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Using technology to support an adult constructivist learning environment

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Using technology to support an adult constructivist learning environment

Abstract

The purpose of this paper is to look at the connection between constructivist learning theories and the application of technology in an adult learning environment. The review examines five components consisting of constructivism, the purpose of constructivist learning environments, technologies in constructivist learning environments, adult learning, and the constructivist approach for using technology to support adult learning. This review addresses the question: how does the constructivist approach for using technology support adult learning in a technology-based environment?

Using Technology to Support an Adult Constructivist
Learning Environment

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ReGina A. Rankins

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ABSTRACT

The purpose of this paper is to look at the connection between constructivist learning theories and the application of technology in an adult learning environment. The review examines five components consisting of constructivism, the purpose of constructivist learning environments, technologies in constructivist learning environments, adult learning, and the constructivist approach for using technology to support adult learning. This review addresses the question: how does the constructivist approach for using technology support adult learning in a technology-based environment?

In the literature, there are a number of epistemological positions underlying constructivist learning theories and how those theories support the integration of technology in an adult learning environment. Constructivism is based on the theory that learning takes place in contexts describing how individuals attain, develop, and use cognitive processes in order to acquire knowledge. The theory of andragogy, proposed by Malcolm Knowles, referring to adults as self-directed learners who bring prior knowledge and experiences to the learning environment, supports the use of constructivist principles.

This theory claims that educators should create a learning environment that is student-centered in comparison to the traditional teacher-centered classroom environment.

Constructivists claim that constructivist-learning environments should allow learners to have some form of control over what they are learning which will allow the learners to become more engaged in the learning process. By creating technology-based environments educators can engage the learners by using strategies such as discussions, teamwork, and computer applications to support the constructivist principles of learning in an adult environment. This review of literature focuses on the linkage between adult constructivist learning theories and principles and the integration of technology in an adult learning environment.

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Introduction

Constructivism is an approach based on the theories of how people learn. This approach can be viewed as the top level of a hierarchy system with many foundational branches. Educational theorists have described the constructivist learning theory and its impact on the field of adult education and learning (Beal, 2000; Brookfield, 1986; Brown, 1998; Jonassen, 2000; Kanuka & Anderson, 1999). In education, constructivism is often discussed as an instructional or philosophical approach. The use of this methodology can promote student thinking and support the goals of adult learning. As a result, "constructivist perspectives are a growing influence among educators seeking to help students connect learning with life experiences" (Brown, 1998, p. vii). These experiences provide an avenue for learning to take place. Therefore, the best way to describe using the constructivist approach in an adult technology-based environment, based on several researchers in the field, will begin with the educational foundation to learning.

This review of literature will explore the impact of a constructivist approach in using technology for adult learners. The purpose of this literature review is to

determine linkages between constructivist learning theories and applications of technology in an adult learning environment. This review will answer the following question: how does the constructivist approach for using technology support adult learning in a technology-based environment?

Methodology

The methodology used for this review included identifying valid and reliable resources relating to the constructivist approach and technology integration in adult learning environments. The reviewer began the search using the ERIC (Educational Resources Information Center) database as the principal search tool with the following descriptors: constructivism (learning), constructivist learning environments, technology-based learning environments, adaptive learning environments, learning processes, and adult education. The reviewer used this database because it provided unpublished documents and published journal articles on educational research and practice. The use of journal articles was the primary source of information because it provided a major source of original reports as well as credible resources on established and emerging theories.

Another database used to locate resources was the University of Northern Iowa's Rod Library database, known as UNISTAR. The UNISTAR provided print sources such as academic journals, documents, personal papers, and referenced works of authors who had conducted relevant research. The databases allowed the researcher to narrow

the selection process of locating relevant publications on the topic. The reviewer also accessed the faculty within the Educational Technology Division at the University of Northern Iowa. Faculty members provided helpful information regarding the selection and evaluation of resources. The final resource used by the researcher included World Wide Web search engines. Using the search engines on the Internet yielded multiple results. The reviewer evaluated the online sources by determining the credibility of the authors, authors' accessibility to the information, and by determining how recent the information was published. The researcher screened all the resources to narrow the topic to constructivist learning and adult teaching methods. The articles were then selected in terms of focus, method, and results.

The reviewer determined that in order for information to be valid it must be consistent in its' results. Therefore, the reviewer decided on the reliability of each source by evaluating the consistency of the findings based on the constructivist approach to technology integration. The reviewer also validated the publications to determine the accuracy of the information presented throughout this review using the following criteria.

1. What are the author's credentials for conducting research in the field?

1. Is the information reliable and valid?

1. How current is the information?

Analysis and Discussion

Defining Constructivism.

Educational theorists have researched the theories of constructivism and its impact on learning environments for the past few decades. These theories are the foundation for the constructivist learning approach and can be viewed as a broad conceptual framework based on philosophy and science. Based on these theories, constructivism is identified as an explanation about the nature of knowledge describing how an individual attains, develops, and uses cognitive processes to acquire this knowledge. To understand the role of constructivism in an adult learning environment it is imperative to begin with a brief introduction to the foundation of constructivism. A summarization of the constructivist views of theorists Piaget, Bruner, Vygotsky, and Papert will be addressed.

Jean Piaget. Piaget's learning theory is a basis for the constructivist theory of learning and instruction. His view is focused on cognitive development, which states intelligence is based on how an organism adapted to its environment. Piaget's biological views provide an understanding of the mind and how individuals construct meaning based on the world around them. He believed that

"knowledge is invented and reinvented as the child develops and interacts with the world that surrounds her" (Driscoll, 2000, p. 188). Based on that assumption, Piaget believed that individuals, through interaction, attempt to adapt by assimilation and accommodation. These interactions provide learners with the understanding of their environment (Fosnot, 1996).

Jerome Bruner. Bruner's constructivist views provide a general framework for instruction based upon the study of cognition. Like Piaget and Vygotsky, Bruner's approach is based on learning taking place as a result of the learners' current and past knowledge. Bruner stated that people learned through an active process in which learners construct new ideas as a result of their prior knowledge. He identified that students commonly learned best through discovery and activities (Fosnot, 1996).

Lev Vygotsky. The major theme of Vygotsky's theoretical framework is that social interaction plays a fundamental role in the development of cognition. Vygotsky expanded his ideas on cognitive development by focusing on the relationship between language and thinking. He also believed that the potential for cognitive development is limited to a certain time span and is dependent upon full

social interaction. This learning theory is a key component of situated learning. In addition, Vygotsky identified the zone of proximal development (ZPD), which is the foundation of collaborative problem solving strategies (Fosnot, 1996).

Seymour Papert. Papert's learning theory was based on the idea that technology can provide new ways to learn. He led the push for the "future" of computers in the classroom, where children use computers as instruments for learning and for enhancing creativity (Papert, 1993).

Comparing the constructivist views of these theorists, Piaget's biological; Brunner's current and past knowledge; Vygotsky's social interaction; and Papert's views that technology can provide new ways of learning, is difficult for researchers to come to an agreement on one shared constructivist theory of learning. As a result, whether these views are considered within individual or group instruction, there are multiple implications for ways in which learning is taking place. Therefore, all of these theorists are important in order to understand the foundation of constructivism and its approach in technology-based adult learning environments.

Other researchers in the field of education and learning have expanded the theories of constructivism.

Savery and Duffy (1995) identified the three major concepts of constructivism based on the theories of Piaget and Vygotsky:

1. Cognition occurs as people share their understandings with each other and test the degree to which they are compatible.
2. The goal or purpose of investigation influences what is learned and what experiences the learner draws upon to construct new understandings.
3. Knowledge evolves through social negotiation, either independently or in collaborative groups. Alternative views and additional information enable learners to test the viability of understandings and to build new propositions that are compatible with those understandings (p. 32).

A second expansion of constructivism identified by Brown (1998), states that:

People construct meaning through their interpretive interactions with and experiences in their social environment. It presumes that prior knowledge and experiences play a significant role in learning and form the basis for subsequent actions. It focuses the learners'

attention on the why of learning and opens the door to critical thinking and intellectual development (p.6-7). The review of literature confirmed that constructivism has been viewed in many different ways. These views include the sharing of understandings by the learners, social negotiation of knowledge, interpretive interactions and experiences, and that the purpose and goal of learning effects the outcome of what is learned. As noted, these views of constructivism provide diverse directions through various interpretations and purposes in adult learning environments.

The review also identified knowledge and its nature and what we come to know as essential considerations for constructivists. Kanuka and Anderson (1999) identified questions regarding how individuals construct knowledge. These questions include:

1. What does it mean to know something?
2. How do we come to know it?
3. How does this knowledge influence our thinking processes?

Kanuka and Anderson's three questions provide adult educators with a foundational framework that looks into the impact of knowledge on previous experiences, which allows

learners' to construct their own meaning. Also, educators' could use these questions and answers as a tool to enhance learning by gaining an understanding of prior knowledge possessed by most adult learners.

Interpretations of constructivism are derived from a diverse set of theorists. These interpretations will influence the selection of classroom strategies by the instructors. The literature supports that individuals are constructing their own version of knowledge as they see it.

Constructivism is a theory of learning that describes how structures and deeper understanding come about on the premise that, by participating in reflecting on experiences, learners will construct their own knowledge. Based on this theory, educators need to define and determine the purpose of a constructivist-learning environment in order to effectively support adult learning.

Definition and Purpose of Constructivist Learning Environments

Wilson (1995) defined a constructivist-learning environment (CLE) as "a place where learners may work together to support each other as they use a variety of tools and information resources in their pursuit of learning goals and problem-solving activities" (p.28). This

environment may be technology-based where learning is enhanced through the use of the Internet, chat rooms, and computer applications. Four years later, Jonassen, Peck, and Wilson (1999), expanded upon Wilson, suggesting a broader definition of constructivist learning environments that incorporates the use of technology. They concluded that:

Learning environments are personal and group exploration spaces in which learners control the learning activities and use information resources and knowledge construction tools to solve problems. In traditional uses of technologies, messages in the media direct and control the learning experiences that require learners to view and retain information presented by technology (video, computer, film, etc.). In learning environments, learners are presented with a complex and relevant problem, project, or experience that they accept or reject as a challenge (p. 194).

Educators define constructivist-learning environments differently based on their approach to learning. However, with the expansion of the definition to include the use of technology, learners have the opportunity to explore, experiment, construct, converse, and reflect which produces

the possibility of retaining the information learned (Jonassen, et al., 1999).

Another important component of a constructivist-learning environment (CLE), identified by the literature, is its purpose. The purpose of a constructivist-learning environment is to be able to incorporate constructivist principles within learning. These principles promote increased social interaction and discussion in the classroom, both between teachers and students and between students (Brown, 1998). According to Jonassen et al., the concept of constructivism emphasizes the student as being the "active learner", playing a central role in mediating and controlling learning.

Jonassen (1991) identified eight purposes of a constructivist-learning environment. The purposes include:

1. Create real-world environments that employ the context in which learning is relevant.
2. Focus on realistic approaches to solving real-world problems.
3. Allow the instructor to act as a coach and analyzer of the strategies used to solve these problems.

4. Stress conceptual interrelatedness, providing multiple representations or perspectives on the context.
5. Promote instructional goals and objectives to be negotiated and not imposed.
6. Foster evaluation as a self-analysis tool.
7. Provide tools and environment that help learners interpret the multiple perspectives or the world.
8. Allow learning to be internally controlled and mediated by the learner. (p. 11-12)

These eight purposes identified by Jonassen provide an overview for a constructivist-learning environment for this paper. Based on the constructivist approach, researchers believe that adult educators could use Jonassens's purposes to determine how to effectively integrate technology to engage the learners in meaningful learning. Since this review focuses on using technology to support an adult constructivist-learning environment it is beneficial to identify the impact technology has on learning.

Technology in Constructivist-Learning Environments.

Today technology is increasingly viewed as an "optimal medium for the application of constructivist principles to learning" (Murphy, 1997, p.1). By using this approach,

adult educators can use the principles of andragogy while teaching with technology in order to facilitate adult learning. Using technology, such as computers, as "teaching machines" assist with the construction of knowledge and learning. In addition, when theory is presented in a logical manner, computers will compliment instruction, permit practice, provide feedback, and test comprehension (Lewis, 1989).

Means, Blando, Olson, Middleton, Morocco, Remz, and Zorfass (1993) identified technology as "a mean[s] of supporting goals related to increased student involvement with complex, authentic tasks and new organizational structures within classrooms and schools" (p. 1). An environment with the effective integration of technology provides learners with strong, structured, safe environments in which learners have freedom to learn based on goals and objectives. In addition, Sandholtz, Ringstaff, and Dwyer (1997), described technology as a:

Catalyst for change in classroom processes because it provides a distinct departure, a change in content that suggests alternative ways of operating. It can drive a shift from a traditional instructional approach toward a more eclectic set of learning

activities that include knowledge-building situations for students (p. 48).

Technologies are cognitive tools that help learners to elaborate on what they are thinking and to engage in meaningful learning (Jonassen, 2000). The constructivist approach, using technology in teaching and learning, allows students to become more empowered and spend more time in the active construction of knowledge (Bagely & Hunter, 1992). This approach, using the constructivist perspective in the classroom, "is best promoted through an active process that emphasizes purpose interaction and the use of knowledge in real situations" (Gabler & Schroeder, 2003, p.16). The focus of technology as an important component of education allows learners to be able to integrate new ideas with prior knowledge thus allowing the ability to retain and use information at a later time. By fostering student-centered classrooms, instructors are able to translate their "classrooms into meaningful experiences that replicate the real-world environment for their students" (Beal, 2000, p. 132). This can be obtained through using Internet search engines, e-mail discussions, and chat rooms.

The use of technology in adult learning environments provides positive impacts on the learning process. Stites, Hopey, and Ginsburg (1998) have documented this impact by determining that the use of technology in an adult learning environment provides:

1. Improvement in both educational attainment and skill acquisition.
2. A relevant and appropriate context for adult learning.
3. Ability to accommodate learning differences.
4. Motivation and sustain adult learning.
5. Empowerment for adult learners.

Although these five benefits of technology integration contribute to the learning process, Thomas (1992) states "technology in and of itself does not directly change teaching and learning. Rather, the critical element is how technology is incorporated into instruction" (p. 43). Therefore, adult educators must determine how to effectively integrate technology into adult learning environments.

According to Kasworm and Londoner (2000) there are four recommended approaches for integrating technology in adult learning environments. These approaches include

technology as a curriculum, delivery mechanism, complement to instruction, and as an instructional tool.

Technology as a curriculum. This area focuses on teaching the content surrounding the computer and its capabilities. An example of technology as a curriculum would include teaching computer skills such as key boarding, database and spreadsheet manipulation, word processing, desktop publishing, and Internet research. The benefits of this approach provide learners with hands-on opportunities to develop a comfort level with various applications as well as the ability to apply the skills as needed throughout their daily lives either at work or home. However, the major limitation to this approach is that rapid changes in technology cause a continual cycle of new skills to be learned. The educator must determine the priority of what should be taught and learned about computing technology. In addition, the various degrees of computer literacy among adults cause problems for determining the foundational level of a course.

Technology as a delivery mechanism. Using technology as a delivery mechanism in adult learning environments is to use it as a means for delivering instruction. Through the use of individualized learning systems (ILS), adult

educators can provide instruction as well as allow the learners to practice a set of learned sub-skills. The ILS approach allows educators to monitor the progress of students while allowing the learners to return to certain portions of the skills until they have mastered that particular skill. However, the major limitation is the cost effectiveness of the instructional delivery and lack of institutional support. In addition, the learners work in isolation from other learners and sometimes the teacher.

Technology as a complement to instruction. In adult learning settings, technology is frequently used to complement instruction within the traditional classroom environment. The adult educators are given the opportunity to be the facilitator and monitor of learning. This strategy allows learners to access their base level of knowledge as well as build upon their prior knowledge. In addition, this approach provides learners with experience using multiple software applications such as word processing, spreadsheets, databases, and desktop publishing. The challenge for the educator considering this approach is in being viewed as a risk taker in order to apply technology as a teaching mechanism in adult environments. Also, the educator must have an understanding

of how technology supports, delivers, and enriches the learning experience.

Technology as an instructional tool. As an instructional tool, technology provides assistance to the learners to help them to achieve the educational goals of the course. An example of how these goals can be met is by allowing learners to use spreadsheet applications to develop budgets as a class project. This strategy allows learners to develop skills and have experiences with technology in ways that will benefit them outside the instructional setting. Using technology as an instructional tool, educators are able to incorporate on-line instruction, e-mail, audio and teleconferencing, Web-based resources, and computing software applications within the instruction. The major challenge within this approach is the educator's knowledge of technology and its application. In addition, Imel (1998) states that the willingness of instructors to adapt or develop technically integrated instructional activities is also a major challenge.

These four approaches are currently being used in many adult-learning environments (Imel, 1998). Using technology-based instruction can effectively meet the requirements of adult learners. This allows adult learners to learn at

their own pace, working in collaboration or independently (Fidishun, 2000). These approaches also provide a basis for determining how to integrate technology into adult learning (Imel, 1998). However, adult educators must examine barriers of technology integration within these environments.

DeJoy (1991) describes three viewpoints of barriers to technology integration. He identified the barriers as:

1. Educators' ability to manipulate instructional materials, hardware, and the physical environment to support successful learning experiences.

2. Learners' past experiences, emotions, perceptions, motivations, self-concepts, and their emotional responses to technology-oriented learning environments.

3. Learners without prior experience with technology view themselves as unsuccessful.

By identifying barriers that may be displayed by learners such as attitudes, values, and abilities to deal with technology, the review of literature found that educators could apply DeJoy's three considerations and Kasworm and Londoner's technology integration approaches, for creating a positive learning experience.

The review of literature found that by using the constructivist approach, technologies are tools used to enhance learning. Therefore, in order to achieve the best results for using technology in adult constructivist-learning environments, educators need to identify who adults are and how they learn.

Adult Learning

Theory of andragogy. The study of adult education first became popular in the early 1900s. The foundation of adult education began with the traditional learning principal of the pedagogical model. This model was based on the science or profession of teaching. The ERIC database defines learning as a "process of acquiring knowledge, attitudes, or skills from study, instruction, or experience" (Educational Resources Information Center, 1968). In contrast, cognitive processes is defined as "processes based on perception, introspection, or memory through which an individual obtains knowledge or conceptual understanding, which includes perceiving, judging, abstracting, reasoning, imagining, remembering, and anticipating" (Educational Resources Information Center, 1966). Thus, individuals begin to learn from birth. These experiences and background information provides the

learning of new concepts. According to Merriam and Caffarella (1999), adults learn in a multitude of settings such as home, the workplace, and community agencies.

Also in the 1900s, it was believed that the same methods and techniques for teaching children could also be applied to adult education. However, an opponent to this view, Malcolm Knowles proposed a theory of adult learning, pedagogy for adults, called andragogy (Knowles, 1984). Knowles, who became the pioneer in adult learning, based andragogy on the concept that adults learned differently from children therefore, requiring different teaching methods and needs (Knowles, 1984; Fidishun, 2000).

Andragogy is based on a set of assumptions about how adults learn. This theory is related to what, where, how, and why adults learn as well as how they develop and mature throughout the lifespan (Brookfield, 1986). The theory, as described by Knowles (1984), states that adults learn more successfully using humanist learning theories by establishing teaching strategies; such as the role of the educator, as a facilitator and a resource rather than a teacher. As a result, all learning is valued and learning opportunities are based on students' previous experiences and immediate needs. An understanding of the information is

encouraged by active involvement of the learner rather than merely expecting the learner to be a passive receiver of the information. Learners are encouraged to become critical thinkers and self-directed learners who seek out learning experiences for themselves.

Knowles (1984), based andragogy on the five following characteristics of adult learners:

1. **Self-concept:** Adults are autonomous and self-directed. They need to be free to direct themselves. Teachers must actively involve adult participants in the learning process and serve as a facilitator for them. As people mature, each person's concept of self moves away from being a dependent personality towards being a self-directed human being. In spite of adults' need for autonomy, previous schooling has made them dependent learners. It is the job of the adult educator to move adult learners away from their old habits and into new patterns of learning where they become self-directed, taking responsibility for their own learning and the direction it takes.
2. **Experience:** As learners mature they accumulate their own individual growing reservoirs of experience that

provide an increasing resource for learning in comparison to children. Adult learners bring their unique learning characteristics to the learning situation. These experiences and characteristics provide an additional base of knowledge that can be utilized in the classroom. Also, adults are the richest resource of information for one another. These resources can be used in the learning environment through collaborative teaching strategies such as group discussions, field experiences, and problem-solving techniques. As a result, adult learners want to be able to transfer the learning in the classroom into their everyday lives. The experiences may include work-related activities, family responsibilities, and previous education (as cited in Ference & Vockell, 1994).

3. Readiness to learn: Adults are goal oriented. These learners usually know what goals they want to attain. Adults are ready to learn "when they experience a need to know or do something in order to perform more effectively in some aspect of their lives" (p. 11). As people mature their readiness to learn becomes increasingly oriented to the

developmental tasks of their social roles. Adults are willing to learn information that may be relevant to moving from one change to another. These changes such as, a divorce, death of a friend, or job, would cause the adult to acquire a need to learn new information.

4. Orientation to learning: As people mature their time perspective changes from one of postponed application of knowledge to immediacy of application, as a result, they shift from a subject-centered to a problem-centered orientation toward learning. "Adults do not learn for the sake of learning; they learn in order to be able to perform a task" (p. 12). Adults want to see how what they are learning will apply to their life, such as solving a problem at work or home.
5. Motivation to learn: As people mature, the motivation to learn is internalized. While adult learners will respond to external motivators such as, salary increase or a better job, internal motivators are more important. Internal motivators such as self-esteem, better quality of life, and self-confidence provides the greater impact for

learning among adults (p.224-226).

The key to Knowles five characteristics of adult learners identifies that current and past learning experiences play an important role in the learning process.

Alan Rogers (2002) also explored seven adult learning processes for teaching adult learners. Rogers' assumptions of adult learning processes include that:

1. The participants define themselves as adults.

Therefore, they have the choice to determine whether to participate in a learning experience in comparison to children who do not have a choice.

2. The participants are growing and developing, but in different directions and at a different pace. Rogers contends that this is happening to all adult learners however, the growth and direction changes from person to person.

3. The participants bring a package of experiences and values. These blankets of experiences are viewed through the learners' "lens of their existing experiences and knowledge and this may distort the messages" conveyed by the instructor (p.73).

4. The participants usually come to education with their own intentions. These intentions are viewed as

a means to understand the purpose of the instruction. Also, as adults they have the opportunity to apply what they have learned immediately whereas, children may have to wait until they are grown.

5. The participants bring certain expectations about education itself. These expectations are a result of previous knowledge experienced in school.
6. The participants have competing interests. Adults view education as a secondary interest because education is overshadowed by the realities of life: their job or lack of job or their family situations.
7. Adults possess set patterns of learning, which varies considerably. Adult learners develop their own strategies and patterns of learning thereby helping to learn information in a variety of different ways.
8. Knowles and Roger's assumptions about the theory of adult learning suggests that adults learn by building on their past knowledge, experiences, and interests (p.71-81).

Other theorists such as Brookfield (1986), Mezirow (1991), Lawler (1991), and Merriam and Caffarella (1999)

have also addressed the concept of andragogy and how it can be used to facilitate adult learning. The research indicates that adult learners will not learn until they are motivated and ready to learn. Often, this requires helping them to overcome inhibitions, behaviors, and beliefs about learning. The importance of self-directed learning is a primary consideration because some adults are more self-directed than others therefore relying heavily on their many experiences as learning resources (Brookfield, 1986).

Since Knowles introduced his theory in the mid-1960s, many concerns have been raised about how the claims of andragogy are grounded. Pratt (1993) disagreed with Knowles assumptions regarding adult learners by arguing that Knowles assumed all adults learners were willing to engage in learning situations grounded in a male concept of individuality. Later proponents of this theory concluded that Knowles assumptions might not have been based on concrete evidence and there are vast arrays of potential interpretations of these assumptions (Rachal 2002; Courtney, Vasa, Luo, & Muggy, 1999). Lastly, other criticisms of Knowles assumptions regarding adult learner characteristics in comparison to children are on the opposite side of the continuum noting that some adults are

highly dependent, some children are independent; some adults are externally motivated, some children intrinsically motivated; adults' life experiences can be barriers to learning; and some children's experiences can be qualitatively rich (Merriam 2001; Vaske 2001).

Based on the review, there are many different assumptions on how adults learn therefore this theory is limited in all adult educational settings. However, the foundations of adult learning can be considered when using the constructivist approach for technology to support adult learning to make it more effective.

Constructivist Approach for Using Technology to Support Adult Learning.

Researchers state that the link between adult learning and a constructivist approach for using technology provides self-directed and collaborative learning opportunities (Brown, 1998). For the purpose of this paper, self-directed learning and collaborative learning will be reviewed as instructional tools to promote learning through the use of technology.

Self-directed learning. Self-direct learning (SDL) is the process in which individuals take control of the techniques and purposes of learning with or without the

help of others (Knowles, 1984; Brookfield, 1995). During this process adults set up their goals, look for resources, decide on their learning styles, and evaluate their progress (Brookfield, 1995). In addition to the general explanation of self-directed learning (SDL), Brockett and Hiemstra (1991), offers a second dimension adding learner self-direction (LSD). According to the researchers, LSD "centers on a learner's desire or preference for assuming responsibility for learning" (p.7). Thus, identifying their learner's personality. This dimension termed the Personal Responsibility Orientation (PRO) model which matches external characteristics of an instructional process to internal characteristics of the learners.

Another aspect of SDL is the impact of motivation and volition in initiating and maintaining the efforts of the learners. Through motivation the learners have the ability to make decisions whether to participate in learning. In contrast, volition provides the learners with the ability to achieve the goals (Corno, 1992; Garrison, 1997).

The literature contains examples of how technology is being used to promote self-directed adult learning. As a tool for teaching and learning, the Internet can facilitate self-directed learning (Brown, 1998). Through Internet

searches, learners can access a vast amount of databases and self-select information based on their needs. If SDL is implemented correctly, adult educators are provided a positive learning experience. In addition, SDL can be found in a variety of adult learning environments such as Web-based and distance education (Rogers, 2002).

Collaborative learning. Collaborative learning can be defined as learning that focuses on teamwork in an instructional environment. The review of literature states that an enhancement to learning is to use technology as a collaborative tool within the traditional classroom. An environment that fosters collaborative learning through the use of "media, such as email, with which students exchange ideas with peers located near or far, can both motivate and give added authenticity to student learning" (Gabler & Schroeder, 2003, p. 203). This provides an environment, which engages learners in the process of learning by fostering interaction with others.

Jones, Valdez, Nowakowski, and Rasmussen (1996) states that collaboration is fostered when "groups that include males and females and a mix of cultures, learning styles, abilities, socioeconomic status, and age bring a wealth of knowledge and perspectives to authentic, challenging tasks"

(p. 10). The literature documents that the use of technology in an adult environment brings different people together by sharing information to collaboratively construct socially shared knowledge to accomplish a common goal (Jonassen, et al., 1999). This can be supported through computer conferencing, newsgroups, and bulletin boards, which promote conversation and collaboration and assist meaningful learning.

The review of literature also found that technology supports the reflection process in adult learning. Through technology the reflection process allows learners to articulate ideas in group discussion, debate, and activities offering learners opportunities to reflect on their past knowledge and experiences (Brown, 1998). This allows adults to think contextually and critically.

Based on the concepts of self-directed learning and collaborative learning, Jonassen et al. (1999) expanded on the constructivist approach for using technology by identifying five interdependent attributes of meaningful learning. They suggest technologies should engage learners in:

1. Active learning, where they explore and manipulate the components and parameters of technology-based

environments and observe the results of their activities.

2. Constructive learning, where they articulate what they know and have learned and reflect on its meaning and importance in larger social and intellectual contexts.
3. Intentional learning, where they determine their own goals and regulate and manage their activities.
4. Authentic learning, where they examine and attempt to solve complex, ill-structured, and real-world problems.
5. Cooperative learning, where they collaborate with others and socially negotiate the meanings they have constructed (p. 218).

These approaches, although geared toward K-12 educators, can also be applied in adult learning environments.

Based on the findings, self-direct learning and collaborative learning, through the use of technologies as instructional tools, provide a range of benefits including bringing a wide variety of resources to the classroom, motivating learners, providing new teaching tools, accommodating individual learning styles, and redefining the role of the teacher/instructor (The U. S. Congress,

Office of Technology Assessment, 1995). In addition, these benefits create an environment, which presents "content in ways that are more engaging and involve students more directly than do textbooks and more traditional teaching tools" (p. 165). Through technology adult educators can provide an environment that fosters active learning skills, problem-solving skills, critical thinking skills, and reinforces student-centered instruction, teamwork, collaboration, and motivation (Hopey, 1998).

Conclusion and Recommendations

This literature review is attempting to answer the question: how does the constructivist approach for using technology support adult learning in a technology-based environment? A number of perspectives regarding constructivism, adult learning theory, and technology integration in adult learning environments were examined.

The review documented that the constructivist learning approach has a very broad conceptual framework in philosophy and science. Based on a perception about the nature of knowledge, constructivism describes how an individual attains, develops, and uses cognitive processes. Therefore, constructivism is a philosophy of learning that describes how structures and deeper understanding can be developed. Based on this theory, constructivist principles provide a basis to help adult educators create learner-centered and collaborative environments that support learning. An adult constructivist-learning environment should incorporate the theory of andragogy (as proposed by Knowles and amended by Pratt) as a guide to teaching adults, which best facilitates learning when it is approached as a set of assumptions. In addition, Jonassen's purposes for constructivist learning environments, if

implement correctly, helps adult educators create an environment where the learners can participate in real world experiences. This type of environment should be learner-centered instead of the traditional teacher-centered method.

Knowles theory of andragogy is a foundation for the education and development of adults. When applied in adult technology-based environments, it is possible to create learning and teaching strategies that meet the needs of the learners. Through self-directed learning and collaboration as learning strategies, learners are provided an opportunity to be in control of their learning and work in teams to gain diverse perspectives and views regarding a particular topic. Knowles contends that all learning is valued and is based on previous experiences. By allowing students to bring these experiences into the learning situation, it opens the door to different interpretations and views. Adults possess characteristics that influence how they learn and that should be considered when developing goals and objectives in technology-based constructivist environments.

The literature reveals that technology as a curriculum, delivery mechanism, complement to instruction,

and as an instructional tool can be applied in an adult constructivist-learning environment. Through the effective use of technologies adult educators provide an environment in which learners could determine compatibility, investigate potential experiences, and evaluate understanding of concepts. In addition, the use of technologies allows learners to engage in meaningful learning and to foster critical thinking.

There are advantages and disadvantages for technology-based constructivist adult learning environments. The literature contained a number of examples of how technology is being used to promote adult learning. Any of these examples for technology-based integration can be effective if it is not the focus of instruction. A successful adult technology-based constructivist learning environment should provide adult educators the ability to enhance instruction and learning by empowering learners to take more responsibility for their learning and creating a more powerful learning environment.

Areas for future research

One area where research is needed is to examine how to help teachers/instructors move from traditional instructional approaches to those of the constructivist approach of integrating technology in adult learning environments. Instructors need the proper training in order to effectively facilitate learning in a student-centered environment. Another important area for future research includes determining the utilization of professional development as a tool for encouraging the use of fostering an interrelationship between constructivist learning environments and technology to support learning. Lastly, educators must examine the different learning styles and diversity of student populations when creating this type of learning environment. As increases of culturally diverse learners are entering educational institutions, it is important to develop learning strategies to meet student differences.

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