware of some need for learning. This need may be to acquire some particular knowledge or skill in order to gain certain benefits, such as a better job or greater self-confidence, more self-esteem or greater competency in performing a role; or the need may be simply to enjoy the pleasure of learning or to satisfy curiosity. (p. 8)

Restrictions to the true meaning of self-directed learning occur when attempts are made to categorize self-directed learning. "Any learning process where the learner is the decision-maker and in control of the learning process is self-directed learning" (Ghost Bear, 2001, p. 12).

Brookfield is a proponent of critical reflection of the learners experiences. In order for transformation to take place the learner must reflect upon new learning experiences and adjust their existing beliefs to redefine their world (Mezirow, 1997). Brookfield examined four strands of empirical research about adult learning that he felt established the distinctive adult dimension of lifelong

learning as opposed to just adult learning. They include the capacity to think dialectically which is a form of adult reasoning where learners has a chance to explore contradictions and discrepancies and apply them to their life. Second, learners must employ practical knowledge based on a understanding of the situation they find themselves in after a lengthy and mindful immersion in the experience. The learner should be able to make a logical decision. The third strand is the learning-to-learn stage where the learners become self-consciously aware of learning styles and are able to adjust them in the situation where they find themselves. The fourth and last strand involves the ability to use critical reflection regarding the assumptions they had made about a situation. This is reflected in their beliefs and value systems which were developed during early childhood and adolescence. Learners test assumptions to see if they are valid based on their norms and their context in life.

Brookfield in his discussion of facilitating learning clarifies six central principles of effective practice. The first is that the participant is a volunteer. Learners engage in activities because of some desire to develop skills, acquire new knowledge, to improve already assimilated competencies and improve self-insight. Second

there is mutual respect between the facilitator and the learner. If a learner is disrespected in front of their peers or embarrassed by the facilitator they may be unable to learn. Third the facilitator should work in collaboration with the learner. This should include diagnosis of needs in the setting of goals, in curriculum development, in methods or techniques to be used and in generating a way to evaluate the criteria. Fourth is action and reflection. Praxis is closely associated with the ideas and literacy activities of the Brazilian educator, Paulo Freire (1970a, 1970b, 1973, 1985) who discussed a number of specific techniques that were used to help South American illiterate acquire literacy skills. This process centers on the need of the learner to engage in continuous and alternating processes of investigation and exploration, followed by actions grounded in this exploration, followed by reflection on the action, and the cycle keeps repeating itself. Fifth is critical reflection, which fosters an attitude of healthy skepticism. This represents a democratic student-centered approach to learning. It is Brookfield's contention that learning is being effectively facilitated when the educator is prompting in the learner a sense of culturally constructed nature of knowledge, belief, values and behaviors. Finally, sixth there is an aim of

facilitating to nurture self-directed and empower the adult learner. Self-direction is a way of learning how to change the learner's perspectives, shift our paradigm and replace the way we interpret the world by another (Brookfield, 1986, pp. 9-19).

Learning How to Learn

Learning how to learn is a matter of adults having or acquiring the knowledge and skills essential to function effectively in the various learning situations in which they find themselves (Smith, 1976, p. 5). The concept of learning how to learn can be given meaning by identifying what the learner needs to know and involves the sub-process of planning, conducting, and evaluating learning activities.

Learners need to identify educational needs and interest, be realistic about the attainable goals and objectives, and be able to evaluate the process. Planning is the first phase of the concept of adult learning which involves locating and analyzing resources to be used and then selecting appropriate procedures or strategies. During the second phase of the process or the conducting process, the learner must learn to manage the resources and procedures (of). The learner learns to give and receive feedback. In the third phase of the process, the learn should be able to evaluate how effectively the process was carried out. The

learner must be able to determine appropriate forms of action and assumes responsibility for the learning; others may be and considered as collaborator, facilitator, or co-learner (Smith, 1982, p. 22). If the learner perceives a need, the learner should have the freedom to make the choice about what works and does not work.

Learning means different things to different people. Some learners think learning involves a teacher or enrolling in a class. Others believe they do not need anyone to teach them; they seek out knowledge for themselves by using available resources. "It is tragic that most of us know how to be taught, but we have not learned how to learn" (Knowles, 1975, p. 18). Learners use their existing knowledge to construct new knowledge. "If you possess the necessary knowledge and skill, you learned how to learn; and when you help yourself or others to acquire that kind of knowledge or skill, the concept is also at work" (Smith, 1982, p. 19).

Like the term self-directed learning, learning how to learn is subject to a variety of expressions and "is not readily defined with precision" (Smith, 1976, p. 4). When a learner undertakes a project, it is because there is a disorienting dilemma or a task for which there is no previous experience, knowledge, or resources available for the process of reflection. During the process of solving the dilemma or

task, learning take place. Therefore, the learner becomes self-directed in the process of learning how to learn. "Learning is not a task or problem; it is a way to be in the world. Therefore, adults learn as they pursue goals and projects that have meaning to them. He is always learning something" (Jourard, 1972, p. 66).

Cognitive Development

Cognitive development has been studied since the 1950's. One author who has devoted his life to the study of cognitive development is Jermone Bruner, who was a Professor of Psychology at Harvard (1952-72), a Watts Professor at Oxford (1972-80) and now at the New School for Social Research in New York City. His work was on the cutting edge of what is called the Cognitive Revolution, which had it beginning in the 1960's. His work along with other educators is the foundation on which the Reel and Deals study was based. Bruner was a major contributor to the field of learning. However, he was not a learning theorist but could be classified by his theories in the contructivist domain. "Constructivism stresses that all knowledge is context bound, and that individuals make personal meaning of their learning experiences. Thus, learning cannot be separated from the context in which it is used" (Knowles, 1998, p. 142).

Bruner's focus was on the "cognitive development" and

the "theory of instruction" in children. Cognition is related to thought, but in a broader sense it refers to all the ways in which a person comes to know about the world (Educational Psychology, 1973, p. 85). He developed activities that engaged children in formulating the big picture concepts through the use of illustrations. Children go through a sequential developmental process of growth during intellectual development. Bruner (1966) developed six "benchmarks" in the nature of intellectual development. They are:

1. Growth is characterized by increasing independence of response from the immediate nature of the stimulus.
2. Growth depends upon internalizing events into a storage system that corresponds to the environment.
3. Intellectual growth involves an increasing capacity to say to oneself and others, by means of words or symbols, what one has done or what one will do.
4. Intellectual development depends upon a systematic and contingent interaction between a tutor and a learner.
5. Teaching is vastly facilitated by the medium of language, which ends by being not only the medium for exchange but the instrument that the learner can then use himself in bringing order into the environment.
6. Intellectual development is marked by increasing capacity to deal with several alternatives simultaneously, to tend to several sequences during the same period of time, and to allocate time and attention in a manner appropriate to these multiple demands. (pp. 6-7)

These "benchmarks" for the theory of development were

constructed based on work in the field of cognitive development of Jean Piaget. Piaget identified four principle periods of development (Bloom, Hastings, & Madaus, 1971, p. 297. In the sensorimotor period (0-2 years), learning takes the form of motor skills. In the preoperational period (2-7 years), intelligence is intuitive in nature. In the concrete operational period (7-11), cognitive structure are developed. In the formal operational period (after 11), thinking involves abstractions).

Studies of adult development revealed that adults pass through developmental phases that are different from those experienced by children and youth" (Smith, 1982, p. 42). Smith divides the developmental theory of adulthood into various stages. One of the most common and manageable divisions is early adulthood (18-39), middle adulthood (40-59), and later adulthood (over 60). During periods of transition, adults require learning that allows them to explore their personal meanings and values and to transform those meanings to make them more congruent to reality. This is sometimes called qualitative learning. During a stable time in their lives, the adult learner broadens and consolidates knowledge for integrating new meanings into old constructs and life experiences (p. 43).

Les Vygotsky, a Russian psychologist who was born in the

1896, was responsible for the social development theory of learning. He was employed at the Institute of Psychology in Moscow between 1924-1934. He began his work in psychology in 1924, and 10 years later he died of tuberculosis at the age of 38. He determined that social interaction profoundly influenced cognitive development. His legacy to education was the "Zone of Proximal Development" which is defined as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). This construct was introduced as a way of critically approaching instruction and psychological testing. Vygotsky used the zone of proximal development to refer to the difference between what children can do own their own and with the assistance of a teacher. If an educator carefully provides instruction at an appropriate level of guidance, children will be able to perform at a higher level than they could have done on their own. Piaget's theory suggests that development had an endpoint in goal whereas Vygotsky theorizes the developmental process that begins at birth and continues until death is too complex to be defined in stages (Driscoll, 1994). One feature of the zone of proximal development is it can be

either natural or deliberately constructed as long it reflects a difference between actual and potential growth (Frawley, 1997, p. 102).

Inspired by Piaget, Bruner (1966) focused on how learners construct new knowledge. His contructivist approach still influences current theories. The "theory of instruction" has four major features: (1) a theory of instruction must be concerned with experiences which implant in the learner a readiness to learn; (2) instruction must be structured so that it can be easily grasped by the learner (spiral organization of the curriculum); (3) instruction should be designed to facilitate effective sequences in the presentation of material to be learned so that allows the learner to go beyond the information given; and (4) a theory of instruction should identify the nature and pacing of rewards and punishment in the process of learning and teaching
(p. 40-41).

The "theory of instruction" involves the manner in which a child represents the world through three progressive modes of representation in intellectual development: enactive, iconic, and symbolic. The enactive (motor/doing) involves representation through action itself. "It consists mainly of knowing how to do something; it consists of a series of

actions that are appropriate for achieving some results" (Spencer, 1988, p. 173). It is the interaction between learner and an object that bestows reality upon an object or ways of manipulating the environment. This is represented by Piaget's work with children in the sensorimotor stage of development.

> A one-year old child, presented with a favorite toy, will not cry upon its removal unless he is holding it in his hand. Later, removal will bring tears if he has begun to move his hand out to reach it. Still later, if suffices to enrage him that it is removed when his eye has fallen on it. Finally, he will cry when the object, place under a cover some time ago, is found to be missing when he returns to it. Objects, in short, develop an autonomy that is not dependent upon action. If at first "a rattle is to shake" and "a hole is to dig," later they are somehow pictural or conceivable without action. (Bruner, 1966, pg. 12-13)

The iconic (sensory/imagery) mode involves representing intellectual understanding through the use of mental images to summarize and capture action. This mode allows the child to recognize minor changes in the objects. In this stage, a child notices and remembers the visible or "surface" features of objects. For example, children were presented with a board (Bruner & Kenny, 1966) on which nine glasses were then scrambled after the child had looked at them. The child was then asked to reconstruct the arrangement that was there previously. To the extent that the child could successfully perform the test, it verified the iconic representation of

the matrix stored in memory.

The second phase of this study was the same as the first with a change when a glass that was initially in the lower left-hand corner of the matrix (the shortest, thinnest glass) was placed in the lower right-hand corner. The child was asked to build the matrix that was there before, leaving the one glass that had been changed by the experimenter in a specified position. The child then had to transpose the matrix, which would not be possible if the only representation was an image. The 3-year olds had difficulty with either task; they presumably are still primarily relying on enactive representation; the child now has an iconic representation of what was seen. "But the performance may be contrasted with that shown for transposition, an accomplishment beyond the ability of children of this age. Without symbolic representation the transposition task is not soluble" (Educational Psychology, 1973, pp. 90-91).

The symbolic (verbal thinking or language) mode represents things by design features that include remoteness and arbitrariness, which is symbolic representations greatest strengths. "Linguistic symbols are far more versatile than action or images; using them one can rapidly eliminate alternatives, deduce conclusions (also in abstract, symbolic form), and reach the greatest heights of his own cognitive

capacity" (Educational Psychology, 1973, p. 91). Language permits the learner to communication and make meaning of images. The cognitive activities of learners involve categories, which is the process of building and using representation in order to make sense of the world. Learners carry around in their heads a conceptual model (or models) of the world and things that are in it, including one's self. These models are elaborated over many years, and the learner can interpret the sensory data with which they are continually bombard and can maintain the integrity of perceptual and cognitive experience (Bruner, 1966, p. 11). Burner believes that the theory of development must be linked with both the theory of knowledge and the theory of instruction (p. 21).

Adult learning researchers performed similar studies using memory-recall in adults. However, Bruner's work was age specific when recall was tested in his studies of the matrix boards. The first study was conducted by Djakow, Petrowksy, and Rudik in 1927. The experiment was a Memory-Recall Model to study the long-term memory on the perception of a chess game constellation using adults. In the original study experts and non-expert chess players were asked to reconstruct different types of stimulus materials that were experimentally varied more or less to resemble a chessboard

and its pieces. The participant were masters and a control group who had no cognitive knowledge of chess. There appeared to be no difference between the masters' and the control subjects' ability to reconstruct a pattern of pieces presented for about 1 minute when the board and the pieces did not resemble a chessboard and chess pawns. However, when a 8x8 board with moving pieces was used, the masters' reconstruction was slightly better than that of the control subjects. More importantly, when actual chess position were used, masters scored "three times as high" as the average obtained in "mass experiments with non-chess players (Sternberg & Frensch, 1991, p. 351).

This study was replicated in different knowledge domains by de Groot starting in 1965. The subjects in his study were a grandmaster, a master, an expert, and a strong chess player. They were show 16 positions on a chess board rather than just 1. The position was only viewed for 2 to 15 seconds with a mean exposure time of 4 seconds. At the end of the each trial, the pieces were shuffled and the players were given half-a-minute to organize their memory. The two top players responded verbally, and the two lower players repositioned the pieces on a chessboard. The results was clear-cut. For 10 positions in which the conditions were nearly homogeneous (about 17 pieces to recall with an

exposure time of 3-4 seconds), the number of pieces correctly recalled were as follows: 93%--the two top players (grand masters), 72%--experts, and 51%--strong players. In addition the grand master recalled only 2 of the positions perfectly. The two less-skilled players did not recall any of the 10 positions. De Groot (1965) interpreted these results as due to different amount of experience possessed by the four players. The grand master is an experienced player and knows what to expect in a chess game. Grand masters know what chess configuration are more or less typical and which pieces are more or less likely to occur in a certain constellation. Master players can perceive and store relatively larger constellations of piece when they fall in a typical category. Inexperienced players, in contrast, do not possess this knowledge and are much more likely to view individual pieces as separate entities that are not related to each other (Sternberg & Frensch, 1991, pp. 351-352). One of de Groot's conclusions was that experienced players simply possess a more fine-tune information processing machinery than less-experienced players. In addition, their short-term memory for any kind of information and not just chess is better than short-term memory of less experienced players.

These two studies were in impetus for a study completed by other researchers. Chase and Simon (1973) were the

developers of the Chunking Theory. According to Sternberg, they looked at how the reconstruction process took place. They noticed that experts place more chess pieces on the board at one time, which were placed in groups that represented functional units of meaningful chess configurations. They established that experts had conceptually driven recall rather than generally better perceptual memories for random placements of chess pieces. They indicated experts' memories were superior to novices' only for combinations that were meaningful in terms of the chess game. Expert's had larger "chunks," units that were functional in the domain, available for recall (Sternberg & Frensch, 1991, p. 289).

Jerome Bruner was a proponent of the discovery method, the inquiry method, and self-directed learning or problem-solving learning. Computers can help promote discovery and inquiry approaches to learning and teaching. His framework of inquiry was based on the belief that all individuals have a will to learn.

> The will to learn is an intrinsic motive, one that finds both its source and reward in its own exercise. The will to learn becomes a "problem" only under specialized situations like those of a school, where a curriculum is set, students confined, and a path fixed. The problem exist not so much in learning itself, but in the fact that what the school imposes often fails to enlist the natural energies that sustain spontaneous learn-curiosity, a desire for competence, aspiration to

> emulate a model, and a deep-seeded commitment to the web of social reciprocity. (Bruner, 1966, pp. 125-127)

Adults approach learning with the concepts they developed at an early stage in life and life experiences. Knowles (1973) states "the notion that the development of skills of inquiry should be a primary goal of youth education is the cornerstone of the concept of education as a lifelong process" (p. 79). He also states that pedagogy assumes that children are ready to learn those things they "ought" because of their biological development, and andragogy assumes adult learners are ready to learn those things they "need" because they are approaching their social roles. (p. 47).

Based on a notion of Bruner's work (1971), Gagne contended that there is a distinction between problem solving and problem finding. In problem solving (discovery), the participants are faced with a problem "out there" to which they can apply rules. In problem finding, by contrast, participants define the problem themselves using previously acquired rules but also personal ways of thinking to produce an original solution (Gagne & Driscoll, 1988, p. 56).

Concept Formation

The traditional methods of studying concepts were in two types. The first was used to investigate the already formed concepts of children through verbal definitions of their

content. In the second method, there was a concentration of the word but that failed to take into account the perception and mental elaboration of the sensory material that gives birth to concepts (Vygotsky, 1962, pp. 52-53). Concept formations has to do with the linking of word and objects.

> Memorizing words and connecting them with objects does not in itself lead to concept formation; for the process to begin, a problem must arise that cannot be solved otherwise than through the formation of new concepts (p.53).

The task of understanding and communication are similar for a child and the adult, however children develop concepts at an extremely early age but their thoughts differ profoundly from those of an adult's in respect to composition, structure, and mode of operation. In concept formation all of the intellectual functions come together in a holistic process. The process:

> Cannot be reduced to association, attention, imagery, interference, or determining tendencies. They are all indispensable, but they are insufficient without the use of sign, or word, as the means by which we direct our mental operations, control their course, and channel them toward the solution of the problems confronting the learner. (Vygotsky, 1962, p. 58)

In the adolescent stage of the life the learner does not abandon concepts that have been learned at an early stage. The concepts continue for a period of time to dominate the way the learner thinks. The adolescent will use a concrete concept quite correctly in a concrete situation but will have

difficulty expressing it in words. An even if they use words the concepts will be much narrower than might be expected based on the way the learner used it. According to Vygotsky, adults have this same problem, even at an advanced level of thinking. "The analysis of reality with the help of concepts precedes analysis of the concepts themselves" (Vygotsky, 1962, p. 79). He also proposed that this confirms that the assumption that concepts evolve in ways different from deliberate conscious elaboration of experience in logical terms (p. 79). In the introduction of the book, Thought and Language, Jermone Bruner made the following statement, "There is a repeated emphasis on man's capacity to create higher order structures that, in effect, replace and give new power to the conceptual structures that one climbed over en route to higher mastery" (Vygotsky, 1962, p. ix).

Computer technology provides an excellent conceptional environment where learners can collect information then organize, visualize, link, and discover relationships between facts and events. The very pervasiveness of technology in the lives of learners is a relatively new phenomenon with implications in education and business that is only now beginning to be understood and appreciated. Learners who use computers have already developed some concepts about the world around them.

In the study of the Reels and Deals Skill Stop game, learners who played the game are not necessarily aware they are using concepts that were developed at an early stage in life. Learners were creating associations and categorizing based on what appeared on the three spinning reels on the computer screen. They were using differentiations as simple as an apple is red and belongs to the category fruit or the bars on the screen belong to a category of shapes.

Furthermore, concepts can vary from simple terms, such as a lamp, to complex formulations, such as justice (Educational Psychology, 1973, p. 169). However to better understand how adults use the computer to enhance their current concepts, experiences, and strategies, an effort must be made to understand concept development and the learning process.

Concept formation is a consistent process that begins during the infant stage and inevitably changes throughout the life-span. Concept formation involves the recognition that some objects, events, or ideas belong together while others do not. Concept formation or concept learning is represented as a way of organizing experiences of the learner. The process of growth in an infant moves from a stage of "utter" helplessness to one of control in the pathway of cognitive/ intellectual development. This learning process involves

both differentiations and integration of knowledge. Young children react to situation as a whole. For example:

> When a baby tastes something objectionable, the whole body tends to respond, not just the taste organs. Through the experience the children start to differentiate their response to the environment. They start distinguishing between mother and father and other members of the family they come in contact with. They soon can separate dogs from cats and them become aware of varieties of dogs and cats. These differentiations based on experience leads to the development of concepts, that is, the development of the ability to classify objects by characteristics they have learned to identify. (Heinich, Molenda, & Russell, 1985, p. 7)

During this developmental process verbal labels have some meaning, but prior to the acquisition of experience, verbal labels may lead to diffuse and confused responses from the child (p.7).

The second step in the intellectual growth of children is the process of integration of the differentiations they learned into generalization and abstracts. The child continues to learn responding to the total environment but from a different prospective. They start organizing their differentiations into a series of constructs or classification/categories. In the process of differentiation, the child first distinguishes dogs from cats and then certain dogs from other dogs. At this stage in differentiation the child is now in a position to deal with the class, dog, in a much more meaningful and useful way (p.

7). The child can carry over from one experience of the object to subsequent experiences certain expectations of certain characteristic modes of behavior--and may expect these even before they show themselves (Dewey, 1991, p. 128). If the behavior of the object are not fulfilled, the child is forced to throw out certain traits from the dog meaning, but if it is fulfilled, other traits are selected and emphasized (p. 128).

This ability to integrate helps learners to achieve working generalization or categorization. The ability to categorize objects or experiences as part of a group is what is meant by concept attainment (Educational Psychology, 1973, p. 170). The same principles can apply to any leaner of any age who has very little experience about any particular subject. Adult learners make differentiations much quicker than children because of their past experiences. Differentiations and integrations are part of the learning process. Moreover, learning can be guided by instruction and instruction by the teacher (p. 7).

Learners form concepts to simplify the environment and know how to react. To reduce cognitive struggle and assure that concepts are learned readily and accurately, learners adopt certain learning strategies.

Learning Strategies

Learning strategies are ways adults approach a specific learning task. It is their preferred method of organizing and conducting their learning process. There is a growing body of knowledge to support this process. Learning strategies are those techniques or specialized skills that a learner elects to use to accomplish a specific learning task (Conti & Fellenz, 1991, p. 64). The skills or methods selected to accomplish a task often have a great influence on the success of the learning activity.

Learning strategies have been credited with improving both classroom achievement and the learning that takes place outside of formal educational institutions (Fellenz & Conti, 1991). In the field of Adult Education, learning strategies have been conceptualized as consisting of the areas of metacognition, metamotivation, memory, critical thinking, and resource management (Conti & Kolody, 1999). Metacognition is a conscious, reflective endeavor which requires the learner to analyze, assess, and manage learning activities. Metamotivation deals with one's knowledge and understanding of how and why one is motivated to participate and stay in an activity. Memory is the ability of a leaner to retain information, recall it when needed, and recognize it when it is seen and heard at a later date. Critical thinking is a reflective thinking that uses higher order thinking skills in

order to learn. Resource management uses resources effectively by managing and finding solutions to real-life, everyday problems.

Research in the area of learning strategies has uncovered three strategy preference groups (Conti & Kolody, 1999). These are Navigator, Problem Solver, and Engager. Navigators are focused learners who chart a course for learning that is conscientious. They make logical connections from planned and organized activities. Problems Solvers rely heavily on all the strategies in the critical thinking area. Engagers are passionate learners who love to learn and seek out activities that provide opportunities that are interactive and collaborative.

Learning strategies are often misinterpreted to be learning styles. Learning styles are cognitive, affective and physiological traits that can indicate learning environment awareness, interaction, and response which are fairly stable and consistent. Learners use learning strategies in formal and informal situations and learning strategies "are more a matter of preference; they are developed throughout life and vary by task" (Fellenz & Conti, 1993, p. 4). The learning strategy that a learner uses may have a great impact on wether or not the learner is successful. The theory of learning is prescriptive in the

sense that is sets forth the rules concerning the most effective way to achieve knowledge and skills. It is also normative as it sets up criteria and states the conditions for meeting them (Bruner, 1966, p. 40).

Bruner believed that from a phenomenological prospective everyone does not learn the same. Schmeck (1988), a professor at Southern Illinois University in the Department of Psychology, asserts learning is at two extremes; one learner might describe learning through retention of knowledge which is often achieved through repetition and recitation while another learner might describe learning as an interpretive process aimed at understanding reality (p. 3). In an active learning process, the learner selects and transforms information, constructs a hypotheses, makes decisions, and relies on a cognitive structure to accomplish the task.

Strategies are not fixed things. They are altered with the nature of the concept that is being sought. Piaget states that individuals construct their own reality and a child is thought to incorporate accurate images of the real world.

> Knowledge is derived from action, not in the sense of simple associative responses, but in a much deeper sense of assimilation of reality into the necessary and general coordination of action. To know an object is to act upon the object and to transform it. Intelligence consist in executing and

> coordinating actions though in an interiorized and reflective form. (Piaget, 1971, pp. 28-29)

Learning strategies are the techniques and skills a learner elects to use in order to accomplish a task. Strategy selection is dependent on past experience, relevant knowledge, or amount of personal and involvement in the situation. Skills and techniques selected by the learner to accomplish a task often have a great influence on the success of the learning activity. Expertise and insight in the use of learning strategies is a significant part of one's ability to learn (Conti, 1993, p. 3).

Strategies refers to a pattern of decisions in the acquisition, retention, and utilization of information that serves to meet certain objectives, to insure certain forms of outcome and to insure against certain others" (Bruner, Goodnow, & Austin, 1986, p. 54). Strategies take on the form of patterns in the sequence of decisions that are made in determining whether objects belong to groups, events, or ideas.

To show how cognitive strategies should be used by educators to build concepts or representation, Bruner and Kenny (1966) organized an experiment using 4 children (2 boys and 2 girls) who were 8-years old as the participants. Plywood board were used as the instrument. Some educators refer to these boards as the "Bruner Boards". This first

thing they did was to get and hold their attention. Each child was provided with building materials that included large flat squares whose dimension were unknown. The boards were described as x long and y wide. There were other strips that were as long as the side of the square, and there were little squares with sides equal to 1" width. The researchers had to convince the children that they did not care about the metric size of the big square so the children would work in a relaxed manner. From that point, the children discovered for themselves that the long strips were x long. They took on trust that the small square was 1" or simply as "1 by x." The children were asked if they could make the large square bigger. The children very quickly built large squares by making numerous designs. The children were asked to keep notes for the recipe of their constructed squares. They could readily measure off, an x and 2, or x + 2, and so the whole thing was $(x + 2)^2$. The child continued to translate the image constructed in terms of a mathematical formula. It was almost impossible for the child not to make some discoveries about the number: for example, the x values go up 2, 4, 6, 8; the units values go up 1, 4, 9, 16; and the dimensions increase by addition to x of 1, 2, 3, 4. The children developed an understanding of abstract formulas by working with concrete, visible, manipulable pieces of wood.

An example of one formula was $(x + 2)^2 = x^2 + 4x = 4$. The children learned the concept by using concrete objects. What is concrete at one period of growth is abstract at another (pp. 59-66). The researchers followed this process with another project using a balance beam to look for at accumulative property on the children mathematical language.

Gaming players also deal with concrete concepts when they attempt to visualize the order of objects (cherries, oranges, plums, bells, and wild objects) on the spinning reel matrix. What might be abstract to one learner might be concrete to others based on their intellectual level. Concrete represents thinking applied to activities for the sake of dealing effectively with the difficulties that present themselves fundamentally--"beginning with the concrete" signifies that the learner should at first make much of doing" (Dewey, 1991, p. 139).

In some learning environments, learning and teaching strategies are integrated into its design. In other environments, teaching and design are separate. DeBono (1971) believes that the sequence in which a learner encounters materials has a direct effect on the mastery of the task. This applies to all learners not just children. When a learning task is presented to adults who have no applicable experiences on which to draw, the learner will ultimately

have to follow the path developed as children that involved iconic and symbolic representation. New information is organized and placed into pre-existing categories, or new categories are developed by executing the task. Category is a term used by Bruner to describe a grouping of related objects or events. In this sense, a category is both a concept and a percept. Bruner also defines it as a rule for classifying things as equivalent. A category also represents a unit of information composed of events, happenings, and instances (Strauss & Corbin, 1990).

Schema Theory

Schema is the process of explanation in guided principle that every input is mapped against some existing schema and that all aspects of the schema must be concurrent with the input information (Carrell & Eisterhold, 1988, p. 76). There are two basic modes of information processing, called bottom-up and top-down processing. Bottom-up is evoked by incoming data which is converge into high level, more general schemata. Bottom-up is called data-driven. Top-down conceptual processing occurs as the system makes general predictions based on higher-level, general schemata and then searchers the input for information to fit into these partially-satisfied, higher-order schemata (pp. 76-77). "Top-down processing refers to processing that is affected by

what an individual brings to the learning situation on the basis of knowledge and past experience" (Gilhooly, 1989, p. 292). The primary impact of prior knowledge on memory occurred at the time of retrieval and remembering is affected by schemata; memory is "an active organization of past reactions, or of past experience (Bartlett, 1932). Rumelhart (1980) explained what he meant by a "schema" in the following definition:

> A schema, then is a data structure for representing our knowledge about all concepts: those underlying objects, situations, events, sequences of events, actions and sequences of actions. A schema contains, as part of its specification, the network of interrelations that is believed to normally hold among the constituents of the concept in question. A schema theory embodies a prototype theory of meaning. That is, inasmuch as a schema underlying a concept stored in memory corresponds to the meaning of the concept, meanings are encoded in terms of the typical or normal situations or events that instantiate (i.e., provide concrete examples of)that concept. (p. 34)

Metacognition

Experts and novice differ in the metacognitive levels. In educational psychology, metacognition is the ability of a learner to control and be aware of the knowledge that is in one's cognitive system (Schraw & Dennison, 1994). It involves the process of people understanding how they go about learning. "Meta" is the broad overview of looking at how one goes about learning. The concept was introduced in the 1970's by John Favell and Ann Brown. It is a important

component of intelligence and cognition. The learner has knowledge about the cognitive abilities (memory restriction), about cognitive strategies (to remember time tables I must rehearse), and about a task (distributed learning). Metacognition is the ability to learn how to learn by using skills that teach learners to ask questions about what they know and do not know and to go about regulating how they conduct the learning process. "Metacognition deficiencies are the problem of the novice, regardless of age. Ignorance is not necessarily age related; rather it is more a function of inexperience in a new (and difficult) problem situation" (Brown, 1987). Metacognition allows learners to be successful learners by introducing them to higher order thinking. Metacognition is basically thinking about thinking and thinking about what one knows and does not know. Thinking people are in charge of their behavior.

Research has shown that metacognition differs from cognition in that cognitive skills are necessary to perform a task and metacognition is necessary to understand how the task was performed (Schraw, 1998, p. 113). There are three different learning strategies involved in metacognitive awareness: declarative, procedural, and conditional. Declarative knowledge includes knowledge about oneself as a learner and about what factors that influence the learner's

performance. Based on the findings of Baker (1989), what learners know about their own memory indicates that adults have more knowledge than children about the cognitive procedures associated with memory and that good learners appear to have more knowledge than children about different aspects of memory such as capacity limitations, rehearsal, and distributed learning.

Procedural knowledge refers to knowledge about doing things and is represented as heuristics and strategies. Learners with a high degree of procedural knowledge perform tasks more automatically, are likely to possess a larger repertoire of strategies, and sequence strategies effectively (Pressley, Borkowski, & Schneider, 1987) and learners use qualitatively different strategies to solve problems (Glaser & Chi, 1988). The examples include how to chunk and categorize new information.

When learners chunk, they are looking for patterns or ways of putting pieces of information together. While it is difficult to remember 20 things, these things can be chucked into 4 to 5 groups that can be remembered enough to make sense of small groups. This is a process of organizing information into meaningful patterns.

Finally, conditional knowledge is based on findings by Garner (1990) who theorizes metacognition is knowing when and

why to use declarative and procedural knowledge. His example is that effective learners know when and what information to rehearse, which helps learners to designate resources and use strategies more effectively (Reynolds, 1992). Metacognition also enables the learner to adjust to changing situations (Schraw, 1998, p. 114). As learners advance in learning, they acquire more metacognitive knowledge which is flexible and can be adapted to new learning areas. One such area where the learner is challenged is computer gaming technology.

Metacognition is very important to the learner because it helps learners manage their skills. It helps them to determine their strengths and weaknesses in the use of their cognitive skills. It aids the learner in setting objectives and goals for the project at hand.

Metacognition strategies include Planning, Monitoring, and Adjusting (Blakey & Spence, 1990; Counter & Fellenz, 1993). Planning involves the learner determining the best technique for accomplishing a learning task. Learners must know and understand their own learning needs, know what is required by the learning task, and develop a general plan on how to best proceed with the situation. An example would be generating questions to record data in an experiment by prioritizing, organizing, and establishing the criteria.

Monitoring occurs as a learner goes through the process of learning. It requires the learner to maintain an awareness of knowledge, task, goals, and strategies in relationship to one's own abilities and skills with respect to the learning project. As the learner processes the new knowledge more deeply, the knowledge more likely will be retained in long-term memory (attainment).

Adjusting is the process of modifying and revisiting the learning and making appropriate evaluation of the processes in order to implement changes. In the case of the participants, their strategies were being changed to meet the objectives that had been constructed for hitting the wild icon. Learner restructure the learning procedure to satisfy their cognizance level and develop new systems to help match the task. Adjusting gives the learner control and objectivity over their learning. "Effective learning calls for such modification or change in order to fine-tune or occasionally revise learning situations" (Conti & Fellenz, 1993, p. 9).

Learning Objectives

For learning Reels and Deals, the participants were initially given only one clue on how to play the computer-based game based on information from a previous study. This clue was to watch the reels and focus on seeing a pattern

around the icon. They were told it was a skills-based game. "Students like to know what they are supposed to learn and what they are suppose to know when learning has been completed" (Gagne & Driscoll, 1988, p. 75). Later the participants were given a list of things that might be helpful, which is as follows:

1. There are a limited number of icons on the reels
2. Each reel has the same number of icons, but they may be in a different order than on the remaining reels.
3. The reels are continuous and repeat themselves every few minutes.
4. The reels will spin continuously until your stop them.
5. There are no set winning positions in the device. Everything depends on how you stop the device.

The participants needed to develop the strategies of applying ideas to the game problem. Not all participants learned at the same rate. Bruner's guided-discovery method and Bloom's Mastery-Learning model are effective for participants that need to inquire into and solve problems. Bloom's mastery-learning can be applied with participants that need to catch up with the rest of the participants. Some students are not at the level of concept formation as other students and tend to be the slower students in the classroom. The basic problem for mastery learning strategy is finding away to reduce the amount of time the slower learner requires so that they can be on the same level as

other students. With instruction these students can catch up with other students who have a higher level of cognition in the subject. Bloom (1968) suggest that the key difference between learners ability to master materials is time (p. 45).

In 1956, Benjamin Bloom worked with a group of educational psychologist to develop a system of classifying objectives that had a profound influence on education for nearly 50 years. The psychologists proposed three categories: these are the cognitive (knowledge), affective (emphasizing feeling and emotions), and psychomotor (dealing with motor skills) domains. The most important domain for the purpose of the study is the cognitive domain.

According to Blooms' Taxonomy in the cognitive domain, there are six levels of learning. Taxonomy is defined as the process of categorization. The levels in the taxonomy range from simple recall at the lowest level to a more complex and abstract mental process at the highest level. This cognitive structure is used to insure the educational instruction stimulates and develops a learner's higher-order thinking skills. The six levels are as follows: (1) Knowledge is the learner's ability to recall patterns, structure, or setting of information, which is the minor part of a task. With appropriate signals, cues, and clues the learner will most effectively bring out whatever knowledge is stored without

understanding what the cognitive structure means. (2) Comprehension occurs when the learners focus on the meaning and understanding of their acquired knowledge and are able to process, translate, and interpret the knowledge. (3) Application is the learner's ability to analyze data and materials and to break them down into elements according to rules and principles so the organized structure is understood in solving the real-life problem. (4) Analysis deals with the learner breaking down ideas into parts where the learner can understand the relationship and explain it in a logical framework. (5) Synthesis takes place when the learner combines elements to produce something new by using experience to develop new concept formations or ideas. (6) Evaluation is the final level in which the learner processes critically the information learned by setting values and making judgements (Bloom, 1956, pp. 201-207).

The two remaining domains, affective and psychomotor learning are a continuum to the cognitive process. The affective domain is progression which starts when the learner is merely aware of a problem. The learner then is willing to think about the problem and respond with a positive feeling. At some point the learner will conceptualize a behavior and feeling to organize it in a structure, which grows into complexities as it becomes part of the learner's organized

structure (Bloom, 1956, p. 27). This process is call internalization. Affective learning focus on behaviors indicating attitudes, interest, attention, and response to interaction with others.

Psychomotor skills are learned activities such as driving a car, playing sports, or typing on a keyboard. The objective of domain is to develop muscular or motor skill, which aids in manipulation of materials. The participants in this study needed a command of this skill because they used their hands to press buttons on the reels to stop them. The motor skill focused on speed, manipulation, and action that demonstrate the fine motor skills of reach, touch, initiate, and construct.

Past Experience

Lindeman (1926), the father of modern Adult Education, concluded that "experience is the adult learner's textbook" because adult experience is already there waiting to be appropriated" (p. 10). Experience is the learner's invisible but significant framework for recall. Experiential learning has it roots in the philosophy of Lindeman (1926), Dewey (1938), and Kolb (1984). Past experience of the learner has a bearing on how fast the learner adjusts and accepts a new learning experience. New experience and skill are imprinted on the brain linking new knowledge and experiences with past

experiences. Dewey and Lindeman viewed knowledge as inseparable from ever-changing experience (Darkenwald & Merriam, 1982, pp. 53-54). Knowles (1980) proposed:

> As people grow and develop they accumulate an increasing reservoir of experiences that become an increasingly rich resource for learning and people attach more meaning to learning than gain from experience than those they acquire passively. (p. 44)

Adult learners need to realize that their experience represents both potential asset and a potential liability for learning (Smith, 1982, p. 27). If learner seeks to add to an existing highly developed knowledge structure, the experience can be rewarding. A learner who lacks a highly developed structure will mostly likely have difficulty learning in a new subject area. This needs to be taken into account when the learner sets out to adapt and transform the new knowledge and skills derived from their past experiences. This has the additional effect of the adult accumulation of experience which is "to make adult learners themselves very important resources for learning. They can often direct their own learning and learn a great deal from each other" (Smith, 1983, p. 42).

The difference in experiences between children and adults comprise three implications for learning (Knowles, 1980, p. 50). First, adult have more to contribute to other learners and are rich resources for learning. Second, adults

have a richer foundation of experiences from which to relate new experiences. Third, adults have acquired a larger number of fixed habits and patterns of thought.

Computer Speed

The modern computer's speed is so great that even though the steps of computation may be difficult and numerous, it can handle the processes that are too laborious for a learner. Since the beginning of the personal computer revolution, the computer has been getting faster, more intelligent, and cheaper. Each generation of computers out performs the previous.

Many different components effect how fast the computer gets things done. The computer components are as follows: Microprocessor, Central Processing Unit (CPU)/Bus, Random Access Memory (RAM), and software. The processor is responsible for everything the computer does. It keeps track of which devices are to do what, sends messages to the right places, and updates the status of all devices (Arnold & Bowie, 1986, p. 18). The microprocessor in the 1940's weighted 5 tons, took up 6 rooms, processed about 10,000 Instruction Per Second (IPS), and cost $5 million; now is 5 millimeters square, about 1.5 inch thick, processes 4 million IPS's, and cost less than $5.00 (Stallings, Hutchinson, & Sawyer, 1988, p. 448). The processor speed is affected by

system clock rate which equals an electronic pulse used to synchronize processing with only one action can occur between pulses. A mega-hertz (MHZ) equals 1 million cycles per second, and this is what is meant when a computer is referred to as a 100 MHZ machine. The clock rate is 100 million cycles per second. As the number gets bigger, the processing is faster. The process allows the microprocessor to support multitasking and increasingly sophisticated type of artificial intelligence (AI) programs such as expert systems that are used in manufacturing and general production. Some who have compared cars to microprocessors make the statement: "If automobiles developed like the microprocessor technology, the fastest car today would travel at 10,000 miles per hour and cost $2.00 dollars" (Tapscott, 1996, p. 99). It is predicted that the microprocessor will continue to grow until it is no longer a uniprocessor system.

The personal computer with a specific process can perform various functions such as communication, graphics and artificial intelligence. Future developments will eventually bring about true parallel processing which will allow the processors to separate components of a problem simultaneously. With parallel processing on the horizon, the processor could work on one part of a problem and several other processors could simultaneously compute partial

solutions or calculation at a greater speed. Modern day processors can execute one instruction while simultaneously decoding a second and fetch a third (Stalling, Hutchinson, and Sawyer, 1988, p. 449). All instruction and data travel between the processor to memory on a bus.

The bus width equals the amount of data a CPU can transmit at a time to the main memory and to input and output devices. Any path that bits travel is a bus. An 8-bit bus moves 8 bits of data at a time. Bus width can be 8, 16, 32, 64, or 128 and so forth (http://www.jigworks.com/lesson/lesson4/lesson4-6.htm, p. 1). Just in the last year, IBM has announced a microprocessor to be used in high speed fiber optic switches with 40 billion bits of information per second and runs at 110 gigahertz.

The Random Access Memory is similar to the top of a desk. With more room on the top of a desk, more things can put on it. The old computer Random Access Memory was large enough to hold 64,000 characters (64K) of data. The new processors can support even larger amounts of data. Internal memory is necessary for the user to take advantage of new operating systems software and new applications, which are memory dependent like electronic spreadsheets, graphics, and Artificial Intelligence. Random Access Memory is much more important than chip speed for almost everything on the

computer.

Software is the program, the operating system, language, tools, and application needed to take advantage of computer hardware developments (Arnold & Bowie, 1986, p. 19). The software of today offers more than the basic management programs of the past. Future software will allow users to work in English rather than computer jargon. A new HyperCard released by Apple for Macintosh is a new type of software ready-to-use applications, which allows the users to write their own customized software; it produces text, graphics, sound, and video animations (Stalling, Hutchinson, & Sawyer 1988, p. 454). With this software, a person with a 3 gigabytes of RAM, a 60MHz 32-bit processor, and the right software, will be able to:

> Set a voice/video conference with their counterparts in Japan and have their PC program automatically transcribe--in both languages--the conversation, display a summary of the past meetings, and telecommunicate all designated data to the location the user determine. (p. 454)

Speed was one of the major factors that was being pondered in the learning of the Reels and Deals game since the speed of the reels could be too fast for the learner to view a pattern on the reels. Speed rather than memory seems to be a limiting factor to what can be accomplished by the computer. One of the major differences between humans and computers is:

> Our nervous system as an information processor in comparison to the computer and the human brain: speed, energy, consumption, size, efficiency, and number of basic switching components. He calculated the computer requires greater volume, consumes more energy, and is 10,000 times less efficient than the brain. Each human has around 100 billion neurons. We can set each of our eyes to feed us bits from 127,000,000 rods and cones in the retina, via the visual cortex, at about 1 Gigabyte per second. This far outweighs the input from our hearing, tactile, smell and taste sensor, which total less than, but still relative high, 20 megabytes per second. In contrast our typing rate is only around 40 bytes per second, speech is about 100 bytes per second. (Thompson, 2001, p. 2)

The typical estimates of speed range from 100 million Instruction Per Second (MIPS) to 100 billion MIPS. A high range personal computer today has about one thousand MIPS. The most powerful supercomputer to date performs at about 10 million MIPS. Even at one thousand MIPS's, learners are barely challenging the modern computer of present day with their simple task. Speed was regarded as the main advantage of the computer (Thompson, 2001).

Man and Skills Machines

The idea of humans as limited-capacity information processors goes back as far as the 1950's and has gradually evolved into the construct known as "working memory." Learners have basically worked with objects to extend cognitive powers. Things that are invented by man enable the learner to remember and learn as part of the technology

of teaching. In this contemporary time, information technology and computers provide a rich set of new tools to help educators teach and learn. Computer systems that model the student based on their response can gear instruction to the student's level of ability and interest. To truly learn is to digest and make the material one's own by updating one's internal models and using them for new applications. Real-time interaction with a computer providing immediate feedback and individual guidance is the goal (Gevarter, 1985, p. 155).

Despite the fact mechanical and social forms of technology are ever present in day-to-day life, technology is perhaps one of the least understood aspects of contemporary culture (Bowers, 1995, p. 78). Modern technology such as the Digital Video Disk television, radio, VCR's, and computers profoundly influence how people perceive and interact with their environment.

The term"Twitch Speed" is used to describe a generation of learners who grew up playing video games (http://www.marcprensky.com/writing/Prensky%20-%20Twitch %20Speed.html, p. 1-2). Their developing minds learned to adapt to speed and thrive on it. An example of what has happened in the generation is as follows:

> The under 30 generation has had more experience at processing information quickly than its

> predecessors, and is therefore better at it. Humans have always been able to operate at faster-than-normal speeds. This generation grew up with the ability to multitask, they can watch television, listen to music and chat all at the same time. The mind can actually process many tracks at once and still have some "idle time" from it primary task that can be used to hand other task. (Prensky, 2002, p. 2)

This generation since childhood has been continuously exposed to television, video, and computer games that puts high-quality, high-expressive graphic in front of them. This experience has sharpened their visual sensitivity. They process information at a much quicker speed, and they crave engagement. Learners have changed (Prensky, 2002) for the most part because they are raised on media where everything is so vivid, graphical, fast, and intense. By the time they become adults, they will have played over ten thousand hours of video games, seen hundreds of movies in theaters and on videotapes, been exposed to over four hundred thousand television commercials. Since this adds up to tens of millions of images, it is no wonder they now have a very different mix of cognitive skills than their predecessors and are referred to as the "The Games Generation" (pp. 02-1-4).

Patricia Marks Greenfield, Professor of psychology at the University of California--Los Angeles, studies the effects of media on socialization and cognitive development (Prensky, 2002). Greenfield noticed her son, who was about

age 11, was developing thinking skills through playing video games that she did not have. She felt that the skills developed as a result of playing video games go far beyond the eye-hand coordination skills most often observed by others. Greenfield (1988) pointed out that sensorimotor skills such as eye-hand coordination are important in themselves. They are useful in many occupation as well as in the everyday life, and according to Piaget's theory, they are the foundation for a later stage in cognitive development. Additionally, there is much more to games than eye-hand coordination. The games are complex, and they incorporate different types of complexity that are impossible with the conventional games. She is convinced that many of the people who criticize the games would not be able to play them (p. 107). By adding an interactive dimension to television, the video games and computers may also be creating people with special skills in discovering rules and patterns by an active and interactive process of trial-and-error (Prensky, 2002, p. 02-9).

Computers were developed to solve problems in a fast manner (Gilhooly, 1989). However, the problem solving is synthetic and seeks to construct processes that can assist the learner or even replace and exceed human operators. Computer hardware is constantly updated to handle human

problems. "For example, searches in chess can become wider and deeper in fixed time because of improvements in memory and speed of basic operations have increased dramatically in a few years" (p. 8).

Computer programs already exist that play better than most learners in chess. Chess and computers go back a long way. In 1950, Claude Shannon, a scientist at Bell Laboratories, published the article titled "Kasparov versus Deep Blue", which spawned the field of computer chess (http://whyfiles.org/040chess/main4.html., p. 1). The first computer (IBN704) to play chess was invented in 1958 with one-millionth of Deep Blue's capacity. Shannon outlined how the computer would evaluate and choose future positions. He even suggested how far into the future the computer would need to search. Each player typically has 30 to 40 moves. With one move by each player (that is called two "piles" or one "move"), the board could have about 1,000 positions. By another complete move, there would be 1 million, and by the third move, there would be 1 billion. This was called "combinational explosion" which could lead to a phenomenal analysis where the number of possible unique chess moves equals 10 (p. 1).

Even with these large numbers, artificial intelligence pioneers Herbert Simon and Allen Newell predicted in 1957

that a computer would beat a human within 10 years (p. 2). On May 11, 1997, and IBM computer named Deep Blue beat the world chess champion Garry Kasparov. "In other words, humanity's last best hope for defying a mechanized assault of human dignity (or at least our capacity to play chess) had caved to a machine" (http://whyfiles.org/040chess /main5.html, p. 1). The computer had a 512 Reduced Instruction Set Computer (RISC) processor under its frame running at 133 MHZ. The computer made deep searches as far as 10 moves ahead of its human competitor. RISC is new technology and might become a significant power as development is underway at several major companies including Hewlett-Packard, IBM, Dec, TRW, and Fairchild Semiconductor. RISC is probably coupled or integrated with parallel processing or distributed processing, and it is expected to see immediate utilization in artificial intelligence (Arnold & Bowie, 1986, pp. 121-122).

Technology appears to have created a new human environment called "Cyberspace". "Cyberspace, at the broadest concept level, is the global village, the Internet, the Information Highway, and the World Wide Web. It is humanity connected by electronic information" (Provernzo, 1999, p. 19). In Gibsons' (1984) novel *Neuromancer*, there is a fictional work which is tied together by an electronic

construct called the "matrix". The matrix is connected to all of the computers and information systems in the world. According to William Benedict (1992), a professor of architecture and design at the University of Texas, cyberspace is:

> A new universe, a parallel universe created and sustained by the world's computers and communication lines. A world in which the global traffic of knowledge, secretes, measurements, indicators, entertainment, and alter-human agency takes on form: sight, sounds, presences never seen on the surface of the earth blossoming in a vast electronic night. (p. 1)

The early games of the 1980's were war games that were gradually moved over to the computer. Players at one time used large paper maps or boards that were left out for days while the players made strategic moves. If the game was put away, someone had to record the position of the objects on the board, and then it would take up to an hour to set up the board again to play. Even if players could be found to play the game for a period of time, it was time problematic. Computers solved this problem because Artificial Intelligence was ready to play, and the maps or boards were located on the screen inside the computer not in the middle of the family room on a table.

Dungeons and Dragons was one of the games which was popular in the 1980's (Dille, 1997), and developers quickly seized on the opportunity to capitalize on the appeal of the

game. Role-playing games (RPG) were given life, and games were later converted for AI. Role-playing exercises may use some data about a real situation; it also includes a specification of the characteristics, or roles, of the people involved; it mirrors reality (Romiszowski, 1988, p. 266). When the game was converted to the computer, there was a lack of social interaction so the social element was recreated. This first involved interaction with computer controlled characters. The interaction was limited because of the repetition of canned messages. Due to improvements in the computer programs, Non-Player Characters' remembered the player's conversations and actions. Thus, the computer was programed to act differently at various points in the story line based on the players accomplishments at a certain level in the game. The player's experience was heightened, but the computer fell short on the human level (pp. 2-3).

Adults learners grew up playing games which were an integral part of the social conditioning and the proving ground of their character. Games also train the analytical mind and teach rudimentary problem-solving skills. In more advanced gaming applications like war games, they can even develop one's ability to combine diverse elements into complex strategies (Dille, 1997, p. 1). The learner's interacting with a computer replaced the individual

interaction with one another. Two of the first computer games were Pong and Space Invaders. "Arcade games are defined here as titles presented in a two dimensional third person perspective and focus on timing and reaction skills over cognitive skills" (Dille, 1997, p. 7). The third person is the learner who is substituted into the role of the adventure. The object is to build up skills and attributed of one's knowledge enough to eventually take on the challenge from the evil-doers and to defeat them. As one plays more games, experience is gained.

The number of card and casino games on the Internet or of games for the personal computer seems almost to be limitless. Casino Blackjack and Casino Poker can be found online anytime day or night. Players can meet friends in the Casino Poker lounge or join others at the table for a quick round or a tournament online (Dille, 1997, p. 158). Computer enthusiasts argue that games have educational value by teaching such things as logic or vocabulary.

Simulations put the players in the driver's seat to shoot down the enemy, seek out the information to be learned, or win the game. However, the players must feel like they have some control. The difference between the action/arcade games and simulation is the idea of realism (Dille, 1997, p. 10). Realism occurs when the player has a goal or series of

goals to achieve with little or no resources and is in competition with other players with the same goal. Many advances have been made in the context of the computer, but most developers and participants are too busy looking into the future to write about the latest developments.

Learning on a Computer

When computers entered the classrooms in the 1960's, they were restricted to a select few. They were an offshoot of mathematics, and their general use in the classroom was just being recognized (Underwood & Underwood, 1990, p. 5). The use of the computer begin to spread in the 1970's, and now they are very common place in the classroom. Computer-assisted instruction provides not only the necessary concrete experiences but also helps learners integrate prior experiences. The computer allows the learner to move from a process of instruction to construction of knowledge. In knowledge building activities, the learning environment feels more like real workplaces where problems are solved through conversation, inquiry, trail-and-error, and constant comparison of one approximate solution against another (Sandholtz, Ringstaff, & Dwyer, 1997, p. 3).

Computers are cognitive learning tools rather than an instructional media (http:itech1.coe.uga.edu/itforum/paper1/paper1.html). In the past, instructional designers have

invested in these tools for the purpose of "designing" instruction which, in effect, only constrained the learners. The computer as a cognitive tool is a significant departure from the traditional conception of technologies where information and intelligence is encoded in the educational communication which is designed to transfer the knowledge to the learner. With cognitive tools,

> The traditional design and development processes are eliminated. Rather than the tools being used by the teacher to constrain the learners' learning processes through prescribed communications and interactions, the technology is given to the learner to use as a media for representing and expressing what they know. Learners function as designers using the technology as tools to analyzing the world, accessing information, interpreting and organizing their personal knowledge, and representing what they know to others. (Http://itech1.coe.uga.edu/itforum/paper1/paper1.html.,p. 2)

"The appropriate role for a computer system is not that of a teacher/expert, but rather, that of mind-extension "cognitive tool" (Derry & LaJoie, 1993, p. 5). "Technology is most powerful when used with contructivist teaching approaches that emphasize problem solving, concept development, and critical thinking rather than simple acquisition of factual knowledge" (Sandholtz, Ringstaff, & Dwyer, 1997, p. 174).

A exclusive value of gaming is that it provides a specific framework for implementing what has become known as

discovery learning, the inquiry method, and experiential learning which represent inductive teaching and learning strategies. It can also be referred to as deductive strategy in the classroom.

Computer simulation provides teachers and instructional designer with a powerful tool to sustain knowledge retention and transfer. For example, Jackpot, supplied by Wida Software, is based on simulation on the computer screen of a "one armed bandit" fruit machine (Romiszowski, 1988). The machine has three cylinders that can be rotated by pressing appropriate keys. Imaginary coins are fed into the computer to make it play. At certain, randomly occurring moments in the game, the player gains the right to hold or to nudge one or more of the cylinders just as if it was a real-life gambling machine. However, instead of trying to line up the lemons or other winning combinations of fruit, the player must line up three words that, together, make sense. The game Jackpot was designed to drill sentence formation in foreign language. Another games has a history application that involved matching, WHO did WHAT and WHEN. With a little more ingenuity, other applications may be invented (p. 310). However, in the Jackpot game the student is not aware of the general nature or probabilities of winning and losing the game and of how controls built into the game are stacked in

favor of the machine as would be the case in casino gaming.

According to Underwood and Underwood (1990), Bruner argued that positive attitudes to learning are encouraged by complexity and challenge of the task at hand. Complexity encourages curiosity, and perceptual curiosity in turn generates a state of high arousal or excitement which is alleviated by exploration and stimulus. It is not hard to relate the need for mastery over the environment or for a reduction in arousal through exploration of a stimulus to the high level of motivation observed in boys playing arcade games. Motivation when playing computer games has been found to be highly correlated with challenges as defined by a clear goal, or by keeping scores and the ability of the program to stimulate curiosity (pp. 174-175).

Learners who play games in casinos have already developed concepts that assist them in playing the game. The discovery process is at work and mastery development depends on the interaction between the learner and the machine. The addition of sound, color, and images can add appeal that will draw the learner. "Enjoyment and fun are part of the learning process and important when learning new tools since the learner is relaxed and motivated and therefore more willing to learn" (Bissco & Luckner, 1996, pp. 109-110). During the gaming process, learners can

formulate intuitive guesses to build concepts from what they already know to what is to be learned. To be a learner is to comprehend the surrounding world though the five senses and to generate a decision based upon prior information called memories and experiences. In learning Reels and Deals, learners are challenged to deal with the speed of the game, internal cognitive levels, and external factors all at the same time.

For many centuries, the brain has been compared with all types of inventions, and the computer is no different. Nothing that man has created has even come closer to the shear complexity and power of the brain. The brain is unlike a computer which can perform calculations thousands of time faster without error and pin-point accuracy and can store memory at incredible speeds. However, it has no emotion or thought.

If the theory of nerve volume as a proportion of processing power is true, there is a correct estimate of the brain's processing power (http://library.thinkquest .org/C001501/the_sage/cmpare.htm, p. 1). This can be applied to the retina of the vertebrate eye to give an idea of the human brain's capacity. The retina is a transparent, paper-thin layer of nerve tissue at the back of the eyeball that detects lights and sends images to the brain. The

human retina is less than a centimeter square, and a half millimeter thick, and it is made up of 100 million neurons. There are five kinds of neurons. Light-sensitive cells feed wide spanning horizontal cells and narrower bipolar cells that are interconnected by amacrine cells and by ganglion cells with outgoing fibers bundles that form the optic nerve (http://www.frc.ri.cmu.edu/~hpm/ book97/ch3/retina.comment.html, p. 1). Scientists say the retina sends to the brain, particular patches of images indicating light intensity differences which are transported via the optic nerve, a million fiber cable which reached deep into the brain. The retina seems to process about ten one-million-point images per second. Because the 1,500 cubic centimeter human brain is about 100,000 time as large as the retina, a simple calculation estimates the processing power of an average brain to be about 100 million MIPS (Million Computer Instructions Per Second) of speed (http://library.thinkquest.org/C001501/ the_saga/ compare.htm., p. 2).

The fastest personal computer chip on the market in the 1990's was 700 MHZ Pentium that had 4200 MIPS. It would require 24,000 of these processors in a system to match the speed of the brain. This would mean that the brain is like a 168,000 MHZ Pentium computer.

The computer requires greater volume, consumes more energy, and is 10,000 times less efficient than the brain (in binary actions per unit either of energy or volume), but the computer compensates by its considerable advantage (a factor of approximately 5,000) in speed (Aspray, 1990, p. 208). The brain and the computer are logically organized in rather different ways: the brain favors more but slower-switching components while the computer favors fewer but faster components. The computer has a serial operation while the brain has parallel operations (p. 208). The human brain appears to consist largely of regular structures with neurons that are trimmed away as skills are learned.

Computers have far to go to match human strengths, and more computer power is needed to reach human performance. However, how much is needed? The computer is one the greatest inventions of humans, and without the computer human technology would not have advanced to the point of today's Technological Revolution. The most powerful computer in 1998 was composed of thousands of the fastest microprocessors and cost tens of millions of dollars. Therefore, the improvements of computers speeds have some limitations. The supercomputers are within a striking distance of being powerful enough to mimic the human mind. However, the more memory it has the slower it becomes

because it takes longer to run through the memory once. If the computer has less memory, it has more MIPS but is confined to less space to run big programs. This process has remained constant throughout the history of computers. The earliest computers had fewer than a thousand bytes of memory and could complete few calculations per second. The latest computers can do a trillion calculations per second and have a trillion bytes of memory. Software programs need memory as well as processing speed to do their job. However, it is still debatable whether or not it is wiser to purchase more memory or more speed.

Deep Blue was the first man-made machine to win a game in chess in 1996, but Kasparov, the chess champion, quickly found the machines weakness. In the match, Kasparov drew two and won three of the final games. However, he played against an improved version of the computer in 1997. This became the first competition match he had ever lost. When playing chess, Kasparov claims to see into his opponents' minds during play, intuiting and exploiting their plans, insights, and oversights. However, in the case of Deep Blue he saw "alien intelligence" (p. 12). On the other hand, the builders of Deep Blue saw no "intelligence"; they had only a large database of opening and end games and scoring and deepening functions that were tuned by

consulting grand masters, and they had raw speed that allowed the computer to look ahead an average of 14.5 moves per turn. The computer was not designed to think like a human, but instead it formed abstract strategies or see patterns as it raced through the move/countermove tree as fast as possible.

The gap between technology and neurons is closing fast. It has been estimated many times by many different people that a computer will be built that can process as many bits per second as the human brain in a few decades. The computer will exceed the human in raw processing power. However, some believe that the storage capacity of the brain is functionally infinite.

Summary

The learning process has been of interest to philosophers, psychologist, educators, and politicians for years because there was a need to identify educational objectives. Researchers have investigated the phenomena of the adult learning processes to explain how learners learn. Thus, there are numerous learning theories about the different orientations to adult learning. However, there is little theory to support concept formation levels of adult learners. Psychological theories that support learning theory are Bruner's "cognitive development", Vygotsky's

"social development", and Piaget's "stage development." Contructivist theories about adult cognitive development include, Knowles' "Andragogy", Brookfield's "Developing Critical Thinkers", and Smith's "Learning How to Learn." Two related theories are Schema theory and Chunking theory, which are both considered to be storehouses of prior knowledge and prove how experience may affect the learner's ability to learn. Concept formation levels indicate how thinking patterns change for the learner over time based on past experience.

Special interest was given to the idea of novice and expert learners and how they learn differently. In the process of thinking, every learner moves from a gradual, fragmented, error-prone learning pace toward a rapid, efficient, self-directed, and automated cognitive level to develop expertise.

Computers were developed to help humans solve problems. Computer hardware is constantly being developed to help the learner in solving problems more efficiently. As a cognitive tool, the computer can transfer information to the learner. Learners are designers using technology to analyze the world by accessing information, interpreting and organizing their personal knowledge, and representing it to others. Learners can increase their own concept

levels without the assistance of the educator, and they are doing so in record numbers through the used of computers. However, an issue has developed centered around the idea of man verses machine.

There is a need to weave the study of cognitive theory framework into the study of adult development theory. There has been very little theory in the area of concept formation levels in the adult learning arena. Concept formation involves experience-based knowledge and is characterized by the ability to reflect on one's thinking in real-life settings.

CHAPTER 3

METHODS AND PROCEDURES

Design

The study utilized a descriptive design. In descriptive Research, the researcher does not manipulate variables or control the environment in which the study takes place (Merriam & Simpson, 2000, p. 71). None of the contrived or manipulative techniques that are common to experimental design is used. The goal of the research study involves collecting data to answer questions concerning the current status of the subject of a study and to determine and report the way things are (Gay, 1987, p. 189). This study sought to describe the approach to learning of adults playing the Reels and Deals Skill Stop Game. To do this, data was collected from (a) game performance for up to 30 hours, (b) participation reflection sheets after each hour of play, © follow up interviews with the participants who played for 30 hours during the field-based research study, and (d)interviews with those who have learned the game at a higher proficiency level.

It involves collecting data by interviewing the volunteers and the experts who have mastered the machine. It will answer questions concerning the current status of

the phenomenon which occurred in a real-life setting.

Sample

A target population is the group of interest to the researcher, the group to which the researcher would be like the results of the study to be generalizable (Gay, 2000, p. 122). The target population for the study is the general adult population who are willing to play video games.

A sample is a number of people selected from a target population preferably in such a way they represent the larger group (Gay, 2000, p. 628). There are several types of samples. Probability samples use some form of randomization which non-probability sampling do not (Kerlinger, 1973, p. 129). One form of non-probability sampling is purposive sampling "which is characterized by the use of judgement and a deliberate effort to obtain representative samples by including presumably typical areas or groups in the sample" (p. 129). Since this study is concerned with determining if it is possible to learn the Reels and Deals Skill Stop Game rather than generalize the information to a specific population, a purposive sample was used. The sample for this study was volunteers from Oklahoma State University-Okmulgee campus, and students in the Adult Education program at Oklahoma State University-Tulsa. The sample included three expert

learners of the Reels and Deals Skill Stop Games, who either worked for Spinit, Inc., or Gaming Laboratories International.

ATLAS

The participants were given the Assessing The Learning Strategies of AdultS (ATLAS) to identify their learning strategy preference during the recruitment phase of the study. ATLAS is a relatively new instrument that was created because there was a need for a tool that was easy to administer, can be completed quickly, and can be used immediately by facilitators and learners (Conti & Kolody, 1999a, p. 16). It is used to identify the learning strategy preferences of adults in real-life settings (Conti & Kolody, 1998). The ATLAS was used in this study because it is a proven instrument that appears to be simplistic in design and would overcome test trepidation of students who may have previously had negative experience with educational testing.

ATLAS is a five color-coded flow chart represented by pages that lead the learner through a series of instructions. The ALTAS utilizes a 8.5" x 11" flow chart design:

> Sentence stems, which are in the top box on the page, leads to options in other boxes, that complete the stem. Connecting arrows direct the participant to the options. Each option leads the learner to another box, which either instructs the participant to proceed to another

> colored card that provides information about the learner's correct learning preference group. (Conti & Kolody, 1999a,p. 16)

An instrument is valid if it measures what it is suppose to measure (Gay, 1987, p. 553). The learner follows descriptive phases by reading a page and turning pages to the selected responses. Each response leads the learner eventually to their preferred learning strategy group, which is either Navigator, Problem Solver, or Engager.

The ATLAS makes it easy to identify the learning strategies preferences. The ATLAS instrument is based on the research findings of the Self-Knowledge Inventory of Lifelong Learning Strategies (SKILLS) and carries with it the validity of the SKILLS instrument (Conti & Fellenz, 1991). Extensive literature reviews were conducted on each of the five constructs which are metacognition, metamotivation, memory, critical thinking, and resource management. Validity is concerned with what a test actually measurers and there are three kinds of validity recognized in educational research. They are construct, content, and criterion-related validity (Kerlinger, 1973, p. 457).

Construct validity is "the degree to which a test measures an intended hypothetical construct" (Gay, 1987, p.

131). A construct cannot be seen you can only observe its effect (Gay, 1976, p. 89). "The process of establishing construct validity for ATLAS was to synthesis the results of the numerous research studies using SKILLS and to consolidate these results" (Conti & Kolody, 1999b, p. 16). The instrument has been field tested on numerous occasions which has bought about modifications of the answer sheet and the instructions. The instruments is still being improved as additional qualitative date is collected during field testing. The initial consolidating of data involved over 16 doctoral dissertations and national studies in the United States and Canada. The dissertations studies include (Straka, 1995; Hayes, 1995; Kolody & Conti, 1996; Kolody, 1997), the business community (Gehring, 1997; Courtnage, 1998;) Tribal communities (Hill, 1992; Bighorn, 1997), nursing (Lockwood, 1997), the military (Yabui, 1993; Korinek, 1997), public school administration (McKenna, 1991), students concurrently enrolled in college (Ungricht, 1997), and volunteer leadership (Moretti, 1994). Collectively the studies produced a data set of 3,070 cases in which the data were similar.

Since those initial studies other studies have been completed such as: Lively (2001) found that ATLAS provided a good introduction to the interview process by "bringing

initial awkward moments and getting the conversation started" (p. 48). Other current studies using ATLAS include James (2000), Willyard (2000), Ghost Bear (2001), Hinds, (2001), Pinkins (2002 in Africa), and Tapp (2002). These studies have produced data in which the results were similar to previous studies. The construct was established by reviewing the literature of studies actually using the SKILLS in field-based research.

Content validity is "the degree to which a test measures an intended content area" (Gay, 1987, p. 129). ATLAS content validity is concerned with the degree to which items are representative of the learning strategy of the three groups identified by the analysis of the database from the SKILLS instrument. Content validity of ATLAS was established by using discriminate analysis to determine exact patterns and to describe the content of each item. "While Atlas has only a few items, each item was based on the powerful mulitvariate procedure of discriminate analysis to precisely describe the content for each item" (Conti & Kolody, 1999, p. 19). Qualitative data collected during the testing sessions allowed the researchers to determined the best wording for items, so the respondents would not select options appealing to them that belong to other groups. The instrument is designed so the

respondents do not see the strategy groups to which they belong until they have made a selection.

Criterion-related validity is "validity which is determined by relating performance to a test of performance on another criterion" (Gay, 1987, 543). The criterion-related validity for ATLAS was established by comparing the scores for ATLAS to the actual group placement using the SKILLS instrument. The developer of ATLAS continue to collect criterion-related data. One follow-up study using ATLAS confirmed that approximately 90% of the respondents confirmed that the description of their placement on ATLAS correctly identified their learning strategies profile (Ghost Bear, 2000, p. 29).

Reliability is "the degree to which a test consistently measures whatever it measurers" (Gay, 1987, p. 135). When a test is reliable, the researcher can be confident that the results obtained from the administration of the test are essentially the same results that would be obtained if the test were re-administered (p. 135). Reliability is usually expressed in a coefficient; a high coefficient indicates high reliability of the instrument. If a test was perfectly reliable it would have a coefficient of 1.00. ATLAS had a coefficient of .70 or 70% in its development testing (Conti & Kolody, 1999). A

recent study conducted by Dr. Anne Ghost Bear report a coefficient of 87% in her study of "Adult Learning on the Internet: Engaging the e-Bay Auction Process."

Because of the identification of three groups in the studies performed using SKILLS the same groups are established for ATLAS namely, Navigators, Problem Solvers and Engagers. As research continues in the area of learning strategies the use of ATLAS as an instrument to measure learning preferences will be valuable in studies about adult learners. During the initial recruitment period more Engagers signed up for the study. An earlier study performed by Dr. Sandra Massey, Dean of Student Support Services, verified that Oklahoma State University - Okmulgee attracted more Engagers.

"Navigators are focused learners who chart a course for learning and follow it. They are conscientious, results oriented high achievers who favor making logical connections, planning and organizing activities" (Conti & Kolody, 1999a, p. 9). They rely on learning strategies such as, Planning, Attention, Critical use or Resources, Testing Assumptions and Identification p. 9). These learners come out of the cognitive domain. They know how to organize and identify steps essential to their learning. They narrow down resources and organize them in an

effective way to begin the learning task. They use external aids such as list to reinforce memory. They value prompt feedback about their status and grades in a learning environment (Conti & Kolody, 1999a, p. 11). "Navigator become easily frustrated and impatient with a casual approach to teaching and can precede a relaxed , spontaneous atmosphere as an ill-designed time waster which is lacking in purpose" (Conti & Kolody, 1998b, p. 135).

"Engagers are passionate learners who love to learn, learn with feeling, and learn best when they are actively engaged in a meaningful manner with the learning task; the key to learning is engagement - a relationship between the leaner, the task, or subject matter, the environment, and the teacher " (Kidd, 1973, p. 266). They initiate a learning task from the effective domain, or the emotional domain. Engagers have a passion for learning that is combined with cognitive processes. They reassure themselves in their belief that they can complete a learning task. "In addition to reflection on the joy of learning, they review learning plans, check to see if they are on task, and compare their progress to accepted standards or model" (Conti & Kolody, 1998b, p. 135).

Engagers' learning is governed by their emotional commitment and their ability to internalize the content

that they must find of personal value and rewarding, they succeed best with teachers that focus on learning rather than on formal evaluation and who encourage involvement in projects based on their individual interest (p. 135). If Engagers do buy into an activity, they will seek out another activity that is more meaningful.

Problems solvers are critical thinkers. They "rely on a reflective thinking process which utilizes higher order thinking skills" (Conti & Kolody, 1999, p. 11). They score high in the areas of critical thinking strategies of Testing Assumptions, Generating Alternatives , and are open to Conditional Acceptance of outcomes. Problem solvers do not like long lectures straight from the book and are best assessed with open-ended questions and problem-solving activities rather than multiple choice exams. They rely heavily on others and prefer expert advice rather than manuals (Conti & Kolody, 1999a, pp. 12-13). They like hands on activities. They thrive on spontaneity and creativity (p. 13).

Procedures

A field-based research study was initially set to provide information in a federal court case between the National Indian Gaming Commission and the Cherokee Nation tribe in May 2001. The research project was developed to

test whether the Reel and Deals Skill Stop Game was a skills based game. An Institutional Review Board approval was obtained from Oklahoma State University, Stillwater, Oklahoma, for using humans in the field-based research project. A total of 10 machines were transported and set up on the OSU-Okmulgee campus (see Figure 1); however, 5 of these machines were later placed at the Cherokee Bingo Outpost in Catoosa, Oklahoma, for easier access to participants living in the Tulsa area.

Permission for the study was given by the president of Oklahoma State University-Okmulgee. A sign up station was established in the student union at Oklahoma State University-Okmulgee. Participants were given a consent form, an overview of the research project, conditions of the study, and a brief amount of instruction on the machine so they had some background in what they were doing. An observation team of adult education students and M-Power staff from the M-Power project were used to monitor the progress of the students. The M-Power Program is a Welfare-to-Work initiative at Oklahoma State University-Okmulgee that assist recipients on Temporary Assistance to Needy Families (TANF). Team members were trained in how to set the machines for play time, which was done each hour of play. A schedule was developed to place a team member

Figure 1: Reels and Deals Game and Fran Shelton at Field-Test Site

in the setting during the time students were playing. Each machine had a clip board for recording the paytable results, a reflection sheet, and a stop clock, which was tested to verify the timing was correct. At the end of each hour of play, the observation team member opened the machine, recorded the results, reset the machine, and collected the reflection sheet. The participants played a total of 30 hours each within a 3 to 4 week span, which included week days and weekend. Participants were asked to complete an exit interview at the end of 30 hours. This study utilized the data collected for this ex post facto field-based project and will include interview data from the novice and new data from expert players of the game.

Exit Interview Questions

A descriptive study collects data to answer questions concerning the current status of the phenomena under study; "a descriptive study determines and reports the way things are" (Gay, 1987, pp. 10-11). Informal interviews are used to add depth of understanding to the things that were observed or learned. In order to collect the data the interview is taped and transcribed. The interview serves to tap opinions of a broad range of performers and provides the researcher with quotes and thoughts for enriching data gathered other ways (Zemke & Kramlinger, 1982, p. 100).

The exit interview were set up as a way of gathering some data from the participants who had completed 30 hours of interactive play on the game. The following questions were used:

1. You have played the game for 30 hours just tell me how you feel about the game?
2. What patterns did you develop as you tried to learn the game? What was your first clue to learning a sequence/pattern on the reel.
3. If you focus on the end results of what you want to accomplish what would you do different or the same?
4. The speed of the machine is a major factor in try to learn Reels and Deals. How did you deal with this; that is how did you try to overcome it?
5. What strategy did you use to try to learn the game?
6. What kind of games do you like to play? Examples: card games, video, electronic, war games and board games. Why do these games appeal to you?
7. How did your concept of what you were doing change as you played the game from the first, middle, and end of play?

CHAPTER 4

FINDINGS

Introduction

A research team existed for this project. One source of data for the team was from participants practicing the game on machines supplied by Spinit, Inc. and located on the OSU-Okmulgee campus. Because of the court proceedings, Dr. Gary Conti headed up the team, and this researcher was a member of the team that was involved in gathering the data. There were several group discussions related to the study. A class was also developed around the research project, which was taught by Dr. Anne Ghost Bear. Dr. Ghost Bear is the wife of John Ghost Bear, who is the Attorney for Cherokee Nation Enterprises. For the course taught at OSU-Tulsa Dr. Ghost Bear incorporated, (a) research design, (b) data collection procedures, © data analysis, and (d) reporting procedures into the class design. The court case was in progress during the class. However, for submission to the lawyers and the legal part of the study, a report was needed related to some of the data from those practicing on the machines, and Dr. Gary Conti took the lead in writing the report. Thus, some of the following qualitative and quantitative data is a summary of the report that represents the work of the whole

team. However, this researcher was responsible for all data collection and date entry, and for conducting and analyzing all interviews.

Administrative Hearing

The United States Department of Interior, Office of Hearings and Appeals in Tulsa, Oklahoma was the site of a Administrative Hearing between the National Indian Gaming Commission and the Cherokee Nation Enterprises (CNE). A Stipulation Agreement was implemented that allowed the tribes an opportunity to continue using the gaming device while they planned their defense, which was ongoing from May 20, 1999 through January 24, 2000. The actual court appearances commenced on January 14, 2000 and ended on January 24, 2000. A presiding official, who was a federal judge, was asked to decide a dispute between the National Indian Gaming Commission, an entity created by Congress, and the Cherokee Nation of Oklahoma through its wholly-owned economic enterprise, Cherokee Nation Enterprises, Inc.

In mid February - May, 1999 the Choctaw Nation, Ponca Tribe, Comanche Tribe of Oklahoma, Kiowa Tribe of Oklahoma, and Cherokee Nation sought an administrative hearing and negotiated a Stipulation Agreement with the National Indian Gaming Commission. Although other tribes participated in

the initial phase of the proceeding, Cherokee Nation through Cherokee Nation Enterprise was the sole remaining Respondent at the time of the hearing. According to the Memorandum Brief of Cherokee Nation of Oklahoma the dispute was to what extent the National Indian Gaming Commission could extend its regulatory governance to "amusement with prize" or "skill game" electronic equipment used by Cherokee Nation Enterprise in regard to the Class III electronic gaming. Their steadfast position was that the Reels and Deals, was not subject to regulatory reach or classification by NIGC based on it characteristics.

Based on the Chairman's Post-Hearing Brief of the National Indian Gaming Commission. The dispute was that the Reels and Deals electronic gaming device was a gambling device and its play on Indian lands constituted a class III violation and was being operated in the absence of a tribal-state compact. Oklahoma is not a state where gambling devices are legal and even if it was the Respondents did not have a compact for playing of the electronic gaming device, such as the Reels and Deals. The Indian Gaming Regulatory Act allows the use of the Johnson Act gambling devices on Indian land if there is a compact.

Previous to the dispute the Chairman issued a Notice of Violation and Order of Temporary Closure to Cherokee

Nation directing the play of the Reels and Deals device be discontinued. However a Stipulation Agreement was made with each Tribe which allowed them to continue using the games in their facility until a decision could be rendered.

Under Commission preceding the Chairman of the National Indian Gaming Commission had to establish that the device operated by the Respondent (Cherokee Nation Enterprises) was a class III gambling device. Initially all tribes were asked to submit a prototype of each of the four "disputed units" that had been used in their facilities to General Laboratories International, in Toms River, New Jersey. Gaming Laboratories International was to perform a detailed analysis of each of the four games and prepare a comprehensive report of its findings. The Reels and Deals game was the only game submitted by Cherokee Nation to be tested. By January 14, 2002, at the start of the proceedings Cherokee Nation was the only tribe in court with one game, the Reels and Deals. All of the other tribes did not want to participant in the case. Based on the statement of the Attorney, John Ghost Bear, the strategy of the Respondent was designed to offer the court insight into a family-owned and operated business enterprise and professional analysis of the Reels and Deals game.

During the proceedings all characteristics of the game were discussed. Those testifying about the game were NIGC's witness Robert Sertell, and Cherokee Nation witnesses Ronald E. Mach, Robert J. Snyder, and William K. Bertram, PhD. The Respondent's view of the physical characteristics of the device is as follows: (1) There is no random number generator. William Bertram, PhD testified the Reels and Deals game did not contain a random number generator which eliminated skill as a factor in the outcome of the game. (2) There is no retention control. Retention can be of two types. One that is used in electronic games that have embedded within the software the ability to instruct the machine to retain a specified percentage. The second control may also determine by an average of funds retained from coins play through the game. Dr. Bertram testified that Las Vegas requires a minimum return of 75% by the house. (3) Engaging STOP buttons causes the reels to stop immediately. All of the witness concurred with Gaming Laboratories International that the reels stop spinning and rest upon the symbol displayed immediately upon activation of the stop button. (4) When the player depresses the spin button, the player determines the length of the time each reel may spin. Nothing in the game caused any reel to stop except the player depressing the STOP

button on the reel. This feature limits or specifies time to play before the machine stops, is to require a more rapid rate of out, which mean more games are played per hour. (5) The reels spin independently. The players can stop each reel independently of the other reels. (6) There is no knock-off meter. The machine did not contain a meter. This feature allows the operator to allow a player to play and upon cashing out of the play, to re-set the switch or "knock-off" the credits displayed on such meter. (7) There is a multi-coin feature. Robert Snyder and Robert Sertell explained that there are some common features between amusement games devices and casino gaming devices and this is one of them.

An examination of the physical functions of the device that made it a gaming device submitted by the National Indian Gaming Commission are as follows: (1) Multiple bill feature and multi-credit wagering. Reels and Deals was designed to permit a player to insert more than one bill. The device allows the player to extend it play from one to 10 credits. These features allows more money to be spent. (2) A player cannot extend the time it takes to play an individual game. Thus Brevity of Play is an issue because if the player elects not to press the stop buttons and watch the reels spin the machine is no longer engaged but is

considered an observer. When the player resume play the game cycle is measured in seconds. (3) There is a potential to win a larger number of free games and credits and there is a knock-off meter. When a player receives a cash out ticket the credits that are available to the player are reduced, which is equivalent to being "knocked-off." (4) The other features of the machine is that it was designed to look like a slot machine as testified by Mr. Ron Mach, who assisted in the design of the machine (Hearing Transcript, pages 841-843).

In the modern slot machine with a random number generator, it is programmed by the computer to continually select a series of numbers at random whether the machine is being played or not (Scoblete, 2000). The random number generator picks number series that correspond to the various symbols that are located on the reels, which also includes blank spaces. When a participants plays a coin and then pulls the lever or hits a button on the reel, the computer will start to spin the reel to tell the participant which number series was "it" when the coin was played. Most people believe that the independent spinning reels is the selection principle, but that is far from being correct. The reels stop where the computer tell it to stop, based on the number series that was pre-selected by the random number

generator for each reel. In machines with a random number generator, no amount of finessing of the handle or buttons on the reel that can affect the outcome of the game because it has already been decided (p. 1).

Casinos cannot stay in business if they return the players more money than the players originally put into the machines. Therefore, the gaming industry for example programs the machines to return 92% of the money taken in; that means that in the long run of that particular machine's programming it will give back 92 cents for every dollar played, and the casinos keeps 08 cent of the dollar(http://www.gamblingtimes.com, p. 1).

Thompson (1997) implies chance is an outcome that is determined by randomly occurring risk which can be calculated (p. 275). The odds or probability are known and the learner makes wagers with the knowledge that random events will determine the outcome. In pure chance the learner cannot affect the outcome using skills they possess (Thompson, 1997, p. 275). Mr. Phillips, An FBI Analyst testified:

> The biggest factor would be the speed with which those icons go past. So without a doubt you could have the reels spin a slow speed [so] that a person could grab the icon that they're looking at. There is a speed somewhere. I don't know what that speed would be, but there is, has to be a speed at which 50% of the population could do it, 100% of the population could do it. There

would be speeds at which this would be possible (Hearing Transcript, page 389).

Mr. Phillips also testified that an average player cannot eliminate the elements of chance in playing Reels and Deals (Hearing Transcript, pages 389-407). Robert Sertell, testified that the Reels and Deals functioned as a slot machine and as such the customer cannot predict the outcome (Hearing Transcript, page 119). According to him the slot machines of today are controlled by computer and a microprocessor. The game is not decided by the reels but by the software. The Reels and Deals does not contain this software, however the player's hand substitute as a means of random number generator(Hearing Transcript, page 120-121). Chance based on the definition by Dr. Bertram, witness for the Respondent, is (a) luck - unexplained events, absence of skill, and (b) conversation "chance" of rain or opportunity. Ron Mach the designer of Reels and Deals stated, the characteristics of chance, prize, and consideration are all present in the device. Those are also elements of amusement devices (Hearing Transcript, pages 842-843).

Also during the case, Respondent witness Jerry Giles, Jr., and Greg Giles played the game. They testified they had played the game countless times and had developed a mastery of the game. During the demonstration they showed a proficiency of the game that was 577% above chance. They

took minutes to watch the game and study the reels and hitting the stop buttons. They testified that with practice and effort a person could be successful playing the game.

Marcelin Pate, an National Indian Gaming Commission field investigator, testified that during her visits to the Respondent's gaming facilities she witness people "tapping out" of the game, which was done in a matter of seconds. She testified they did not play in the same fashion as the Giles. She also testified she observed a patron playing for about thirty seconds (Hearing Transcript, pages 1328-1329). Greg Giles stated he watched players concentrating on the machines but they played the game in a few seconds (Hearing Transcript, page 1332).

The National Indian Gaming Commission does not doubt that the Giles have an appreciably better playing results than the average player, but it does not make the Reels and Deals device into an instrument of skill. However they are concerned with the average player who does not have the time it takes to learn the game's idiosyncrasies. The average player plays a few coins and moves on. Dr. Bertram testified that in Nevada they calculate the return of the game that is the best possible return that could ever be achieved by anybody or any computer using the optimum game theory. They do not try to calculate how the average player

is going to play or how the worst player is going to play (Hearing Transcript, page 573).

A deposition was held in the Spring of 2000 to look at the credibility and validity of the results of a study performed by Robert S. Kenney, because Cherokee Nation wanted to conduct a study in order to determine the extent of learning and improving a player's skills and strategies as they played the Reels and Deals game. As a result Dr. Gary J. Conti, Professor of Adult Education at Oklahoma State University, was selected to provide information about the Reels and Deals game and report the findings to the Cherokee Nation. Dr. Conti concluded that the Reels and Deals game was indeed a skills game and submitted a report of findings. The study showed that participants were aware of how they approached the game, they developed strategies for achieving the goal of stopping the winning icon and had adjusted their strategies based on their experience with the game. The National Indian Gaming Commission decided not to present the study of Dr. Robert S. Kennedy as part of their strategy.

Dr. Robert J. Snyder conducted a study which involved an employee that was part of the Forensic Examination Confidential Report of Findings. Dr. Snyder testified that during the time the Reels and Deals device was at the lab he

kept record on the participation level of an employee (Jesse). At the conclusion of the test, and over 50 attempts, the employee achieved success 21 times or a 42% success rate. He believed that the employee had learned the game.

During the testimony on the intricate design of the game, people in the audience were asked to leave the courtroom. One of the discussions was on the speed of the reels and the software, which this researcher was not privy to include in this dissertation. Nevertheless, the speed at which the reels spin makes it extremely difficult for the player to stop the reel on a predetermine icon without the element of skill being present.

After each side presented its case, within a few weeks after the administrative hearing ended, each side was given an opportunity to present a post-hearing brief. The judge handed down his recommendation in the case. The judge concluded that the Reels and Deals game falls under the Johnson Act for gambling devices. This decision was based on his belief that the speed was too great for the player to affect the game.

To date, the case has not be decided by the National Indian Gaming Commission. The full National Indian Gaming Commission will render its decision sometime in the future.

Meanwhile the game as been removed from the casino floors in Oklahoma.

Thomas Fricke, a St. Louis-based attorney who represented the amusement industry in a court battle in January 2000, as reported in the Vending Times stated, the folks at the National Indian Gaming Commission had no idea when they proposed a rule to determine whether amusement games played for prizes violate federal law that it would significantly affect a large industry that is not focused on Indian gaming.

Participants

In order to determine if players unfamiliar with the Reels and Deals Skill Stop game could learn it, the defense attorney commissioned a study. A meeting was held between the President of OSU-Okmulgee, Dr. Robert Klabenes, Dr. Sandra Massey, Dr. Gary Conti and John Ghost Bear the Cherokee Nation attorney and the Tom Giulioli, District Attorney of Okmulgee County to work out legal details for the study. The IRB was obtained by Dr. Gary Conti for this field based study.

This researcher headed up the research team and organized the recruitment of students and delivery of machines. The Spinit, Inc., delivered a total of 10 machines to the campus of Oklahoma State University-

Okmulgee, and a room was selected to house all of the machines. The room was divided into an upper room and lower room, which contained five machines each. This researcher was instructed in how to turn the machine on, open and close the machines doors, and read the payout screen. During the time the machines were being set-up, a demonstration was initiated by Jerry Giles, to prove the Reels and Deals icons could be lined up for a winning combination. He demonstrated his mastery of the game by lining up the winning icons (three in a row) at least once in less than five minutes. A day later, a meeting was held with three key researchers to develop guideline sheets, procedures for opening and closing the machines, and recording the data. Adult Education students at Oklahoma State University-Tulsa volunteered to help with the study and were taught the procedures for recording data and opening and closing the machine, both individually and in groups.

A booth was set-up in the student union at Oklahoma State University-Okmulgee with flyers, forms, and the ATLAS instrument. Recruitment was conducted for two days which led to 18 learners participating in the study. A total of 422 hour-session were played on the game. The learners were evenly divided with nine males and nine females. The Oklahoma census for 2000 verifies females make up 50.9% of

the population, in Okmulgee County 51.2% and Tulsa County 51.5%.

The median age of participants in the study was 32.33 year with a standard deviation of 12.42 years and a range of ages 18 to 55. The participants were diverse in ethnicity and educational backgrounds. The ethnic distribution of participants in this study was 22.2% African Americans, 5.55% Hispanic, 22.2% Native Americans, 50.0% Whites. The Oklahoma census for 2000 indicates 7.6% African American, 5.2% Hispanic, 7.9% Native American, 76.2%, and Whites. Participants were recruited from Okmulgee and Tulsa Counties, in Okmulgee County the populations is 10.2% African Americans, 1.9% Hispanic, 12.8% Native Americans, and 69.7% White. In Tulsa County the population is 10.9% African American, 6.0% Hispanic, 5.2% Native American and 75% Whites. Ethnicity was declared by all participants. The participant population was representative of the general distribution of people in the state and counties by race.

The participants were also diverse in level of educational attainment with the following degrees: High School Diploma–50.0%, Associates Degree-11.1%, Bachelors Degree-5.6%, and Masters Degree-33.3%.

The participants were given Assessing The Learning Strategies of Adults (ATLAS) to identify the learning

strategies preference. The results indicated that 22.2% were Navigators, 38.9% were Problem Solvers, and 38.9% were Engagers. The expected distribution for ATLAS in the general population in past studies is as follows: Navigators--36.5%, Problem Solvers--31.7%, and Engagers--31.8% (Conti & Kolody, 1999, p. 18). The high number of Engagers in the study could be explained because OSU-Okmulgee campus attract a larger group of Engagers than expected in the general population (Massey, 2001). This was maybe because the marketing efforts at OSU-Okmulgee appeals to Engagers, with its focus on group work, small classes, peer teacher interaction, a friendly and family-like campus (p. 165). Low instructor-student ratios assure personal attention and mentoring, and Engagers are provided the personal interaction they desire. Engagers have to buy into a learning project before they start it and enjoyment and reward are two important elements that they want to experience (Conti & Kolody, 1999, p. 14).

Playing the Game

The setting for the study was two adjourning rooms in the Okmulgee Workforce Oklahoma Center on the OSU-Okmulgee campus, which housed a total of 10 machines. The chairs at the machines were stools that had a high back that were adjustable and that were very similar to what is used in a

modern casino. However, there were several other types of chairs placed through out the room. The floors were carpeted, and the lights were florescent. The room was relatively quite, those participants who desired music were allowed to use headphones with their CD players. Thus, the setting was consistent with the adult learning principle that "the physical environmental should be one in which adults feel at ease. Furnishings and fixtures should be adult-size and comfortable" (Knowles, 1980, p. 46).

Fatigue and eye strain were two major factors that affected the participants while trying to learn to play Reels and Deals. Initially most of the students played one or two hours and did not appear to be tired. However to complete the 30 hours of play, many played up to three and four hours in a row. These factors were also observed by the research staff. When asked about becoming tired when playing the game, a participant stated:

> About half way I became aware that tedium was a major factor for me. I started having to split my hours up more because after about 50 minutes or so, it was very hard for me to do an hour. I had to take breaks in between the hours. (Age 44, male, Engager)

Several of the participants used eye drops because they stated that their eyes were dry. Some complained that their eyes were just tired from watching the screen. They would take breaks and return. One participant stated:

> I was frustrated, had headaches, and my eyes hurt. I had to take off my glasses to see. Turning out the lights to see the red come up and the Reels and Deals icon, which came up so rarely. It was a difficult game to learn. (Age 45, female, Navigator)

> Time is what is needed. I was fighting tedium. My body was uncomfortable. It would be easier to learn in the comfort of my home or if it had a big jackpot. (Age 44, male, Engager)

The chairs were also an issue. Some of the participants complained that after sitting for an hour or two, the chairs became uncomfortable. Therefore, they would alternate standing and sitting during the game. Most appeared comfortable the first hour. The participants were allowed to adjust the chairs or select another chair that they felt was more comfortable. Two participants stated:

> I don't think that they want you comfortable while you are playing the game. The chair affected me more than anything. (Age 29, male, Problem Solver)

> I need to sit on a higher stool with a foot rest, take my shoes off. Eat lunch. (Age 51, female, Problem Solver)

The lighting was another issue. Some participants found when the lights were off they did better than when they were on. Some participants even asked to have the lights turned off. However, low lighting seemed to be better on the participant's eyes.

The participants approached the task of learning the game with differing degrees of seriousness and

determination. In the beginning some of the participants just hit the buttons at a rapid pace in hopes of getting the desired icon. However as they progressed in the game, they started to slow down and concentrate. One participant stated:

> I did not have a strategy. I was just going for hitting it. I was just trying to match up the icons, even the lowest paying so I could figure out how the whole game worked. My first clue was whenever I was watching for patterns after the third time [hour]. I started messing with the game. I was watching for the Reels and Deals symbol because it was the hardest to find. I would try to hit it just before or as it came by. (Age 26, female, Navigator)

The participants also talked about eye-hand coordination. The timing was the most repeated factor mentioned on the journal sheets. All of the participants worked on getting their timing perfected. A few comments are as follows:

> After a while you get just so tired that you stop concentrating on the timing and it becomes a chance deal. It becomes more chance as fatigue sets in. I don't know if I could have changed anything, but if I could I would have changed the timing. The timing was what I would work on the most. I would catch myself. I was trying too hit it too fast sometimes or too slow. The hands hit it too fast or too slow. (Age 26, female, Navigator)

> It took me a while to get my rhythm up to find that little niche on how to do it. But it took time. I guess I would have to just concentrate. The ones I got [to stop] below [the payline], I was just too slow hitting them in order. (29, male, Problem Solver)

> Timing - after I see a cherry followed by a bonus/reel - 4 reels pop up close to the same time apart; right after. Practice, find the magic touch. (20 year old male, Navigator)
>
> Find another strategy such as the amount of time between the time I it the first button to time I hit the last buttons. (20 year old, Engager)

Although there were physical barriers which existed in the environment that hindered the learning process, many of the participants made a conscious effort to address or overcome them by creating their own solution.

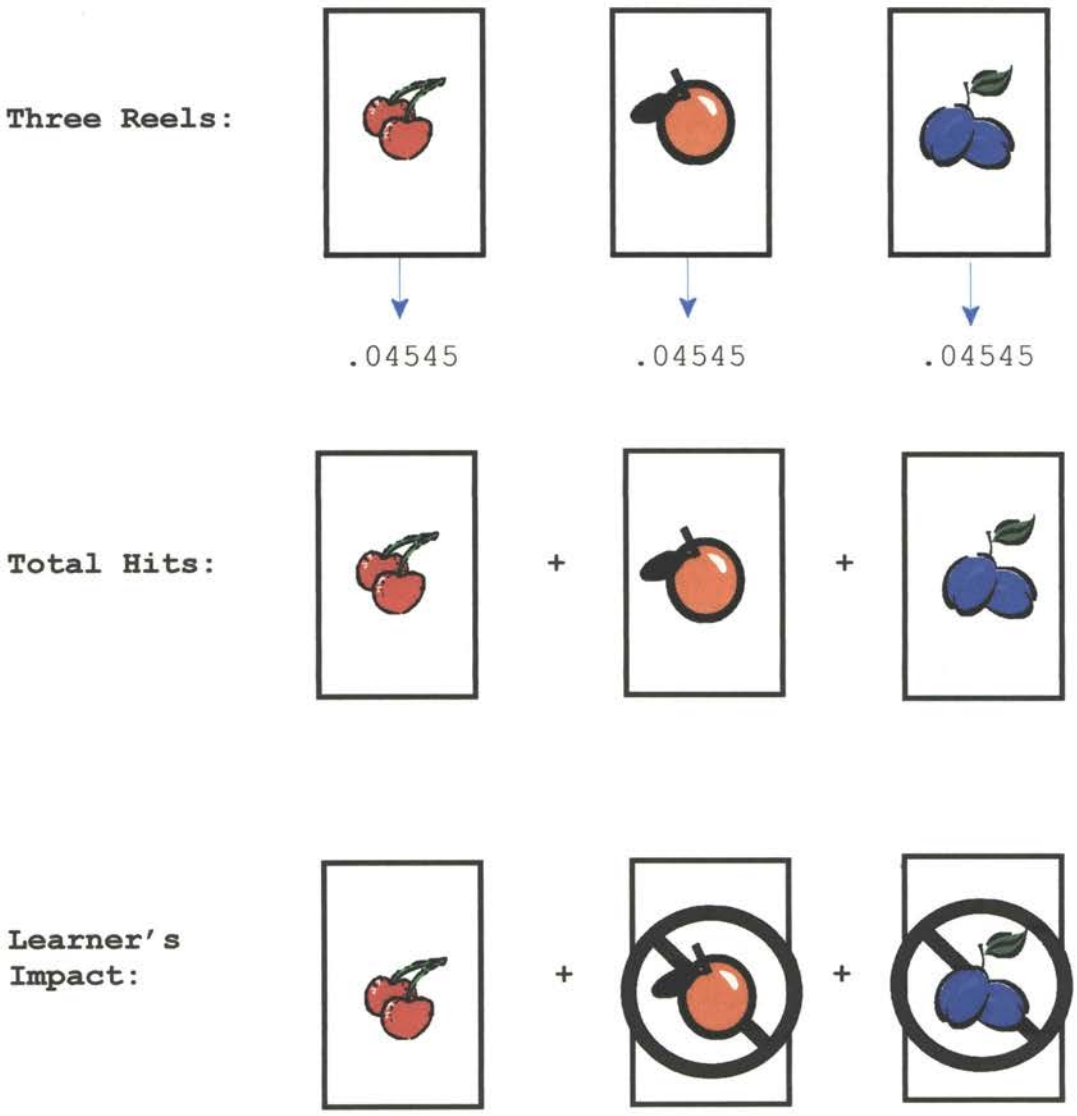
Quantitative Data Analysis

Quantitative data was collected on the 18 participants in the study. The Reels and Deals Skills Stop Game software recorded the results for each participant as they played the game. The participants were responsible for recording the time in and out for each 60 minute session, the date, the computer number, and their name. They also completed a reflection sheet that recorded their impression of what was occurring as they learned the game. The research team was responsible for opening the machine and recording the number of games played, credits played, credits won, and the percentage of icons hit for each hour of play on the data form. The form included a written payout list which represented three reels and all possible combinations of icons. At the end of each hour that a participant played the game, the research team opened the machine and recorded

the results on a paper data form that matched the payout screen. The hour of play was determined by a mechanical timer with an alarm that signaled the participant to stop.

The participants were instructed to concentrate on learning the first reel on the left side of the computer first, and then to just quickly stop the two remaining reels. Since each of the reels have a different pattern, only one reel was used. This study sought to describe the approach learners use when playing the Reels and Deals game and to determine if it could be learned beyond chance. Since it was not possible to program the machine so that only one reel turned, the participants were to focus on one reel and just to stop the other two. Since the results of all three reels were included in the results, the hits for the reel that the participant was trying to learn had to be removed from the chance hits of the wild icons on the two remaining reels. Figure 1 depicts this situation. The participants stopped all three reels, and each reel had a .04545 chance of producing a wild icon. Thus, for the total hits it was possible to have wild icons in all three positions even though the learner was only concentrating on the first reel. Therefore, the chance factor for hitting wild icons in the two other reels had to be deducted from the participant's total score in order to get a true measure

Figure 2: Process for Determining Hourly Percentage of Wild Icons Hit



Learner's Impact / **Games Played** = **Hourly Percentage**

of the learner's impact on the outcome. Since the games were played in hourly segments and since the participants played a different number of games each hour, the number of hits per hour was converted to a percentage in order to have a standard unit for comparison.

The data for the payoff outcomes for the game were electronically captured by the computer programing built into the machine. The following formula was used for each participant to calculate the percentage of hitting the wild icon each hour:

Total number of wild icons hit - (Games played *.04545*2))/Games played = Hourly Percentage

The manufacturers of the game and evaluation at an independent testing laboratory reported that the chance of randomly hitting a wild icon was .04545. This formula multiplied the number of games played by the chance factor of .04545 for hitting a wild icon for each of the two reels that were not being learned but were being stopped. This number was then subtracted from the total number of wild icons hit in order to determine the number of wild icons obtained due to the participants learning the first reel. The results for each participant were standardized so that the results could be compared regardless of the number of games a person played and so that it could be compared to the results of the known outcome for chance. This was done

by converting to a percentage by dividing the number of wild icons recorded as a results of learning by the number of games played.

The data recorded for the 18 participants indicate that the participants' hourly percentage of hitting the wild icon was different from chance, which is .04545 for hitting the wild icon. When the rate is subtracted from the hourly rate for hitting the wild icon the results are different. One example for rating number one the first participants percentage rate for hitting of wild card for hour 1 would be .0593057613168724 minus .04545 the chance factor equals .013857613168724 percent difference for chance for hitting wild card by hour 1. This calculation was made for each hour of raw data for every participant. If the participants were getting results that were chance, it is likely recorded as a zero. Most of the results indicated for hours that were actually played reveal outcomes that were different from chance.

A t-test was used to compare the mean of the participants' results to the chance rate. The one-sample t-test is a procedure used to compare the mean of the group scores under study to a specific mean (Roscoe, 1975, p. 214). The group scores consisted of 422 hourly ratings for the 18 participants of their percentage rate, which was

different from chance for hitting the wild icon The one-sample t-test statistical hypothesis is that the mean of the sample group is equal to a specific mean. In the study, it involved testing to determine if the mean of the 422 ratings is equal to the specific rate of hitting the wild icon by chance. The chance rate had previously been documented by the manufacture and the report from the Gaming Laboratories International, Inc. to be .04545. The t-test produced the following statistics:

Table 1: One-Sample t-test of Hourly Hit Rate to Chance

Test Value = .045455		
t	df	Significance (2-tailed)
30.2935	421	0.000000000000000000020414

In the analysis "if the calculated value for t equals or exceeds the tabled value, the finding is significant, and the hypothesis is rejected; the difference between the two means is significant at the specific level (Huck, Cormier, & Bounds, 1974, p. 214).

Table 2: Summary of t-test Statistics

Mean	Standard Deviation	Standard Error Mean	Mean Difference	95% Confidence Interval of the Difference
0.0169	0.0198	0.00096		Lower Upper
			-0.02926	-0.03116 -.02736

The responses of the participants different from chance. The calculated t for this analysis is 30.294. This value is nearly 10 times greater than the value of 3.291 which is required for a significance level of .001 with a infinite size population (Huck, Cormier, & Bounds, 1974, p. 429). Thus the mean of the 422 ratings of the participants is different from the chance test value of .04545. This finding has a 95% confidence level.

Although the participants learned at a rate greater than chance, there was no relationship between one's learning strategy preference and that person's cognitive level ($\chi^2 = 1.14$, $df = 4$, $p = .89$). The three learning strategy preferences were distributed in nearly equal numbers among the three cognitive levels of learning. Although slight differences in actual numbers exist (see Table 3), these variations are not statistically significant. Thus, those with learning strategy preferences in any group can be at any level of cognitive development related to a topic. Specific learning strategy preferences do not either aid or hinder a learner from being at a specific level of cognitive development on a topic.

Table 3: Frequency Distribution of Cognitive Levels by Learning Strategies

Type	Navigator	Problem Sol.	Engager
Master	0	1	1
Developer	2	3	2
Struggler	2	4	5

Experts and Novices

Description and Differences

This study involved three levels of learners. Understanding the learners' cognitive level is essential to gaining an insight to the nature of the learners' thinking and problem solving strategies.

Thinking is a complex phenomenon which consists of implementing a variety of thinking functions, each of which has it own subordinate cognitive level (Beyers, 1997, p. 256). Beyers believes learners initially exhibit a very halting, fragmented, error-prone, and effortful execution of new thinking operation. In the process of thinking, every learner is capable of moving from a gradual learning pace toward a rapid, efficient, self-directed and automated cognitive level, thus developing expertise (p. 256).

Hubert Dreyfus, a Philosophy Professor at the University of California, along with colleagues, developed a model of the development of skills (Batalden, Leach, Swing,

Dreyfus, & Dreyfus, 2002, p. 106). The five skills levels of the model are as follows: (1) The Novice learner fragments a thinking procedure into various steps and applies them with very little regard for the context in which they are found. They judge the results by how well they have followed the rules and covered the steps. They show very little concern for the results gained. This is very similar to the results that were observed with one group of learners on the Reels and Deals game. (2) Advance Beginner are learners that integrate the pieces of the procedure, yokes it to a specific situation or context, focus on the rules, but proceed in a slow, often difficult nature and refer to personal experiences and content cues. (3) Competent learners begins with an elaborate procedure, separating it from a specific context or task, recognize the important parts on which to focus and show concerned about the results. In this study those learners would be the Developers, who were able to come up with ideas very quickly about what to look for in the way of patterns on the Reel and Deals game. Dreyfus contends that most learners do not move through all of the levels of development. Most individuals will be at the level when they reach their senior years. (4) Proficient Performers recognize present contexts as similar to earlier encountered ones, they have

spontaneous recall by which they generate plans for carrying out actions and do it with very little effort. (5) Expert learners thinks rapidly and holographically rather than in steps, they move from abstract to case-specific rules and sometimes they even break the rules of logic. Strategies seem to spring to mind and they act and learn from the results with no conscious effort or awareness (Beyers, 1997, pp. 256-257).

In this study there were three expert learners who, like the proficient learner, were able to work from spontaneous recall but they also broke all of the rules and mastered the Reel and Deals game in a matter of days. A learner can be a novice in one context, a competent learner or proficient learner in another learning activity, while perhaps nearing expert in another activity. Therefore, the skills level would depend on the context or the occasion of past thinking experience of the learner, as to where they would fit on the skills model.

Knowles (1998) advocates that the major differences between the experts and novices are intellect and experience. Experts solve problems in a different manner than novices. Knowles (1988) states:

> Experts have more focus, recognize cues that allow them to recall "chunks" of information, and are better able to integrate and interconnect knowledge. The knowledge that novices possess may

> be descriptive at a superficial level. In contrast, experts are able to troubleshoot and make interpretations about information (p. 231).

Researchers like Dreyfus and Bloom have shown that learners who have developed an expertise in a particular area are able to think effectively about problem solving. Experts tend to know more about the context, their knowledge tends to be more organized and efficient than novice. Experts are individuals that have learned a great deal, they are more likely than novice to utilize relevant information, they are less likely to be influenced by irrelevant cues than novice, and they are less likely to be overconfident than novices (Byrnes, 1998, pp. 103-131). A successful learner has acquired a great deal of content knowledge that is organized, and they retrieve important aspects about the organized structure when necessary and with minimum effort. "Instead of creating solutions from scratch for every problem situation, they make use of previously stored information in such a way that it facilitates their coping with the current problem" (Sternberg, 1990, p. 133). They have a deep understanding of how to organize, represent, and interpret learned concepts in their environment, which affects their ability to remember, reason, and solve problems. To the expert, new knowledge is recognized as an instance of an established concept, or related to an earlier

instance. Experts and novices differ with respect to their tendency by chunking in free recall, to use comprehensive plans in solving problems, and to classify problems based on their underlying solution requirements (Mayer, 1988, p. 572). A new task is either included or excluded from a concept, or as it provides a new opportunity to develop a new useable category of items, events, or generalizations.

> The expert learner approaches the learning task differently than the novice. In the area of chess and physics, there were broad similarities among expert learners: more use the novices of cognitive or metacognitive strategies to organize input and knowledge, including a general tendency to reorganize learning task along deeper abstract and conceptual structures and schemata, rather than along surface structure (Rivers, 2001, p. 280).

The novice learner is challenged by the same new information that the expert are given. The novice initially attempts to work just as hard as the expert. They examine the information and attempt to deal with it by memorizing and then they shift to random methods of accomplishing the task at hand. They view themselves as unable to learn a new task. They create external diversionary tactics to compensate for the internal expertise they lack. Even when they have learned the concept they may not know how to make a connection between the new knowledge and the environment in which it is found.

Based on the experts and novices cognitive or

metacognitive strategies and their success in learning of the Reels and Deals game, three groups of learners emerged in this study: Master Learners (three experts), Developing Learners (seven competent learners), and Struggling Learners (eleven novices).

Master Learners

Effective and efficient learners can be referred to as Master Learners. In this study Greg and Jerry Giles, who are first cousins and owners of Spinit, Inc., were the proficient learners who undeniably learned the Reels and Deals Skill Stop Game. They were able to show a significant degree of success at playing the machine during the administrative proceedings. The Giles cousins approached the game with a organized structure that had been learned in a prior experience with a similar machine, which was called an Eight Liner/Cherry Master game. They did not discuss when this game was encountered in the past; they only referenced to learning the game. Because of their knowledge of the Eight Liner machine, both believed that the Reels and Deals Skill Stop Game could be played using the same strategies they had learned previously to master the Eight Liner game. Inductive reasoning is a major aspect of cognitive development

The Eight Liner is also a very complicated game to

play. It has three reels with three frames on each reel. The center reel was the most logical to concentrate on first, because based on whether or not the winning wild icon could be stopped in the center frame, it was possible to win eight different ways. The two remaining reels had the same icons in similar patterns. The speed of the reels were just as difficult to stop as the Reels and Deals game. The Reels and Deals machine resembled the Eight Liner in screen presentation and programming.

The Giles cousins recognized the inner structure of the game and also had a cognitive learning strategy about how to play the reels. Learners who have a high level of metacognition knowledge perform better in problem solving. The Giles cousins were able to recall and build on what they already knew about the Eight Liner machine. They were able to troubleshoot and make interpretations about their progress with the Reels and Deals machine. Knowing what they knew and equipped with a sophisticated strategy, the Giles cousins were satisfied to just watched the machine until they could see a familiar pattern they recognized.

Both stated the speed of the reels did not make a difference in what they learned. It just took time to get adjusted to the speed of the reel. They stated it would not make a difference if the reel moved even faster than the

current speed because they were looking for a certain spot on the reel that they recognized.

Time was not a factor for the Giles cousins because they felt they had plenty of time to run the known attributes through an organized process. Both learned the game within 2 to 3 days and felt that once they had learned the pattern, it was stickily a eye-hand coordination function to stop the reel on the wild icon. Their mid point for the learning the game was about 6 hours into the process of learning the game over a period of about two days.

The Giles cousins were also internally motivated and emotionally attached to their method of play because their business and family depended on their production and maintenance of the Reels and Deals machine in the casino environment. They were asked by the manufacturer in Florida to learn how to play the game. A cash bonus provided by the manufacturer for hitting the three Wild icons added to the incentive motivation to learn the game. However, the most powerful drive was their internal motivation to master the game.

Incentive motivation has been called by several names, including achievement motivation, effectance, and the urge of mastery. It reflects the natural tendency of learners to

manipulate, dominate, and "master" their environment (Gagne & Driscoll, 1998, p. 25). It is also motivation that causes the individual to strive to achieve some goal and it is somewhat important that the learner is rewarded for reaching it.

The Giles cousins applied incentive motivation. Greg learned to hit the payoff icon first, which enticed Jerry's competitive nature to beat Greg at the game. As the cousins played competitively and for fun, they became highly effective and efficient learners. Greg stated,

> You can crank it up, change the colors, put me where my family's financial future is at stake and I can still crank you out 500% above chance with one of my worst performances.

Because of his dissatisfaction with his performance in the administrative proceeding, Greg went home and over the weekend learned several other patterns for hitting the wild icons. The Giles cousins learned the game well above chance because they had an organized structure for playing the game. Their belief that it was a skills game and that it could be learned was just part of the incentive they needed to learn the game. Greg stated, "I started learning as soon as the reels began to spin." Prior knowledge of the Eight Liner and knowledge of payout tables that is based on a smaller number highest paying icons being located on the reels, along with patience to watch and learn the reels

helped them to master the program. This mastery was in sharp contrast to the novices who were paid to participate in the study.

The Giles cousins are at the Mastery level of learning on Reels and Deals. However they feel that their gaming technology skills could be taught to another learner and that learner would be successful in playing the Reels and Deals game. They contended that most of the time the players would not use the information or targeted skills provided by them. The Giles cousins told of visiting area casinos and talking with numerous players about how to play the game. It was explained that Reels and Deals was a skills game. Jerry stated:

> I explained to them that it's just a wheel going around and around and around. It's not going to stop until you hit it. When you hit it, it doesn't drop short. It doesn't fall. Whenever you hit the button it stops. Really! [reaction of the person] Yes, it really does.

While other players would listen intently and make a statement that they were going to look for the pattern that was suggested by the Giles, the person would be playing in the manner as previous to the conversation with them when the Giles cousins would return about 10 minutes later. Therefore, it was the Giles cousins' belief that players possess the knowledge for engaging in the task but the players did not feel challenged enough to use it or believed

it was not in their intellectual ability to accomplish the task. Jerry stated, "We are trying to tell them and they just flat don't believe us."

Developers

Initially there was one group of novice learners. However due to their strategies for playing the game, it quickly became obvious that there were two groups of learners instead of one. One group was working with a higher level of cognition. One group became the Developers and the other group was the Strugglers. The Developers were adult education students that had a masters degree and working toward their doctorate degrees. The Developers had a better grasp of the learning task than the other group of novice players. Even though both groups viewed learning of the game as being central, their perspective might have been different. Most of the graduate students had some sense of commitment to the project because they were aware that the study would lead to a report that was being prepared for a federal proceeding. Most of the Struggling learners knew it was a study to determine if they could learn to play the game.

As graduate students, these learners had learned to set up objectives, to then select methods or techniques to accomplish the task, and, finally, to monitor and evaluate

their progress. They had a vague concept and sought to make it work. They had a few more experiences in the classroom setting at problem solving and the higher order of thinking. Higher order of thinking skills includes problem solving, concept formation, reasoning, decision making, and mental representation (Beyers, 1997, p. 286).

The Developers were self-directed in their approach to the task of learning the Reels and Deals Skill Stop Game. However, it was a slow process. One student stated, "In the beginning I was totally clueless." He was just watching the reels spin and was under the impression that he could see a pattern that he recognized. He stated,

> I was trying to figure out where it was, how it went but it seemed so long. It was beyond my grasp to be able to memorize it, and I just went on gut. (Age 44, male, Engager)

Knowles (1980) states performance in the area of understanding and insight requires the participant to demonstrate the ability to size up a situation, see patterns, develop categories, figure out the relationship, and apply knowledge and thought-processes to the analysis of the solution to the problem (p. 230). Another participant who had an engineering background developed a concept which indicated that the cherries on the reels were paying more so he had to concentrate on finding the cherries. He looked at the pay chart and used his general knowledge of probability

to develop a strategy. This was similar to what the Giles cousins did, however they had more concrete experiences because they had the knowledge of the Eight Liner. He expanded this strategy to look for "red" because of the paytable.

> I tried looking for red and patterns of red. I still played all three but concentrated on #3. Still think I'm trying to get "sense" of pattern rather than learning specific order of the wheel. Started to tell cherries from sevens and wilds. (Age 45, male, Problem Solver)

He did not concentrate on the bars, oranges, bells, plums or any other icon because they were the highest in number but the lowest paying icons on the reel. In concept learning a learner is able to respond to and identify an entire class of objects or events. In this study the objects would be the wild (Seal) icon. The Developers observed the other novice participants were just hitting the reels at random and decided that they would use a more mature approach. They focused on seeing the wild icon. They had a high rate of success at playing the game because they had an organized structure or plan of action. They were highly self-directed in their approach.

Self-directed learners tackle a learning task with five steps that comprise the overall approach (Gagne & Driscoll, 1998, pp. 129-140). The first step begins with identifying and analyzing the a goal that involves determining the

prominent aspects of the learning task; what is to be learned and when and where it should be accomplished. The Developers planned a strategy by formulating a plan, consisting of a strategy or a set of strategies to accomplish the desired learning.

> First of all, I am not a video game player, so I had to get familiar with how the thing even functioned. Looking around me, I could see that other people were hitting what it appeared to me, people were hitting them randomly. But that did not make sense to me. So I tried to see if there was any kind of pattern that I could see. In looking at the game, and playing the game. (Age 44, male, Engager).

Second, they think about given the learning task how to accomplish the task and what they should use as tactics.

> Keeping my focus on the middle reel in reading and anticipating the next icons. Yes, I seem to hit the wild cards more often on one of the three of the reels at a greater frequency. Repositioning my fingers. (Age 46, male, Problem Solver).

Third, they carry out the strategy, the Developers used a strategy or strategies to help them reach the learning goal.

> I tried to spin the wheels and stop each reel in isolation. I tried to learn to identify at what stage or visible icon to react to in order to reach the anticipated wild card. Did it work? No not really. I tended to loose tracking. I broke rhythm and I think it hurt my game. Got to develop a rhythm process using both hands. (Age 46, male, Problem Solver)

Fourth they monitor the results of the strategy, the Developers decided when a strategy was not going to help them to reach the goal of hitting the winning icon.

> I looked for the red with the green. My reflexes were not that good. I slowed down on several games. Spending more time looking at the individual reels. It got to the point where I was playing less games, so I had a better chance of seeing. I had the reels and deals within the frame but not on the line, so I realized I was getting close. (Age 45, female, Navigator)

Finally the learner modifies the strategy. The Developers modified their strategy when it was not producing satisfactory results. They constantly changed what they were doing to reach their goal. One participant indicated he was modifying his current strategy and was going back to his original plan.

> I went back to the staring method. Staring to anticipate the reels icon and stop the icon. This worked well this time. Surprisingly, I think I am becoming familiar with when to stop. Keep the starting method going. (Age 46, male, Problem Solver)

The speed of the spinning reels was not a defeating factor in their learning. When asked if the speed of the reels made a difference, one adult student stated, "No not to me, it did not bother me because I was looking for a pattern. And the whole spinning thing was beside the point of finding a pattern." This participant also talked about seeing a "green zone" which allowed him to have more success.

> Starting to learn sections of bars, oranges, and there is a "green zone". I was really on a roll. I am seeing better. At first I could not spot it, then I saw a pattern and it's a matter of eye-

> hand coordination. Timing is what needs to be learned. Started looking for cherries, could then see pattern, now see "green zone". I am trying to time it, to see when to hit (Age 44, male, Engager)

Time was a factor. Most felt that 30 hours was not enough time to grasp the game. With additional time they would have been able to master the game.

Strugglers

The Strugglers did not have an organized structure for learning the game. They were also clueless about how to get started. They were given a hint about how the machine should function and what to look for in the form of patterns. They were asked to concentrate only on the first reel and just stop the two remaining reels instantly. One participants put it in this manner:

> I did not have a strategy. I was just going for hitting it. I was just trying to match of the icons, even the lowest paying so I could figure out how the whole game worked. (Age 26, female, Navigator)

While the Giles cousins, who were the Master Learners, already had an organized structure, these participants had to develop a concept. They were learning in a slow and inefficient way how to find the pattern. Initially they were just hitting the buttons and stopping the reels haphazardly in a trial and error manner, thus they had repeated failures. One Struggler stated:

> When I first started I was interested in the study and what kind of research was being done, but I quickly became frustrated with the game. I am very impatient and like to be able to see that I am accomplishing something before I even get finished. About halfway through my skill started increasing and I became more interested in the game and started trying to improve more. I finally got the bonus. The past few days have went downhill. I am leaving next week and I have had a lot to do. I had not gotten any sleep. So I have been too tired to concentrate. The only thing I have been able to do is try for the first reel and just hope the others line up. I think with enough sleep I could have improved more and learned all three reels. (Age 19, male, Engager)

They had the willingness to learn but lacked a organized structure for developing a sophisticated strategy for initiating the learning. This allowed them to easily be distracted from the task of learning the first reel and led to them trying to "hit" the icon on all three reels.

Instead of concentrating on developing a cognitive strategy, they attempted to manipulate the external factors. They did such things as use eye drops, changed the lights, and adjusted the chairs to different heights in an effort to increase their learning ability. When these external factors were taken care of, the Strugglers concentrated on a different perspective to hit the icons, which means they went back to concentrating on the reels. However, with practice on the device, they began to develop strategies for hitting the wild icon. One participant talked about patience:

> Well, when I first started Reel and Deals research, I was just trying to make credits off of the game. It was just for fun and maybe some easy money. But I started getting some skills abut the game. The game does require some concentration and patience of sitting for large amounts of time. I think some people who had good concentration skills could win. But for just an average person winning could be hard because not having patience and being told to concentrate makes a huge difference. (Age 34, female, Engager)

The speed of the reel was a factor. As they attempted to stop the spinning reels, they saw the wild icon either above or below the payoff line more frequently toward the end of play. They felt that they were getting close to learning the game. Most of the Strugglers thought their hand-eye-coordination needed to be fine tuned. By the time they saw the icon and stopped the reel, it was either too late or too early.

Time with this group of participants was a factor. The exact nature of the inner structure of the concept of the game was still being discussed and being manipulated at the end of 30 hours of play. However, near the end of the 30 hours they were close to learning the pattern but also like the Developer felt they needed more time to learn the game. This group of learners were less able to accurately assess and manage their intellectual skills. At the end of 30 hours of play, one participant did not like the idea of comparing his first and last hour of play:

> I thought this game was really interesting. For the study people should have to agree to come in 2 hours a day, or at least a set amount of time. People get tired after 2 hours, boredom set in, as well as, making time go by slower. I think 2 hours each time a person comes in would be ideal. I do not like the idea of comparing my first hour to my last hour either. My first hour was kind of exciting and went by really fast. I hit the buttons really fast on the first hour carelessly and on the last hour I was so sick and tired and bored of the game that I do not think comparing the two would prove much of anything. (Age 20, male, Engager)

Intellectual skills are important elements in the transfer of knowledge. There are two kinds of transfers in which intellectual skills are involved. The first is vertical transfer, intellectual skills exhibit transfer to higher-level skills, that is, to skills that are more complex (Gagne, 1985). An example would be multiplying whole numbers is a more complex skills of dividing and adding. Transfer of these skills are dependent primarily on the prior learning of the simpler skills. Once basic skills are mastered they are readily retrievable and may from the basis for learning a more complex task (Gagne & Driscoll, 1988, p. 94). The Strugglers had no previous knowledge in the gaming context. Most stated they had never been in a casino. The second kind of transfer is called lateral transfer, which is the generalization of what is learned to new situations, differing from those in which learning has occurred. Most school learning involves this type of

transfer. It is hoped that learners will take what they learn in school and transfer it to situations outside of the school. An example would be arithmetic skills. Adult learners use this skill to do things like balance a checkbook or calculate unit prices in the grocery store (p. 94). The transfer of skills also involves the influence of external events in the learner's environment. While intellectual skills involves retrieve of learned skills it also requires the use of cues to relate the skill to a new situation or problem contexts. It is to the advantage of the learner to practice the application of the skill in the new context. Therefore, because cognitive strategies are internally organized control processes, the effect of external conditions on the learning of the Strugglers was less a barrier to learning than their intellectual skills.

The learner can recall great deals of knowledge that have laid dormant until needed. This knowledge can be concepts that were constructed due to previous experiences at an earlier stage in life. The learner is continually constructing and being informed by involvement in new learning processes. One participant believed she had improved her skills:

> I really enjoyed the game it made me feel like I was given a chance to build on my goal, strategy, and skills. I hope that I was a help for someone. (Age 34, female, Problem Solver)

The novice learners could have benefitted and made better progress through the metacognitive process.

Qualitative Data

Data were collected by observations by the research staff, an hourly journal of participants, and exit interviews of the participants by research staff. This data revealed three trends. (1) All of the participants felt they had learned to play the game. (2) The participants all talked about seeing a pattern and having to make a deliberate effort to concentrate. (3) The learning strategies were different for each group of learners. One expert stated his strategy did not change from the beginning to the end of learning the game. The following is how he describes his strategy:

> This is how it worked for me. Once I hit spin, I never ever looked at anything else except cherries, and seals, and sevens, because those three are different colors. The seal is different color than everything else. So that one sticks out as plain as day. Then I would watch the reds go by. The cherries would come by and the sevens would come by, and no matter how fast it is going because of the shape of them, you can see them go by. (Greg)

Another expert stated he changed his method of play several times, until he found which one was most accurate from him.

> At first I could not put anything together, so I started looking for icons on the reels and found that there were certain icons and cherries stuck

> out to me, so I had to find areas where I could pick-off seals to follow certain cherries. After I saw certain icons go by, then it was just a timing game. (Jerry)

The Developers made a conscious effort to stop just hitting the buttons and developed a strategy before they started to play the game and changed their strategy as to needed. Two Developers:

> I felt like I was more in control and had a better grasp of what was going on than from the beginning. (Age 44, male, Engager)

> At the beginning I was just hitting the reels and I did not know I was going to play. In the middle when I decided I was going to play, I looked for red and green. I started slowing down sometimes and then going faster. We should have played in half-hour increments. I had a personal connection to learning the game because I knew we needed the information for a court case. I hung in there just because of the research. (Age 45, female, Navigator)

One of the Strugglers made the following statement:

> I was trying to concentrate more in the beginning, but it was on the wrong reasons. It was the wrong way to hit the keys, or the wrong patterns you were watching because you don't know the pattern when your first start watching. So you are trying to concentrate more because you are trying to learn it. Then later on when you figure out the pattern time you start drifting away, there is just a certain way you hit it. (Age 29, male, Problem Solver)

The Struggling Learner also talked about seeing a color sequence pass by where he could tell the difference in colors. "You can see which ones are red and which ones are not." He also talked about sequencing his hands in order to

stop that first reel and just stopping the two remaining reels. He stated "I nailed it at least three times." The main strategy that was used by all of the players was to "learn the pattern."

Interviews

Individual interviews were conducted at the end of this study. The intent of the interviews was to analyze and discern general patterns in the participants level of involvement in playing the game. The interviews were tape recorded and transcribed. Notes were also taken during telephone interviews. Data was analyzed for points of similarity and contrast.

All of the participants that were interviewed felt they had learned the game. They were not aware of their actual scores which were documented internally by the computer and recorded, but they did notice a difference in how they approached the game initially and at the end of the 30 hours of play.

Also interviewed was Dr. Ann Ghost Bear who was an observer of the research team and participants. She developed and taught a class around the field base research experience. Dr. Ghost Bear stated:

> This was a remarkable learning opportunity for adult learners and for myself as a researcher and instructor. It was fascinating and exciting, because my past advisor was an expert witness and

> I had the opportunity to work with a group of doctoral assistants who were part of a research team. Watching and digesting the trail/courtroom drama unfold was awesome. It was the first opportunity for me to see my husband go through his legal maneuvers. I was so nervous I had to leave the courtroom a couple of times, because of all the interaction between the lawyers, witnesses, and experts on both side of the case, my stomach was upset. What a learning experience.

This researcher also interviewed the Lead Counselor, John Ghost Bear for the Cherokee Nation Enterprises. His approach to the administrative hearing was as follows:

> The major thrust of what we sought to do was to convince the judge, given all of the characteristics of a number of games, other than Reels and Deals, this was truly a game of skill, which could be learned, even though it may have been difficult to do so.

Attorney Ghost Bear also stated it was important for the judge to understand that Gaming Laboratories International, the independent test agency had established a certain criteria within the game. He believed it was very important for them to show that Reels and Deals did not have those types of characteristics. The ways he had plan to approach his strategy was to have expert witnesses to testify, who had conducted independent studies. His line up of witnesses included mechanical engineer, a mathematical engineer. He then lined up two expert players of the game, who had been able over a short period of time learn the game and could in fact affect the outcome of the game

substantially over chance. His other witness was an adult educator who proved that the game could be learned.

There was one maneuver that John Ghost Bear demonstrated in the courtroom that impressed this researcher. The government had sponsored a study which they elected not to introduce or make a part of their evidence. He felt that because they did not want it divulged to the administrative judge he would talk about it in his closing argument. He walked over to a waste can in the courtroom held it up and asked them about their study. In doing so he indicated what he thought they had done with their study using the public's tax money. He then placed the waste can back on the floor. He stated, it was where they had placed their study because that was what they thought about it.

When asked about the Giles's performance in the courtroom he stated:

> I thought they did a good job. They were under extreme pressure and I was unaware of any other players who could have done much better because of the pressure placed upon them. In addition the demonstration was even more important because they were employees of the company that maintained and serviced the games, so they had a stake in what happened. That in addition to their performance created greater stress on them, I think. That was indicative to what happened to them in the courtroom. I, know they were able to demonstrate outside the courtroom a much greater mastery of the game.

The Giles cousins based on this researcher observations

were quite impressive in their demonstration in the courtroom. However they were under tremendous pressure to prove that the game had been learned.

CHAPTER 5

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

Summary

The concept formation level that learners possess as adults acts as a switching station through which all thinking can be accessed, linked, and sent forward, thus developing their intelligence and building new experiences. Concept formation is linked with learner experience. Without concept formation or intelligence nothing is constructed that can be carried over to a higher understanding of new experiences. Concepts can be considered as the building blocks of cognition (Eysenck, 1989, p. 290). Adults continue to learn concepts and develop new concepts through numerous activities both formal and informal. The intelligent mind creates from experiences, and this allows the learner to go beyond the information that is given. Both Bruner and Vygotsky believed cognitive growth involved interaction with other learners and that language serves to intervene between the environmental stimuli and the learner's response. Burner perceived that the outcome of cognitive development was thinking. Piaget believed cognitive development was an ongoing re-organization of mental process as the results of maturation and experience. A corollary is that the notion of iconic,

enactive, and symbolic stages may also be applicable to adults while in an activity where they are developing a mastery of practice or attempting to understand an unfamiliar subject. Different learners attain concepts in different ways and they may change their strategies during a concept formation task.

As a learner moves from one problem solving experience to another, the new experiences are linked back to an imprinted organized structure based on how the learner perceives and functions in multiple contexts in the real-world. Problem solving can be found in social, political, or technological environments. Cognitive development, which is based on learner's experience, can be either at a high-level or low-level of cognition. By studying individual differences in concept formation levels educators can begin to verify some general assumptions about the cognitive process through problem solving techniques.

Self-directed learners who decide to learn from a particular activity may start with a general concept or with no concept at all in that context about how to proceed. The organized structure will be influenced by the learners cognitive process and whether or not the strategy that is engaged will lead to their predetermined objective or goal. The whole life is learning; therefore education can have no

ending (Lindeman, 1926, pp. 4-7). Learners enter into new learning activities with diverse schemas, cognitive levels and learning strategies.

The purpose of the study was to describe the approaches adult learners used when playing a computer based machine, the Reels and Deals Skill Stop Game, and to determine if the game could be learned. The study sought to determine if the performance of the participants on the Reels and Deals game differed from chance, what strategies novice participants used for learning the Reels and Deals game, and what strategies expert participants use for learning the Reels and Deals game.

Summary of Findings

This study utilized a descriptive design. Information and data were gathered using records of participants' performance on the complex computer-based game, observations of the research team, hourly journals of participants, court records, interviews with participants, and interviews with experts. A research team was headed up by this researcher to recruit participants and to coordinate the delivery of machines. Spinit, Inc., a company based out of Denton, Texas, delivered 10 machines to the OSU-Okmulgee campus and a room was selected to house all of the machines. The team was taught how to operate the machines and how to record the

data.

Before the machines were delivered, meetings took place with Dr. Robert Klabenes, Dr. Sandra Massey, Dr. Gary Conti, Tom Giulioli, and John Ghost Bear. Giulioli is the District Attorney of Okmulgee County, and John Ghost Bear is the Attorney for Cherokee Nation Enterprises. The purpose of these meetings was to work through all of the legal details for the use of the Reels and Deals game on the Oklahoma State University-Okmulgee campus. An Institutional Review Board approval was obtained through OSU-Stillwater for the field based study.

A recruitment table was set up at OSU-Okmulgee in the Student Union with flyers and forms detailing the study for the purpose of recruiting participants to practice learning the game. Doctoral students from Adult Education program at OSU-Tulsa also assisted as participants learning the game and as research assistants. Assessing The Learning Strategies of AdultS (ATLAS) was used to identify the learning strategies preferences of the participants. It was administered during the recruitment process. Each participant took the ATLAS and completed the demographics information. Initially 30 students signed forms for the study, but some students did not use their current addresses and telephone numbers on the registration card making it

impossible to contact them. Although an effort was made to contact the students on campus who lived in the dormitories, it was not possible to contact all of the students. Of those contacted, some did not return phone calls or did not show up on the days they had agreed upon to start playing the game. Others had conflicts with their class schedules. Some came to play the game but did not return after playing only one game.

A total of 18 volunteers from Oklahoma State University-Okmulgee and Oklahoma State University-Tulsa participated in the portion of the study involving practicing to learn to play the game. Participants ranged in age from 18 to 55. One half of the participants were female. Over 50% of the participants were White, and 49.1% percent minorities. ATLAS measured the initial learning strategy preferences of participants who signed up for the study. ATLAS results for the participants indicated that 22.2% were Navigators, 38.9% were Problem Solvers, and 38.9% were Engagers.

Quantitative data was collected on the 18 participants. The majority of the participants played 30 hours each. A total of 422 hourly session were played on the Reel and Deals Skill Stop Game. A t-test revealed that the participants had learned significantly above the chance

factor which was .04545.

The physical environment was a factor in the participants ability to effectively play the game. The major concerns were the chairs participants sit in during the hours of play, the florescent lights that bothered their eyes, fatigue, the timing of the reels, and the noise level of music in the room.

As a result of the qualitative data, three sets of learners emerged during the study. These were the Master Learners, the Developers and the Strugglers. The factor that separated these groups of learners was their concept formation levels that they brought to the study.

The National Indian Gaming Commission classified the Reels and Deals Skill Stop Game as a gambling device based on their interpretation of the Johnson Act and asked that it be removed from the casino floors on the Cherokee Nation in Oklahoma. A Stipulation Agreement that was ongoing during the research study between the National Indian Gaming Commission and several Indian tribes was signed on May 20, 1999. However, before the administrative hearing began all of the tribes with the exception of Cherokee Nation had agreed to comply with the National Indian Gaming Commission decision to removed the games. An administrative hearing was held between January 14, 2000, and January 24, 2000.

Cherokee Nation Enterprises classified the game as an amusement device based on it design and as such, they took the position that it was not a gambling machine. Thus, the burden of proof rested with the Cherokee Nation because they had to prove that they were not breaking the law by allowing the device to be played in their casinos. They also believed that the game could be learned and was a skills-based game. Cherokee Nation Enterprises decided to commission this field-based study to help with their defense of the machine. Both the National Indian Gaming Commission and Cherokee Nation Enterprises presented their side of case. A few weeks after the administrative hearing ended, the administrative judge made a ruling that although the decision could have gone in either direction, his decision was to classify the game based on the Johnson Act as a Class III gambling device because of the speed of the reels.

Experience-Based Learning

> Concept formation levels and experience are yoked together in the learning process.
>
> Three groups of learners exist in adult learning activities based on their prior levels of conceptual knowledge related to the learning task.

Educators from Lindeman (1926), Dewey (1938), Knowles (1973), Brookfield (1986), have talked about the role of experience in learning, but experience is to broad a term. When considering a learner's experience, educators should

also consider the concept formation level that a learner brings to a new experience. Bruner suggested that learners could learn in ways that promote cognitive development. Bruner believes that students learn best by discovery and that the learner as a problem solver interact with the environment, tests assumptions, and develops generalizations. In cognitive development, the concept formation level that a learner brings to a learning environment can affect the outcome of the learning. A new experience has a direct bearing on current learning, which can be enhanced or hindered. The learners can even control the outcome of this learning by refusing to learn.

When concept formation levels are high, it is easy to examine and utilize new experiences which are linked to past experience. However when they are low, it is more difficult for a learner to develop an organized structure. For example, based on Gagne (1965), the hierarchical process in learning principles, generalizations, and concepts are best learned as a result of moving from a concrete phenomena to higher-order abstractions (Bloom, Hasting, & Madaus, 1971, p. 165). In his model a learner moves from facts to terms to relationship. If the learner fails to understand and master some of the lower-order phenomena, the learner will have difficulty in understanding the general abstractions

(p. 165).

The experts in this study had a highly sophisticated level of concept formation for the gaming context. Their organizational structure was based on past experience. They started with a high-level, organized structure and quickly formulated a pattern for the game. Another learner that was mentioned during the court proceeding learned the Reels and Deals game just as fast as the other experts. He had a high-level of cognition for the game and learned to line up the winning icon in a matter of hours. Knowledge is individually constructed and socially constructed by learners based on their interpretations of the experiences in the world (Jonassen, 1999, p. 217).

Bruner's early research on thinking inspired his interest in educational strategies that promote the development of thinking. The "Bruner Board" is a good example of what happens if a learner is in the process of using a strategy to think through a concept. If the learners cannot grasp a concept, their learning is less productive. A learner with a general concept about the context or a similar context can start to build on it even though it may be a struggle. Concept formation is not age specific. Learners can learn new concepts as they move through out life. It is not only the experiences learners

have but also the opportunities that they have to participant in activities that allows them to form new concepts or to build on existing concepts. Educators and researchers can greatly assist learners in working through cognitive models that will assist learners with developing a specific concept. It is advantageous for educators to work with a group of learners to develop procedures, rules, heuristics, and conditions by and under which thinking operations are applied. For every thinking operation, a learner may need assistance in mastery.

Learning pertains to experience and experiencing. To learn is to experience and to interact with one's environment (Smith, 1982, p. 36). How the learner reflects on and thinks through these experiences helps the learner to assimilate new information.

The nature of experience varies according to the conceptual level that the learner brings to a new context. General strategies for learning can be applied in a variety of settings; however, learning that is domain specific is only appropriate within the particular content area. Experts appears to have more and better organized long-term memory structures for their area of expertise (Chase & Simmon, 1973, pp. 215-278)). When an expert learner has to do a search through past experiences, it seems to be more

efficient than that of the average learner. An adult's life is full of experiences that consist of potentials for learning. A learner can be a worker, supervisor, lay preacher, trustee, scout leader, and part time student. These experiences shape the learners' lives and influences how they think about themselves and the world in which they live. The more educators understand about the connection between concept formation and experience, the better prepared they will be to help maximize the opportunities for growth and development of their students.

Cognitive theory is fashioned around the belief that learners have an internal desire to learn (Knowles, 1998). Learners are experiencing learning through new avenues that have little or nothing to do with a formal educational setting. Bruner suggested that learning is an active process in which learners construct new ideas and concepts that are based on their current and past knowledge or experiences. The reason learners persist in taking risk to critically think even when it produces frustration, perplexity, and anxiety is because of the rewards it produces. Critical thinking is one of the most powerful activities of adult life (Brookfield, 1986, p. 254). Learners are no longer willing to accept things the way they are; learners go beyond the knowledge that is given.

Learners in these contemporary times are not waiting to be taught; they are directing their own learning and deciding what is of interest to them. The educator is no longer the reservoir of knowledge but is becoming the leader of the team.

Intelligence entails the ability to solve problems or fashion products that are of consequences in a particular cultural setting or community (Gardner, 1993, p. 15). It is equated with "being smart," that is being able to act intelligently when dealing with everyday life (Merriam & Caffarella, 1991, p. 140). The introduction of multiple intelligence can be traced back to early Greek times. A learner can exhibit high intelligence in one or two areas, such as music and math, and yet demonstrate only average intelligence in other respects(p. 146). His theory of multiple intelligence is framed in theory building within cognitive and developmental psychology of the adult learner.

Three groups of learners emerged during the study. They were the Masters, Developers, and Strugglers. They differed in their individual experience base and various levels of concept formation, related to the learning task.

The Master Learners were the Giles cousins, who were the owners of Spinit, Inc., in Denton, Texas. They both had a sophisticated organized structure about the concepts of

the game that had been developed through previous experiences. With this high level of cognition, they were not only effective and efficient, but their higher performance strategies were also qualitatively different than those of the other groups. Both cousins started learning the game immediately after they sat down in front of the game. They had a high-level of conceptual knowledge about a machine called an Eight Liner. They took their experiences with the Eight Liner and made huge leaps toward mastering the game within two to three days. This was all accomplished at work while they handled telephone calls and provided service to their customers.

The Master Learners had a need for immediate application of what they knew about the Eight Liner. They were internally motivated to learn how to play the Reels and Deals game because they serviced the machines located in the Cherokee Nation facilities. In terms of Bloom's Taxonomy, it means that they were operating at the higher end of the taxonomy instead of the lower end. The Giles cousins were evaluating, synthesizing, and applying what they knew.

Efficiency for storage and retrieval means the Master Learners are capable of thinking and remembering in large conceptual chunks into which smaller chunks of information can be incorporated. The chunking theory established that

experts have conceptually driven recall (Chase & Simmon, 1973). Master Learners are able to organize around a high-level concept which includes representation, storage, retrieval, and application. If a learner has a high-level concept in a specific domain, that learning just explodes, and the learner can take it to a new level with immediate application. That is what happened with the Giles cousins in learning the Reel and Deals game.

The Developers were the Adult Education doctoral students who developed a plan of action to follow. These are the learners that Dreyfus (2002) refers to as Proficient Performers because the have spontaneous recall. They attacked the game with logic and rationale. These participants reviewed their strategies and made adjustments. There was one participant in particular who came from a background in engineering and who therefore brought a high-level of conceptual knowledge about probability to the learning task. This learner looked at the paytable form before he started playing the game. The paytable paid highest first for the wild icon, then the sevens, then the cherries, and then for the other icons. He decided he would not be bothered looking for the lowest paying icons. Since both the sevens and the cherries were red, he decided to concentrate on looking for "red". His knowledge of

probability informed him that there were less of the high-paying red icons than any of the other icons. By identifying the least numerous icons, he could use them as markers on the reel and thereby increase his chances of consistently identifying the wild icon. During his first hour of play, he was at 15% over chance. He was concentrating and waiting on the wild icons. After applying this strategy he decided it was to slow a process, so he sped up hitting the reels and lost his advantage. However, he had used a very intelligent strategy based on his prior experiences dealing with probability. He was able to transfer his concept formation of probability from one context to another with very little difficulty.

Strugglers were students who were recruited from Oklahoma State University-Okmulgee campus. These participants were the novice learners. This group of younger learners would have appeared to have an advantage in learning to play Reels and Deals because of great psychomotor skill for eye-hand coordination of youth and because they are part of a generation that grew up playing video games. However, they came to the learning activity with a very unorganized mental structure for the game and just started hitting the reel buttons. It was definitely a trial-and-error technique. It was not until they had spent

time learning the game, which was around 10 to 15 hours of play, that they started to look for the wild icon and "red." Strugglers would also keep a playing strategy for a longer period of time than the Developers. Both the Developers and Strugglers felt like they had learned the game. At the end of 30 hours of play, all of the participants stated they were getting closer to hitting the wild icon because there were more icons being stopped just above or below the paytable. While the conceptual efficiency of the participants was notably low-level, they went about the task searching for patterns in a manner that reflected their ability to recognize their limited capacity. Therefore, they took risk-making guesses and search choices toward the process of concept attainment. The movement toward increased expertise in any cognitive operation can be enabled and ensured by purposeful and continued instruction and medication (Beyers, 1997, p. 258). However, no instruction was provided to the learners in this study.

Why was Horton (1975) able to move people so far and rapidly? It was because he took experiences that people had and gave them meaningful examples. They were able to convert those experiences into high-level concepts. When contemplating the involvement of Horton (1975) as a facilitator previous to the Civil Right Movement, the

individuals he worked with were given examples and developed high-level concept about what was going on in their communities in regard to segregation. Problems occurring in real-life, problems found in the literature of a given subject, and problems encountered by specialist in the field are more interesting and useful to solve than problems dreamed up by a teacher or evaluator just for testing the learner (Bloom, Hastings, & Madaus, 1971, p. 162).

Through social education as practiced and taught at Highlander, the Civil Rights Movement exploded on the national scene in the 1950's and 1960's. Learning that occurred at Highlander went from a conceptualization process to application at its highest level. The learner developed the "ability to apply" the appropriate training, practice, and concepts to new problems and situations (Bloom, Hastings, & Madaus, 1971, p. 165).

Horton was the facilitator who devise an environment for discovery learning where the learner could seek out resources that were needed to make a situational change. Horton used the idea of the teachable moment. This idea also applied with Paulo Freire (1998), who moved people to the concept of "empowerment," which was a high-level concept formation. He believed that when learners participate in educational experiences, they come to a new awareness of

self, have a new sense of dignity, and are stirred by a new hope (p. 15). "Banking education treats students as objects of assistance: problem-posing education makes them critical thinkers" (p. 64). Freire encouraged learners by helping them to perceive critically the way they existed in a world with which and in which they found themselves; they could see the world not as a static reality but as a reality in process in transformation (p. 64).

Problem solving is a key contributor to cognitive development. The learners' cognitive development cannot occur in the absence of some type of learning activities that causes the learner to think. Experiences are aimed at making the learner better able to learn from direct exposure to the incentives. The use of instruction can change the cognitive structure and increase learners individual capacity to learn. Low-level concept formation performance should not be regarded as a stable or unchanging characteristic of the learner. Direct efforts of intervention which correct the inadequate structures can assist the learner with a change in the cognitive structures.

Goals to increase cognitive development in the adult should involve intrinsic motivation to ensure transfer of what is learned. Activities should be implemented to

correct deficient structural functions of the cognitive structure which include basic concept formation building.

Environmental Factors

The level of respect the learner receives makes a significant impact on the learning process.

Internal and external environmental factors play a role in the learning process.

Speed of the reels on the Reels and Deal Skill Stop game affected the learning process of the participants.

There are some environments that are more conducive to learning than are others. It is important to maintain an environment where ideas can be expressed freely without fear of ridicule. Learning environments should allow and inspire self-determination and self-expression (Darkenwald & Merriam, 1982, p. 85). It is the level of respect that the teacher has for the learner that can be a factor. If a learner is treated as an immature empty vessel and presented with low-level concepts, there will be very little growth. A good facilitator is characterized by a respect for learners' uniqueness, self-worth, and separateness(Brookfield, 1986, p. 13). What Horton did was to treat learners and their experiences with the high-level of respect that allowed them to quickly move to the high-concept level. This may also define what is meant by motivation because Horton proposes that people are

internally motivated but the educator can create an environment to encourage growth which brings about a high level of conceptualization. Brookfield's six principles of effective practice list the second principle as mutual respect. If learners are disrespected in front of others, they maybe unable to learn. He also suggested that a facilitator should collaborate with the learner to establish goals, curriculum development, and methods to evaluate the learning activity. Freire (1998) states, "the teacher is no longer merely the-one-who-teaches, but one who is himself taught in dialogue with the student, who in turn while being taught also teach" (p. 61). The learners in the study set their own schedule for the time they would be available to play the game and they made arrangements when they could not keep their schedule. They were responsible for writing up their strategies on the journal sheets and keeping track of the number of hours they had played. They implemented their strategies and evaluated their learning process then determined whether or not the strategy was working.

A learner may be lacking in higher-levels of cognitive development (e.g., the ability to apply concepts and principles) either as a result of never having attained them or of repression due to environmental pressures to function at a low-level (Smith, 1982, p. 48). Learners need

cognitive skills to perform a task and metacognitive skills to understand the task. The metacognitive skills are declarative, procedural, and conditional. The learner needs declarative skills to know about what factors influence their performance. Procedural skills involve those strategies that a learner uses to reach a goal. Conditional skills can be used effectively when the learner knows how to perform and adjust to the situation.

The participants brought with them prior experiences or schema about video games that may or may not have helped them in gaming context. Some of the participants indicated they had played video games but did not have any gaming experience. The learners had to change their manner of thinking to solve the problem. Knowles (1998) refers to Rummelhart and Norman's work in 1978 that proposed three different modes of learning when dealing with schema. Schema are cognitive structures that are built as learning and experience occurs. The three are: accretion, tuning, and restructuring. Accretion is equated with learning facts, and this results in little change in the schema. Tuning consists of slow and incremental changes in current schemata. Restructuring involves the creation of new schemata and organization of already stored schemata which is the hardest learning for most adults (p. 140). The

latter is the process most of the participants encountered. Adults become ready to learn things they need to know so they are able to cope with real-life situations.

Most learning activities are situational such as those associated with job promotion, loss of employment, job satisfaction, new subject matter, and obtaining additional income. Some of the participants in the study saw this as an opportunity to earn extra money. Regardless of their reasons for participating in the study, the learners felt they had learned something from the experience.

Motivation can be both an external (better wages) and internal (increased self-esteem)factor in learning. Motivation is that which gives direction and intensity to the learning process. In the cognitive domain, motivation activates a variety of internal events which cause a response (Gagne, 1985). Some of the internal responses are (a) conflicting thoughts or uncertainty, (b) casual attributions for what led one to succeed in reaching a goal in the past, © emotions, (d) expectations that one can succeed in reaching the goal in the future, and (e) memories of what others did before reaching the goal (pp. 303-304). One participant epitomized the internal motivation as follows:

> I was excited to play the game. In the middle I had a pretty good pattern. Looking for the

> sevens, and then I tried for the cherries. I was looking for red. At the end of 30 hours, I was saying, "Hallelujah this is over." I do not like playing back to back games. My brain was fried. I tried changing my strategy, but I was not sure about what to do. Toward the end of the 30 hours, I started getting the highest icons and at the very end I was trying to hit it [icon]. (26 year old, female, Navigator).

This participant came to the realization that she was reaching her goal. As learners become aware of the standards and operations intrinsic to a skill or knowledge area, they can begin to set manageable short-and-long term learning objectives (Brookfield, 1986, p. 49). However this only occurs after becoming acquainted with what Peters (1965) calls the grammar of the activity, that is, the internal criteria, operations, and procedures inherent in a subject area or skill set (p. 49).

Adults are motivated toward learning that helps them solve problems and provide internal rewards. What is relevant depends on their particular stage in life. Learner have to form a positive attitude toward the learning process that keeps them motivated enough to set goals. They determine their own designated outcome to solve problems.

Conceptualization includes structuring learning around knowledge-producing strategies. In this process learners need to understand or comprehend something or produce knowledge that they do not currently possess (Beyers, 1997,

p. 54). Conceptualization is used to improve the quality of learner thinking and learning, and educators can structure learning activities around the major steps of any of the knowledge-producing strategies employed in academic pursuits as well as real-life situations (p. 54).

To improve thinking skills or cognitive operations, a number of skill-teaching techniques may be employed. Lessons that best introduce a learner to thinking operations are those build on what novices naturally do as they begin to learn a new skill by helping them to (a) deconstruct the skill to identify key procedural steps in executing it, (b) articulate and demonstrate how the procedure can be executed, and © identify significant rules that may guide its skillful execution (Beyer, 1997, p. 262).

An important physical characteristics of an environment is lighting. "Lighting strongly influences our vision, which strongly influences learning" (Jensen, 2000, p. 60). Lighting is a key to the general well being **of** learners confined to a physical facility a great portion of the day (Hathaway & Fielder, 1986). There is some evidence that lengthy computer or video viewing may stress the eyes (p. 60).

The room where the study was conducted at Oklahoma State University-Okmulgee had fluorescent fixtures.

Although learners are rarely consciously aware of it, florescent lights have a flicker quality and barely audible hum which can have a powerful impact on the learners central nervous system (Jensen, 2000, p. 60). Sleeman and Rockwell (1981) deemed fluorescent fixtures were better than incandescent lights for glare reduction and diffused light production (Lexington, 1989, pp. 73-75). Most casinos had low-level lighting. According to Jensen (2000) Rita Dunn and associates (1985) discovered that even though students do not show an increase in achievement, they relate to lighting; just the fact that many students relax and focus better in low-light situations is reason enough to reduce the use of fluorescent lighting (p. 61). Some of the students in the study asked to have the lights turned off while they were in the room. They wanted the screen illuminated so they could concentrate on the screen, but there is evidence that lengthy computer or video viewing may also stress the eyes (Jensen, 2000, p. 60).

Other factors were the chairs which were changed immediately when the participants complained. The chairs were replaced with stools that had high adjustable backs and a foot rest. In the real-life casino environment the bottom of the foot rest is even with a counter ledge on which the feet can be placed for comfort when the learner does not

wish to use the foot rest.

The floor in the room where the study took place was carpeted as it generally is in the casino to reduce traffic noise of people walking by players. Research on noise in learning environments has strongly suggested that noise interferes with learning both as it occurs and if the learner is exposed to it for long periods of time (Demick & Nazzaro, 1994, p. 145).

Music of some kind is always played or there is a live band in the real-life casino setting. Some individuals learn best in a noisy, busy environment while others need total silence (Jensen, 2000, p. 69). However, there was no music piped into the room where the study took place. Therefore some participants used headphones to avoid distributing other participants. Distractions should be removed from any learning environment which may cause the learner problems with concentration. Simply playing baroque in the background on low volume can evoke a relaxed and optimal learning state (Jensen, 2000, p. 69). Some educators use music to carry positive messages and content to learners unconsciously which can increase the pleasure of learners and give them the feeling that their classroom is a happy, pleasant place to be (p. 69). However learner preference is important.

The computer is part of the external environment. The speed of the reels was a factor. A computers' access times is faster than those of humans. Access time in a computer refers to the speed with which electricity moves from one area to another. Gagne (1985) stated that speed in microseconds of .000001 is typical (p. 13). The access for humans takes about 25 milliseconds (.025) to shift attention from one part of working memory to another. In long-term memory computers are in a range of one millisecond (.001 second), and in humans it is about 200 milliseconds (.200 seconds). Thus, computers appear to be faster than humans in processing information. The computer accesses information in the workplace 20,000 time faster than the learner, and the storage capacity 200 times larger than a learner. However humans differ in that the structure of the memory is not all-or-none; that is humans remember partial information based on their conceptualization process. By contrast, information in a computer is either there and available or not at all. Human memory capacity and retrieval depends on the context; in familiar contexts, the learner is able to deal with much more information (p. 14). Computers are context independent. A learner's dependency on context allows for learning and adaption, and memory allows the learner to think of novel solutions to problems

(p. 14)

Learning Strategies

> Learning strategies preferences are demonstrated in a real-life situation such as with Reels and Deals Skill Stop Game.

Numerous research studies have been conducted to identify learning strategies that adult learners use when undertaking a learning project. Understanding learning strategies can assist educators with developing tools and techniques that can help the adults better understand the learning process. This study used ATLAS to identify learning strategies preference among groups of learners and to categorize them as Navigators, Problem Solvers, and Engagers. This study found more Engagers than expected and fewer Problem Solvers. This finding is consistent with other studies using ATLAS in adult basic education James (2000) and (Massey, 2000; Willyard, 2000) at community colleges. Knowledge of one's learning strategy preference by the teacher and learner can lead to improved academic gain in the classroom (Munday, D., 2002; Munday, W., 2002).

Interaction with other learners is very important to Engagers. Engagers initiate learning from the affective domain. They have a need to be emotionally connected to an activity, and that activity should present a challenge. Their learning involved an emotional commitment to the

project where they had the ability to internalize the content and find personal value and reward. The Engagers made the most adjustments to the chairs and lights in the room. They also appeared to be the most frustrated when they had problems attempting to stop the reels. They shared their knowledge and learned from the other participants. Engager also wanted music in the room and used headphones. Unlike Problem Solvers, Engagers are not interested in developing new ways to doing things; they allow time for focusing on the dynamics of the learning process.

Navigators had problems focusing on the game because they were distracted by other players. They complained that other players might not be trying hard enough. Their journal sheet stated that their main objective was to concentrate or focus on seeing the winning icon on the reels. Navigators indicated that they helped themselves by managing their time and setting goals. Navigators do not like learners who slack their duties because they like things a certain way. They like to play by the rules and do not like to see inefficiency. They like to plan their learning, and their motto is "plan the work; work the plan" (Willard, 2000; Ghost Bear 2001). Navigator do not like big changes, do not want the teacher to waste their time, and do not like to work in groups (Conti & Kolody, 1999a, p. 11).

One navigator stated that she saw another participant playing 99 miles per hour and went for speed, which did not make sense to her. She thought the other players were not serious enough.

Problem Solvers are critical thinkers that are "sustained by the ongoing modification and revisions of their learning plans in relationship to their evaluation of their own learning process" (Conti & Kolody, 1999, p. 12). Problem Solvers alternated their strategies several times to seek a solution to the patterns on the reels. Problem Solver wrote the most detailed explanations about their strategies. Problem Solvers thrive in an environment that promotes experimentation (p. 13). If a strategy was not working, the Problem Solver would alternate their approach between hours of play.

ATLAS is a quick instrument to use to discover learning strategy preferences. The participants in the study fit the learning strategy preferences profiles described by the ATLAS. ALTAS as verified by Dr. Sandra Massey's study found more Engagers were attracted to the OSU-Okmulgee campus, because the marketing efforts appealed to Engagers. This study verified Dr. Massey's finding because a large of Engagers participated in this study. Therefore, ATLAS is a good instrument for determining learning strategy

preferences. ATLAS gives the educator instant feedback that provides the teacher and the student with immediate information. When learners are aware of their preference they can improve upon the educational or informal approach to the subject matter of study. To improve the learner's ability to implement learning strategies, a method of teaching learning strategies concepts and techniques should be developed. ATLAS should be given to students entering an educational component, and students should be given an explanation of the preference group to which they belong. A central focus of researchers and educators learning strategies studies can be traced back for the past 20 years. McKeachie (1978) was an advocate for teaching learning strategies to students.

> In addition to teaching learners to identify their own most effective learning strategies, can instructors teach students to learn to use a larger repertoire of strategies? If this were achieved, instead of adapting teaching methods to students, students could adopt the learning strategy most effective to whatever teaching method they encountered. (p. 241)

What happens if learners cannot make up their minds and keeps changing their strategy? If the learner does not have any discernment and cannot tell if their strategy is working or not it would present a problem. Learners need to learn a comprehensive set of strategies so they know when to apply them. They do not need to move from being a Navigator to a

Problem Solvers but instead they remain in their strategy of preference and incorporate the other strategies when needed. Learners will be able to analyze and reflect on their personal strengths and weaknesses to improve their ability to successfully complete an objective.

Learning as a Political Process

> Educators should make determinations about learning and set the rules that govern it.

Decisions about learning in this study were part of a process that involved the National Indian Gaming Commission and Cherokee Nation Enterprises. The Administrative hearing was the logical avenue to be taken by both entities. "Judges are political because they must choose between competing values brought before them in conflict" (Wirt & Kirst, 1992, p. 322). When people differ in the political arena, a recourse for resolution may be the courtroom. Each side of the Stipulation Agreement was given an opportunity to present their case before the federal judge appointed to hear the witnesses. However, in this particular case the evidence presented by the educators was considered not that pertinent to the decision made by the judge. Lawmakers for years have dictated the rules that govern what should be accomplished in education and whether or not the voice of the researchers is important during there decision making process. Today that process has not changed.

The advocates for the spread of gambling have won some major campaigns in recent years, and the years remaining in this century will be years of serious debate over gaming. The federal government will be studying the issues involved in legalized gambling in detail and will ponder the role they play in overseeing the activities of the gambling industry in the future (Thompson, 1997, xxiii). There will be numerous opportunities to complete studies in this arena which could have a bearing on the decision making policies in the gaming industry.

Throughout learners lives, they take chances in the hopes of obtaining certain rewards (p. 3). It is done when learners select study areas in college, when learners accept jobs, and when learners go in business. People take chances when they invest in the stock market and when they invest money in a savings account. Therefore, all of these:

> Enterprises involve the risks of losing valuable time, money, and opportunity in exchange of the chances of reaping rewards, which are often financial ones. On the non-financial front, the learner may risk health-even our lives in the pursuit of recreational thrills (Thompson, 1997, p. 3).

The commitment for this study was to focus on a game involving a considerable element of skill or chance. It is believed that this was a computer-based game of skill as evident from the quantitative and qualitative data.

However, a decision was made by the judicial branch of the government that this game could not be learned in the real-life context because real-life game players did not approach the game in the same manner as participants in the study.

The judicial and political process will always play an major role in education. The 1980's were filled with national commissions reports, state legislative, and executive orders (Wirt & Kirst, 1992, p. 301). In the Nation At Risk in 1983 educators were told that commerce, industry, science, and technology were being overtaken by competitors throughout the world and that something needed to be done to correct this problem. Two of the competitors mentioned were the Japanese who made better automobiles more efficiently than Americans and the South Koreans who built the world's most efficient steel mill. The report stated that the educational foundations of our society were being threatened and eroding by the rising tide of mediocrity. Educators were told that our institutions seem to be foundering and had lost sight of the purpose of schooling and high expectation from our students. The report established a series of targets and directions for change, but mandates, incentives, and resources were left to the local actions. The way to increase content for the student was to increase course requirements, increase student

testing, and the establishment of curriculum standards. It also stressed changes in licensure requirements and compensation to recruit and retain the best, however by 1986, emphasis had shifted to "restructuring" education to give teachers a greater role in hiring, staff evaluation, and curriculum (p. 302). This area has been the least effective as the career ladders and teacher merit pay have been mixed together in some states, like Virginia, causing some teacher resistance. There is still doubts about the rigor and challenges of some of the new courses in academic subjects, the impact of reform on at-risk students, the quality of teachers and teaching, and the equitable funding of schools (p. 312).

Thus, both in the case of this study and in education in general, important decisions about the teaching-learning transaction have been made by noneducators in the political arena. This judge's error in his conclusions about learning concerning the Reel and Deals game is a good indicator that decisions about learning should be the prerogative of those who are informed about the teaching-learning process and who have personally formed high-level cognitive constructs related to the learning process.

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APPENDIX:

INSTITUTIONAL REVIEW BOARD APPROVAL

Oklahoma State University
Institutional Review Board

Protocol Expires: 5/10/02

Date: Friday, May 11, 2001 IRB Application No ED01126

Proposal Title: ADULT LEARNING AND VIDEO TECHNOLOGY

Principal
Investigator(s):

Gary Conti
206 Willard
Stillwater, OK 74078

Reviewed and
Processed as: Exempt

Approval Status Recommended by Reviewer(s): Approved

Dear PI :

Your IRB application referenced above has been approved for one calendar year. Please make note of the expiration date indicated above. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved projects are subject to monitoring by the IRB. If you have questions about the IRB procedures or need any assistance from the Board, please contact Sharon Bacher, the Executive Secretary to the IRB, in 203 Whitehurst (phone: 405-744-5700, sbacher@okstate.edu).

Sincerely,

Carol Olson

Carol Olson, Chair
Institutional Review Board

VITA

Francis Marzett Shelton

Candidate for the Degree of

Doctor of Education

Thesis: ADULT LEARNING: COGNITIVE FOUNDATIONS OF A COMPLEX COMPUTER-BASED GAME

Major Field: Occupational and Adult Education

Biographical:

Education:

Graduated from Boley High School, in Boley, Oklahoma; received Bachelor of Science degree in Biology from Langston University, Langston, Oklahoma in May, 1968; received Master of Science in Occupational and Adult Education from Oklahoma State University in May 2000. Completed the requirements for the Doctor of Education degree with a major in Occupational and Adult Education at Oklahoma State University, Stillwater, Oklahoma, in May 2003.

Experience:

Employed by Oklahoma State University-Okmulgee as Coordinator/Instructor of the M-Power Program.

Professional Membership:

Oklahoma Association of Job Search Trainers, Okmulgee Business and Professional Women's Club, and Delta Sigma Theta Sorority, Inc.