CREATING A CONSTRUCTIVIST EDUCATIONAL COMMUNITY USING THE PROBE AND MONTESSORI METHODS

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Constructivism advances the notion that the learner constructs his/her learning through interaction with the environment where the learner applies prior knowledge and experiences to new and novel situations. Montessori instructional strategies should be used with young children and then as students gain self-learning and self-disciplinary skills, they should be provided opportunities to use the Probe Method for higher-level thinking combined with the investigation of specific content and any accompanying problems.

Imagine an educational community where children as young as three engage in the process of constructing knowledge through the use of manipulative instructional materials in a multi-age classroom, discovering math concepts, engaging in thought-provoking language activities, and exploring the wonders of life. Add to this, the engagement and interaction among peers and adults as these same children grow into an educational setting whereby they are presented with the opportunity to investigate questions or topics of interest fully with groups of their peers resulting in an intricate, creative presentation of the findings. This educational community combines the time-tested constructivist methods of Maria Montessori (Montessori, 1912) and an innovative, inquiry-based/problem-based constructivist model, the Probe Method (Shepherd, 1998).

Learning theories influence instructional practices and as such are implemented as instructional strategies within a classroom environment. These learning theories help to explain the act of learning, specifically how human beings learn. Instructional theories serve as a framework guiding the educator in the creation of an effective instructional environment. Teachers and instructional designers then employ instructional strategies to create a learning environment that maximizes learning based upon accepted learning theories.

After a review of the literature on learning theories, a proposed constructivist learning community will be suggested as a solution for implementing beneficial and effective instructional approaches for the 21st century educational community, combining the tested theories and strategies with an innovative constructive learning strategy using a broad range of applications. One of the authors, Glenn Shepherd, designed a constructivist instructional strategy in which students thoroughly investigate a problem, question, or topic using cooperative learning, which is called the Probe Method (Shepherd, 1998). The other author, Sandra Shepherd, contributed her expertise in the Montessori method. Teachers can create a constructivist educational community combining the Probe Method with the instructional strategies developed by Maria Montessori. Montessori instructional strategies should be used with young children and then as students gain self-learning and self-disciplinary skills, they should be provided opportunities to use the Probe Method for higher-level thinking combined with the investigation of specific content and any accompanying problems.

LEARNING THEORIES

The major learning theories in the last century are behaviorism, cognitivist learning theory, and constructivism. To discuss these learning theories, educators need to understand the levels of learning advocated by Benjamin Bloom (1956). The learning levels as described by Bloom have been accepted and touted by educators for many years (Seaman, 2011). Bloom labeled the lower levels as knowledge, understanding, and application with the higher levels consisting of analysis, synthesis, and evaluation.

Behaviorist Learning Theory

Behaviorist learning theory has dominated the American educational stage for decades. Behaviorism has enjoyed both praise and criticism since its appearance in psychological and philosophical circles. Some claimed that behaviorism

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marked a new era in the history of the human intellect (Carpintero, 2004), led by the notion that rather than wait for children to learn as they mature, the learning process could be accomplished through the direct instruction of a series of prerequisite skills leading to an academic goal (Morrow & Dougherty, 2011). Behaviorism is a learning theory based upon the learning of concepts (Carpintero, 2004).

Edward Thorndike (1874–1949) was perhaps one of the first psychologists to link the science of psychology and the practice of education (Hilgard, 2001). Thorndike in his work with cats and puzzle boxes determined that whenever a behavior is followed by a pleasant experience, the behavior is more than likely to be repeated. If a negative consequence follows a behavior, the behavior is less likely to be repeated hence the *law of effect* (McLeod, 2007).

B. F. Skinner (1904–1990) was a behaviorist who based his learning theories on the notion of reinforcement and the consequences of experiences from the learning theory set forth by Edward Thorndike (McLeod, 2007). Skinner employed three assumptions in his learning theory. The first was the notion that human behavior functions as a combination of genetics and environmental factors. The second was that educational psychology should attend to the external environment of individuals. Third, the notion of human free will deterred advances in the behavioral sciences (Lamal, 2010). Skinner's theory is referred to as operant conditioning (Ediger, 2012).

The educational manifestation of operant conditioning is programmed instruction. Programmed instruction is the teaching technique that presents the learner with small, organized bits of information in sequence with the end result being the learning of a larger concept (Ediger, 2012; Morrow & Dougherty, 2011). Following each presentation of material, the learner is most often assessed using multiple-choice tests. If the learner responds correctly, the learner is provided with reinforcement. For an incorrect response, the learner is provided with the appropriate answer and then continues along the instructional path. Programmed instruction traditionally moves slowly; however, the learner is presented with sequential tools for optimal success with little concern for the development of physical, emotional, or social competencies (Ediger, 2012; Morrow & Dougherty, 2011).

Applying these concepts in the classroom, learners respond to external stimuli shaping their behaviors by providing positive and negative reinforcements. This learning theory has encouraged educational designers to implement instructional strategies that are teacher led thereby promoting passive learning by the student. These strategies include practices such as lecture, drill and practice, and other teacher-led direct instruction techniques. Behaviorism is used in modern software and online products for learning subject content and facts before moving to higher order thinking skills and problem solving (Danver, 2016).

Cognitive Learning Theory

Cognitive learning theory historically followed the work of behaviorists. Cognitivists saw behaviorists as narrowing the process of learning to only what one could see without addressing the mental processes that were not so readily visible (Jorda & Campbell, n. d.). Defining cognitive learning theory can be a daunting task. Cognitive learning theory addresses a variety of issues used to define the learning process. Basically, cognitive learning theory states that individuals learn through the use of abilities and skills related to cognitive activity (Jorda & Campbell, n.d.). Atherton (2011) defines cognitive learning theory by what it is not: "if it ain't biological, behaviorist or humanist, it's cognitive" (para. 1).

Bloom developed a taxonomy describing the cognitive domain and how individuals learn information. Bloom defined six sequential steps necessary for mastering any material. Each step must be learned before the learner can successfully navigate to the next level. Bloom's taxonomy was revised in 2001 to support a teacher-centered approach and also to meet the needs of modern educators (Seaman, 2011). The revised taxonomy uses verbs instead of nouns.

Using Bloom's taxonomy allows educators to employ cognitive theory in curriculum and instructional design and in the classroom environment (Robinson, 2009). Cognitivists theorize that children learn by internalizing information and thereby derive meaning from the information itself rather than from an external source. Learning has become a mental or neurological process. This cognitivist theory has resulted in instructional strategies that incorporate teacher-led learning strategies but also include components of student-centered learning. The instructional strategies associated with the cognitivist learning theory are concept mapping, interactivity, observations, chunking of information, and repetition. The levels of learning promoted by the cognitivist learning theory are knowledge, understanding, and application with some higher-order thinking skills.

Constructivist Learning Theories

Constructivism advances the notion that the learner constructs his/her learning through interaction with the environment where the learner applies prior knowledge and experiences to new and novel situations. Constructivism puts the responsibility for learning upon the learner rather than the teacher with the result that learning becomes more personal. Learning is deemed to be successful when the learner can establish an understanding of concepts (Thanasoulas, 2002).

John Dewey, American philosopher and pragmatist, believed that for learning to occur, the activities engaged in by the learner had to be meaningful as well as being experienced within a social context where individuals join together to construct knowledge (Weinel, 2023). Materials provided for instruction need to be manipulated by

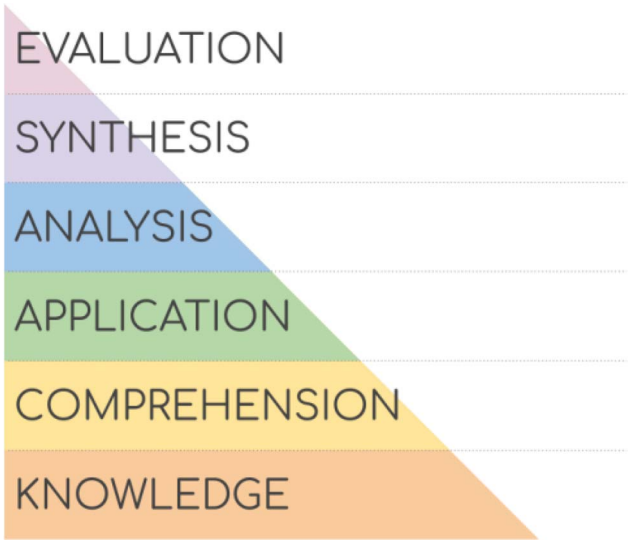

FIGURE 1. Original Bloom's Taxonomy, 1956. www.timeshighereducation.com.

the learners providing concrete and tactile experiences (Thanasoulas, 2002).

Jean Piaget, professor of psychology and sociology, viewed learning as a process of discovery that occurred at different times during the maturation process (Ediger, 2012; Thanasoulas, 2002). A child might connect to a concept during an early phase of development only to discard it later. Learning, therefore, is a sequential activity dependent upon the participation of the learner (Thanasoulas, 2002). Learning occurs through the restructuring of learners' thoughts and abilities within the environment as they progress through the defined stages. This restructuring process occurs when a conflict arises between bits of observed information requiring the child to make sense of the disparity (Hakvoort, 2002); thereby, defining the acquisition of knowledge as the process of changing and restructuring information through direct interaction with the environment by the learner. According to Piaget, learning is an individual activity within the confines of development (Lourenco, 2012).

Piaget defined these four distinct stages of human development as: (a) sensorimotor, a time from birth to 2 years old whereby children employ data retrieved from their senses and movement to learn about their environment and themselves, (b) preoperational, the period from 2 to 7 years old during which time the child can only attend to one variable at a time when comparing attributes, (c) concrete operational, a time from 7 to 11 years old whereby the individual child requires the use of concrete objects in order to understand abstract concepts, and (d) formal operations, a time from 11 through adulthood whereby abstract concepts are understood without requiring concrete representations (Ediger, 2012).

Lev Vygotsky, Russian psychologist, also believed that learning was a social activity often occurring between individuals possessing vastly different skill levels (Hakvoort, 2002; Lourenco, 2012). Vygotsky observed that children possess two levels of learning and understanding. The first level is defined as the period during which the child is capable of performing activities by himself/herself. This is defined as *real or actual development.* The second level of learning occurs when the child is paired with a more capable individual who functions as a guide in the learning process, guiding the child to a level of *proximal development.* The *zone of proximal development* is the difference between the actual development of the child and the development obtained through the guidance of a more capable individual (Lourenco, 2012).

Constructivists theorize that children learn by interacting with their environment thereby constructing their own meaning as a part of the learning process. As technologies advance, children are growing up in a world in which information and communication are accessed instantly. They are constantly interacting with content. In order to gain understanding of this vast amount of content, they must be able to analyze and think critically about this flood of information. The constructivist learning theory encourages student centered and active learning instructional practices, such as cooperative learning, problem-based learning, and real-world simulations. "Learning is a social and cultural activity in which learners construct meaning that is influenced by the interaction of prior knowledge and new learning events" (Arends, 2009, p. 12). The levels of learning promoted by the constructivist learning theory are knowledge, understanding, application, analysis, synthesis, and evaluation.

CONSTRUCTIVISM AND ITS EFFECTS UPON EARLY CHILDHOOD EDUCATION

Constructivist learning theorists provide the psychological and developmental framework supporting the notion that children learn best when they interact with an enriched learning environment. This enriched environment mirrors the theories espoused by Piaget, a constructivist (Burnett, 2010), as well as others that will be described in the following section.

The biological science and neuroscience communities provide educators and others a better understanding of the processes involved in child development giving additional insights not readily apparent. Educators now know how to influence and enhance competencies in several domains (Shonkoff, 2010). Constructivism acknowledges that learning is not only an active individual activity but also requires interaction with others in a social community whereby both cognitive and social components result in a more vibrant learning experience (Jha, 2012).

Neuroscience Research Supporting Constructivist Learning Theory

Neuroscience provides the empirical, scientific basis for constructivist learning theory and its accompanying learning environment. Research in neuroscience indicates that as the brain develops, it is necessary to provide the child with

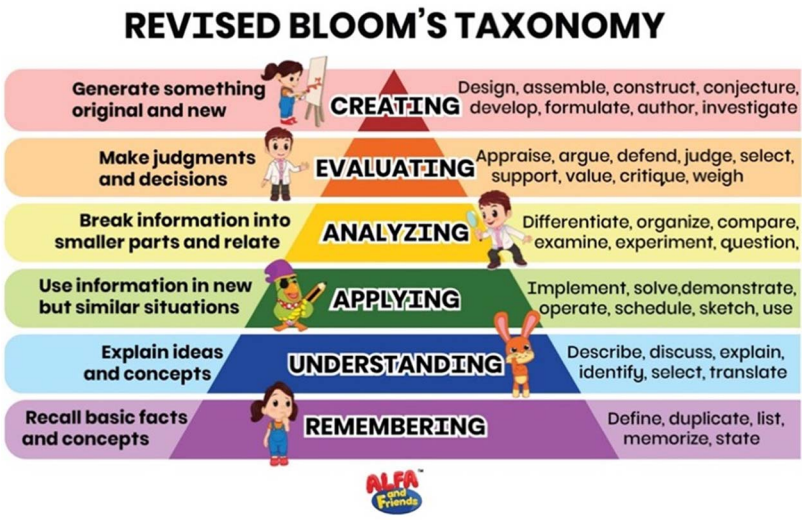

FIGURE 2. Revised Bloom's Taxonomy, 2001. www.alfandfriends.com.

experiences that are challenging and stimulating. These experiences provide the learner with situations that challenge established thought patterns, resulting in *cognitive disequilibrium* (Burnett, 2010). As a child employs the processes of assimilation and accommodation to correct this imbalance, the child learns to make the new information fit into the preexisting patterns thereby expanding his/her understanding of the world. The result is what Piaget called *cognitive equilibrium* (Burnett, 2010). This focus on the interaction between the environment and the learner is also reflected in the developmentally appropriate practices (DAP) as endorsed by the National Association for the Education of Young Children (NAEYC) (Burnett, 2010).

Piaget conducted his research pertaining to children and their cognitive development through his observations of children as they interacted within their learning environment. Neuroscience studies have since supported these observations through the use of research tools that map the structure and activity of the brain particularly those studies supporting the importance of an enriched, novel, and stimulating environment that create and cement synaptic connections. These findings support the belief of Piaget that children need opportunities to construct their knowledge through focused interactions within a challenging and stimulating environment (Burnett, 2010).

Research pertaining to brain function indicates that the actual structure of the brain changes as a result of relevant experiences. The genetic makeup of an individual provides the basic framework for the brain but the environment provides the framework as to how the neural circuits are developed (Shonkoff, 2010). With each engaging and stimulating activity, dendrite connections are formed in the synaptic areas of the neurons thus increasing the density and the structure of the brain, a process that can be particularly important to the development of the cerebral cortex, the area of the brain responsible for thinking and language. It is also necessary for these activities to take place in a social setting allowing for interactions with other people. As the capacity of the brain increases, the ability to assimilate new knowledge into existing patterns also increases. This is a concrete representation of Piaget's notion of *cognitive equilibrium* (Burnett, 2010).

The reverse of this process is also found to be true. If children are not exposed to challenging and stimulating environments, a loss of neurons and their supporting structures can occur. This loss of neural activity can also occur as a result of violent or abusive conditions. Both of these negative environments can affect cognitive and psychological development over the long term (Burnett, 2010; Shonkoff, 2010).

The importance of the relationship between adult and child to the child's developmental process cannot be ignored. It is important that this relationship provides stability and nurturing support, allowing for the children to be active participants in their own learning. In addition, scientific research supports the notion that positive early learning experiences not only influence the acquisition of cognitive, social, and language skills and the resulting brain development but also impact the biological functioning of the human body in the form of cardiovascular health and the regulation of metabolic function (Shonkoff, 2010).

Instructional Practices

As theories of how humans learn have changed over the last several decades, the instructional theories and instructional strategies must also change. The emphasis in curriculum has changed to include higher levels of thinking, so instructional strategies must be implemented to address these newer curriculum goals. The behaviorist and cognitivist learning theories can still be

very valuable for teachers to use in the preparation of instruction.

However, the technological age of the internet, communications, and interconnectivity have changed what students need to learn and how they need to learn. A study by Neo and Neo (2009) concluded that integrating multimedia technology within a constructivist learning environment (CLE) provided students with experience in critical thinking, problem solving, creativity, communication, and reflection. Children are growing up in a technologically advanced world in which they are inundated with information and in which they can communicate with almost anyone in the world. The constructivist learning theory seems to be the one theory that best explains what and how children learn in today's technology-rich world and thus it should be the primary learning theory used to create the school's instructional approaches.

Now, more than ever, teachers need to implement constructivist instructional strategies and methods that provide children with the opportunities to learn in the best possible learning environment to meet these educational goals. The Montessori method and the Probe Method are constructivist instructional strategies that will be explored in more depth to illustrate how an entire school can be transformed into a constructivist educational environment. We are proposing that the Montessori method should be used in the early years of a child's education to obtain the learning and self-discipline skills necessary as they travel their educational road. As students get older they should use the Probe Method to thoroughly investigate the world and their place in it.

MONTESSORI

The application of theory as a guide to the instructional process will be addressed by describing how constructivist learning theory, particularly the instructional practices employed by Montessori (1912), supports the practice of teaching with a research-based platform from which to engage students in the acquisition of academic skills. Research from neuroscientists lends additional support and credence to the implementation of constructivist theory, specifically those designed by Montessori.

Maria Montessori developed her learning theories in 1907 with children experiencing mental disabilities as the target population later to include normal children living in low-income homes. She designed the educational materials to be used with these children resulting in an educational environment that enhances both learning and child growth and development. Better educational outcomes have been exhibited by low-income children enrolled in public school Montessori programs when compared to students enrolled in traditional educational settings (Lillard, 2012). The authors of this paper propose that educators should provide a Montessori-based education for all children, beginning at age 3.

Her strategies and instructional materials continue to have relevance in today's educational settings. Combining the components of motivational theory with the established educational practices of Montessori produces a program where students are actively engaged in their own learning (Murray, 2011).

The Montessori instructional method works because it was designed for children putting the theory of constructivism into practice delivering a detailed curriculum that addresses the primary components of constructivist theory (Bagby & Sulak, 2010). Montessori believed that children did not follow what was put before them but rather constructed knowledge within themselves following a natural inclination to learn in an organized environment (Bodrova, 2003).

The learning theory attributed to Montessori can be viewed as an eclectic mix incorporating empiricism, the notion that humans learn about the world through the engagement of their senses, nativism, the idea that humans are born knowing everything they need to know about the world bringing it forward when needed, and constructivism, the belief that humans construct knowledge through experiences with people and the environment (Elkind, 2003).

Montessori viewed the hand as the instrument that guides the intellect of the child in his/her interaction with the environment allowing for the child to fulfill his/her mission in the world (Elkind, 2003) as well as being an instrument responsible for the changes in civilization (Gilder, 2012). To this end, Montessori designed a curriculum that included activities designated as *Practical Life* skills. Through the execution of these activities, children develop the fine motor skills that allow for the precise hand movements required to successfully use a pencil as well as increased concentration, improved eye-hand coordination, language acquisition, numeracy skills, and increased confidence and motivation. Other studies have linked coordinated fine motor skills with the ability to handle the rigors of school in the later years (Gilder, 2012).

Montessori defined stages of development with the *absorbent mind* occurring between the ages 3 to 6, believed in repetition as a means to foster learning and development, and stressed the importance of a stimulating environment that nurtured cognitive growth. She saw the senses as the interface between the mind of the child and the experiences generated by an orderly, inviting environment. The learning materials designed by Montessori reflect this belief (Powell, 2000). The teacher impacts the environment through design. The role of the teacher is to design an orderly, stimulating classroom environment as well as acting as a director for each child as they embark upon their learning journey (Powell, 2000).

Montessori was more interested in the practice of teaching rather than the development of learning theories. The learning theories intuitively followed the teaching methods. The planes of development as described by Montessori departed from the stages as defined by Piaget in the area of math skills. Montessori designed instructional math materials addressing seriation, the arrangement of objects in a numerical order, and classification concepts deemed too difficult for these young children according to Piaget (Powell, 2000).

Motivation has been found to be a strong indicator of the success of educational strategies and performance. Motivation hinges upon four elements: interest, capability, independence, and connection with the task. These criteria are fundamental to the Montessori program. Montessori believed that when children are motivated, they are enthusiastic. This notion of enjoying academic tasks is central to the Montessori program (Murray, 2011).

One of the pillars of the Montessori program is autonomy or independence. Students are expected to be responsible for constructing their own knowledge using the instructional tools provided. Materials are carefully arranged on shelves allowing for individual students to select those tools of interest thereby promoting discovery. The instructional day provides for a 3-hour block of uninterrupted time where students pursue these educational tasks. Students are responsible for defining their learning goals and to make efforts to move toward achieving these goals. Students move through the Montessori curriculum at an individual pace rather than through a predetermined schedule set by others. The child is the center of the instructional day (Murray, 2011).

Interest is nurtured in the Montessori classroom through connections with the real world thereby assigning meaning to the tasks. Montessori observed that children found knowledge linked to real issues to be more interesting, allowing for these students to engage in the practice of answering questions. The design of the Montessori materials is such that students are provided with incomplete information leaving the student with uncertainties that need answers. Monitoring student progress is essential to keeping interest high, providing the learner with challenging tasks in his/her pursuit of knowledge (Murray, 2011).

Being a capable learner is another basic component of Montessori philosophy. However, feelings of competence and capability cannot motivate without the notions of autonomy and independence. Students who believe in their individual ability as well as in their ability to succeed will persevere when faced with intellectual challenges. The Montessori program addresses these issues through the individualized curriculum, the multi-age grouping, and the method of assessment and evaluation. The teachers in a Montessori classroom maintain comprehensive records describing the progress of each student using the sequenced spiraling instructional materials thereby mapping academic growth while presenting individual students with appropriate and challenging educational tasks (Murray, 2011).

Connectivity is supported in the Montessori classroom through practices that foster a sense of community. Montessori recognized that for young children to become social beings, they must move from focusing upon their individual needs to addressing the needs of the community, a transition that occurs as children proceed from preschool into the primary grades. The feeling of community is fostered, however, through the multi-age grouping obtained through a 3-year class cycle where the young students are provided with older role models, the freedom to work in small groups allowing for interaction with peers through discussion or assisting one another, and the class meetings where disputes are resolved and solutions offered (Murray, 2011).

Drake (2008) claimed that the success of the Montessori program lies in the creation of resilient children who are able to overcome obstacles and stay true to goals. Resilient individuals possess a number of traits that are supported and nurtured in the Montessori learning environment. These include (a) empathy where students feel secure and comfortable in an educational environment, (b) communication practices where every individual is allowed the opportunity to express his/her point of view in an orderly and supportive manner, (c) a sense of community being fostered through the practice that all are welcome and respected, (d) attainable goals that are set within an environment that promotes success in everyone while encouraging appropriate risk-taking behaviors without fear of humiliation or failure, (e) viewing mistakes as a condition for learning allowing for students to use logic and reasoning as applied to the instructional tasks, (f) encouraging children to develop a social conscience where they express compassion for others and responsibility for themselves, and (g) providing opportunities for problem-solving and decision-making through peaceful means (Drake, 2008).

The Montessori curriculum is defined by the use of the Montessori materials (Murray, 2011). Montessori designed these materials after the extensive observation of children in an instructional setting (Lillard, 2012). In the Montessori classroom, children are surrounded with materials that instruct and enhance those skills necessary to learn mathematical and literacy concepts.

Children learn to write before they learn to read. To develop the skills necessary to write, children are presented with materials allowing them to practice a pencil grip, to practice tracing around objects, and to manipulate sandpaper letters. Mathematical concepts are introduced through sensorial materials requiring the children to make perceptual judgments. The concepts of size, thickness, and length are introduced through

concrete manipulatives. The Montessori materials gradually introduce children to increasingly more complex concepts. The materials are also self-checking, allowing for the children to correct their own mistakes and freeing the teacher to provide for individualized instruction and the assessment of skills (Lillard, 2007).

Components of the Montessori Method

The Montessori worldview centers on "concentration, coordination, order, independence, and respect" (Cossentino, 2005, p. 212). The Montessori method consists of three tiers: (a) a coherent practice that relies on consistency in language and behavior across classroom and schools, (b) a Montessori culture that encompasses the Montessori worldview, and (c) the implementation of the Montessori method through routine and ritual expressed daily through actions and behaviors (Cossentino, 2005).

The Montessori education model underscores the notion that every child embarks on a unique and individual developmental process. Learning and the accompanying curriculum should reflect this process. Using the instructional methods and materials designed by Montessori, the acquisition of knowledge and skills is made concrete allowing for children to understand a variety of concepts pertaining to school readiness (Kayili & Ari, 2011).

In the Montessori environment, students are taught without sitting at desks as a teacher recites a litany of facts. Rather students select activities that are developmentally appropriate while working independently (Larson, 2010).

> Children who begin attending Montessori school at age two-and-a-half or three typically learn to read and write by the time they are five. By second or third grade (i.e., seven or eight years old) they read full chapter books; pen creative multipage stories in neat cursive with few spelling errors; have a foundation in grammar; display mastery of the four basic operations of arithmetic with numbers as large as a million; have a thorough understanding of fractions and decimals, and substantial understanding of geometry. By the end of the third grade they have developed skills that many American students do not develop by eighth grade, if ever. (Larson, 2010, p. 41)

The characteristics separating the Montessori classroom from the traditional classroom exhibit practices that encourage learning in an environment supporting individual development (Cohen, 1990). Montessori designed materials allow students to learn concepts in an ordered sequence involving a multitude of senses. Practical skills and hands-on learning form the cornerstone of the Montessori instructional practices. These practices "incorporate activities ranging from simple tasks, such as sorting beads and learning to work buckles and buttons, to complex arithmetic and cultural studies" (Cohen, 1990, p. 64).

In addition, the "materials are designed to help children gain an understanding of whole processes, rather than piecemeal concepts, and allow teachers to assess their progress and diagnose problems by observation without formal tests" (Cohen, 1990, p. 64). The learning materials also must hold the interest of the child for an extended period of time. The instructional tools must engage the children in concentration, activity, and repetition to support a thinking environment (Larson, 2010).

The materials used in Montessori schools are self-checking. This process allows the children to correct their own mistakes without waiting for input and evaluation by the teacher. In addition, the self-checking materials encourage students to learn to distinguish between differences in dimension or other attributes of an object. The student now becomes an observer. The teacher can step back, allowing the student to learn independently and at his/her own pace (Larson, 2010).

Another characteristic that separates Montessori from other instructional methods is the respect for the reasoning mind of individuals. Montessori saw the need to develop the ability to concentrate for longer periods of time as well as to sharpen the ability to focus on a task at hand. According to Montessori, the distinction between man and animals can be found in the ability to reason (Larson, 2010). "Thus the Montessori schools focus not on teaching in the sense of an adult-led process of transmitting knowledge, but rather on establishing and maintaining a specially prepared environment in which the child can and will teach himself" (Larson, 2010, p. 42).

The ability to work independently using self-correcting materials also allows the child to understand that "things have a certain nature and behave in certain ways, that there is a certain order to the world, and that to be successful he has to understand what things are, how they act, and how they relate to other things" (Larson, 2010, p. 46). Through this process, the student learns that problems can be solved (Larson, 2010).

In addition to the above instructional strategies, children are taught to treat others with respect. This means to treat others fairly and to respect personal space. Children are instructed and encouraged to be polite and reasonable. They are taught to walk around mats and workspaces of others as well as to say please and thank you (Larson, 2010).

"Motivation is a crucial concept in education because it has been shown to influence interest, excitement, and confidence, which in turn enhance performance, persistence, creativity, and general well-being" (Murray, 2011, p. 22). Student motivation is a core element of the Montessori method (Murray, 2011).

Motivation was enhanced through the following elements: interest, competence, autonomy, and relatedness (Murray, 2011). Montessori embraced these elements. Interest was encouraged through uninterrupted work times, following the interest of the child in selection of activities, and making connections between new knowledge and the wider world. Competence was supported through Montessori instruction

by the individualized curriculum that follows a definite sequential order as well as grouping students in multi-age groupings resulting in 3- to 6-year olds learning together. Autonomy was addressed through the flexibility of the instructional schedule and the role of the teacher as a guide. Relatedness supported the community of learners in the classroom (Murray, 2011).

Being self-motivated life-long learners can be a significant goal of any educational program. "Self-Determination Theory postulates that autonomy support in social contexts contributes to intrinsic motivation for action" (Koh, & Frick, 2010). Studies have found that Montessori students exhibit a higher level of intrinsic motivation than do students from traditional schools. In addition, it has been noted that intrinsic motivational levels decline among students from traditional schools from third grade to high school. Koh & Frick (2010) ascertained that the Montessori classroom "emphasized self-mastery and independence in students" (p. 12). These findings suggest that the methods espoused by Montessori, fostering academic knowledge, and creating individuals with the desire and the propensity to pursue knowledge independently result in adults functioning at higher cognitive levels.

Active versus Passive Learning

The traditional educational system puts students in a passive role, whereas a constructivist educational system uses student-centered activities thereby placing the student in an active role. Children do not come to school understanding how they are to interact and behave in an environment. Montessori describes a systematic, sequential process required to instruct young students. This process entails the following items: (a) adult instructors must maintain an orderly environment including the appearance and demeanor of the teacher as the teacher and the environment should be tidy, calm, and dignified, (b) teachers must engage the children in the presented activities ascertaining what is appropriate for a particular child at a particular time thereby presenting a challenge without being too difficult, (c) the teacher should not interfere as the child engages with the activity as too much interference will encourage the child to turn the activity over to the teacher to complete (Larson, 2010).

A study reported by Bower (2006) assessed the Montessori method among poor and lower middle-class students from Milwaukee, Wisconsin. The results indicated that these typically lower performing students exhibited academic gains beyond those of students from other schools. At the conclusion of the kindergarten program, the children attending the Montessori program outperformed their peers at both public and private institutions in both math and reading when assessed using standardized tests.

The Montessori system has been used with children from all income and socio-economic levels with success. The active learning strategies and materials have been used for almost 100 years, with modifications being made when needed. From time to time, educators need to re-examine techniques and strategies that have proved to be successful and re-introduce these methods to a new audience. Now is the time to re-examine the Montessori method as well as other constructivist models in an effort to provide an active learning environment in which all students master the necessary skills for success.

THE PROBE METHOD

The Probe Method is a constructivist instructional strategy, which utilizes collaborative learning in which students probe or thoroughly investigate a topic, question, or real-world problem in an active, authentic learning environment. The Probe Method was designed in 1998 by one of the authors of this paper. It shows promise as a method to improve the levels of student critical thinking (Shepherd, 1998). There has been limited research using the Probe Method; however, in a dissertation study, Specht (2015) found positive results for the Probe Method in a high school program in promoting motivation and critical thinking skills. Further studies on using the Probe Method are encouraged. The learning strategy is based on proven problem-based learning models that have shown much success (Shepherd, 2010). The teacher has several options when using the Probe Method as it is conducive for use at many grade levels or subject areas. The teacher can take more control in the instructional process, or the teacher can allow students to exhibit more control.

There are times during which the teacher might need to control the content explored during a Probe Method project. There are other times when the teacher might be able to give students more choices for their in-depth study and the method for learning the material. As students are given more freedom and control in the project, the method becomes more constructivist in nature. Student ownership of the projects studied is an important element in motivation for learning. Teachers are therefore encouraged to provide instructional options for students whenever possible.

In order to be successful in problem-based and project-based learning activities, students need certain independent learning and self-discipline skills that are best acquired through a constructivist learning environment, such as the Montessori approach discussed earlier. If children are initially provided with a Montessori-based education, the introduction to an authentic, problem-solving and project-based learning activity at a later time will prove to be successful.

The idea of the Probe Method is that students are placed in small groups in order to better facilitate learning about a topic, question, or problem. The teacher helps students throughout the process, providing them with a structured environment in which to work together and to

share the information that they discover. Students move from working in a small group to working individually to working with a larger group of students. See Appendix A: Outline of the Probe Method for an outline of the process a teacher might use to implement the Probe Method. This outline is meant as a general guide. The teacher should modify the steps as needed within any given situation. This is the original outline used in 1998 so there are several newer technologies that could be utilized in today's classroom.

Examples of Using the Probe Method

There are many possible examples of projects in which the Probe Method could be used. A Probe Method project can be used in an individual classroom with a small group of students or as a project that could involve many classrooms of students throughout an entire school or multiple school sites. The range of inquiries into a topic, question, or problem can be limited to a short time frame or it can be expanded to allow for one complex project lasting the entire school year.

A simple example would be a unit of study on the American Revolutionary War. In a typical social studies class this topic might be covered in a 3-week unit plan. Students would read the text on the topic and a few additional outside sources. The teacher might show a video on the war and have students complete worksheets with questions pertaining to the war.

The same 3-week unit could, however, be completed using the Probe Method having students thoroughly explore the facts and issues pertaining to the Revolutionary War. Students would be put into collaborative groups and would then explore the war using the Probe Method.

In this 3-week unit example of the Revolutionary War, the teacher could provide as much direction and control as needed in order to ensure that students explore the required information concerning the war. The teacher can also provide options for students pertaining to the topics as they explore, find, and share information. The teacher can also expand this unit on the Revolutionary War by having students go into more depth on issues within the unit. One issue will lead to another issue, which will lead to another and another issue.

The unit on the Revolutionary War might be limited to whatever can be covered in the 3-week time frame or it might change to almost any topic based on the questions from the students and the information they find and share. Creative teachers could make this unit evolve into an interdisciplinary unit that expands into several weeks. Students might begin asking questions as to why we wanted to revolt against English rule and this might lead to questions as to why England did not just allow America to form their own country. This then might lead to the concepts of government and the kinds of control used by England in their dealings with the colonies at the time. This in turn might lead to issues about the whole interactions between other countries in Europe and the types of governments in those countries.

Students might begin asking questions as to where the concept of democracy came from and this could lead to an exploration of a number of writings on the topic and early attempts at democratic ideas in our history. Questions about why governments of most countries in history were monarchs or other forms of dictatorships might lead to a discussion on economics and the concepts of how money and gold are power and whoever has money/gold has the power over others.

Discussions about money and economics might then lead to a wide range of issues to do with distribution of wealth, poverty, crime, corruption, health, business, taxes, social responsibility, indifference, etc. Students might begin to explore any of these issues in more depth, depending upon the interest of the group of students. For instance, students might ask how money affects a person's health and the concept of children in poverty who die from lack of health care simply because their parents do not have the money to buy medicine to save their lives. Students might want to explore how and why many children and people in the world die from malnutrition and lack of medical care and what might be done about this problem.

This unit of study could be expanded to include the entire school rather than just one class of students. Each class in the school could take a different aspect of the problem of children in poverty, for example, and expand upon the issues they discover. Students would begin to thoroughly investigate the problem by reading several articles using electronic sources as well as traditional references. Teachers in the school could then help divide these issues up so that different groups of students further explore these issues and report back to the rest of the school.

As described, a 3-week unit on the Revolutionary War in a single classroom could expand to involve the entire school for several weeks or even throughout the entire year. Once students begin to investigate a topic/question/problem, they can continue to expand upon their pursuit of learning by asking more questions that in turn leads to more questions. In this process of learning, students not only learn about a topic but they learn how to explore a topic, how to find information, how to think critically, how to work together, how to solve problems, and thus they learn how to learn and to appreciate learning throughout their lives.

Creating a Constructivist Educational Community

What is needed for school reform to be successful is to provide an effective early school experience for all children and one of the most effective early childhood educational experiences are those based on Montessori principles (Lillard, 2007). Later as children develop basic skills, self-learning skills, and self-discipline skills, the best educational experience for them is in a constructivist learning environment, such as the one advocated using the Probe Method.

To create a constructivist educational community, educators should begin by putting 3-year-old children in a Montessori-based school environment and begin to introduce problem-solving and project-based experiences for them as they exhibit the skills and maturity to be successful with such constructivist activities. Depending upon the independent learning skill development of the child, the child should be given more and more options for learning and for shaping their own learning experiences.

In order for a constructivist educational community to be successful, educators must create an atmosphere for nurturing independent learning, decision-making, and self-responsibility. These are not skills that young children have, especially children from lower income families. The Montessori instructional approach will provide the early experience in a constructivist learning environment that children need to prepare them for success in a constructivist school when they get older. Each grade level can then provide more opportunities for children to make choices in what and how they learn and thus construct their own learning. Making changes to our educational system, of course, takes time, but we need some models with a constructivist vision that can be used as guides.

CONCLUSION

Students want to learn. Young children naturally ask questions and want to understand themselves and the world around them. If they are placed in a daily learning environment in which they are passive learners and are continuously told what they need to learn, they will tend to lose their natural desire to learn. But when children spend the day asking questions and trying to find answers to their own questions, they will feel empowered and will want to ask more questions and thus they will want to continue to learn.

Education is a process in which we, as individuals, learn about ourselves and our world. This learning process is a life-long adventure and does not just happen in a school or during a certain period of our lives. The ultimate goal for education is for each person to learn how to learn and to want to continue to learn throughout his/her life. What humans learn is not as important as our motivation to learn and our self-learning skills providing us with the skills to be able to learn whatever we wish to learn.

When our entire school system is based upon constructivist learning principles, such as with the Montessori approach and the Probe Method, then we will finally make real progress in school reform. When we provide young children with a Montessori-based education giving them the school readiness skills necessary for academic success, then we will finally leave no child behind. Schoolwide Probe Method projects can create an authentic, real-world learning environment that can help teachers transform schools from passive, boring institutions to active, exciting, and challenging places in which students thrive and engage in intellectual pursuits.

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APPENDIX A: OUTLINE OF THE PROBE METHOD

Outline of the Probe Method

1) Students are provided with information about the unit. Students should be given the objectives of the unit along with a list of required readings, exercises, and assignments that relate to the unit of study.
2) Students then identify a real-world problem that relates to the unit of study presenting an introduction pertaining to the issues related to the problem to the whole class in some way.
   a) Introduction of the issues pertaining to the problem via a short lecture presentation or an online presentation.
   b) Show a video or other visuals to expand on the introduction of the problem.
   c) Invite a guest lecturer or expert to present the issues.
   d) Engage students in a discussion of the topic allowing for the definition of the actual problem.
3. Examine the problem as a whole class in a teacher-led discussion. Discussions can be face-to-face or via electronic communications.
   a) Large group discussion
      i) Verbalize the problem.
      ii) Discuss different sides of the problem.
      iii) Consider the complexity of the problem.
      iv) Develop possible solutions to the problem.
      v) Develop a plan of action to solve the problem.
         (1) Decide on the types of information (areas) needed to foster a better understanding of the problem.
         (2) Establish small groups of students (2 to 4). If distance learning is involved, divide each site into small groups as well so that students work in virtual study groups.
         (3) Determine the specific area that each small group will research.
4) Students will gather data and present the data in an appropriate format.
   a) Each group collects data pertaining to their chosen area.
      i) Use CD-ROM databases, electronic encyclopedias and atlases, and other computer software programs containing related, pertinent information.
      ii) Use internet and World Wide Web to conduct searches on the topic resulting in a variety of sources for appropriate information providing several sites with resources, if needed.
      iii) Use conventional library skills (card catalogs, periodical guides, encyclopedias, books, magazines, films) leading to other sources.
      iv) Compile discovered information individually as assigned by the small group.
   b) Small groups decide what data is deemed the most relevant, weeding out some data that is not pertinent to the problem after discussing their "new" understanding of the given problem and indicating how the data might help in the solution to the problem summarizing the most important data.
   c) The *key* data is entered into electronic format (such as word processors, desk-top publishing, databases, spreadsheets, authoring or presentation programs, and graphic programs). Graphic programs can be used to create illustrations, maps, and graphs. These graphics can be then be imported into other software programs. Some data might be put online as web pages or links.
5) Small groups present data.
   a) Each small group presents their data to the larger group. Information is presented in electronic format using web-authoring or presentation programs.
   b) Each small group also discusses their interpretation of the problem and how the data might aid in the solution to the problem.
6) Large group teacher-facilitated discussion
   a) Smaller groups and individuals verbalize their understanding of the other groups data and interpretations.
   b) Verbalize the criticisms made of other's interpretations.
   c) Discussion by online groups as to the issues through the use of the internet. One group at a distant site can communicate to a specified group at another site concerning their ideas. Several classrooms could be working together on one probe method project at locations around the world to refine ideas. Wikispaces can be set up for students to communicate and to share ideas and work. Blogs can be used for the discussion of the topic with others at a distance.
7) Simulation and/or CBI (computer-based instruction) program, if available, either by using a software program or online. This would be optional if such software was found to be appropriate.
   a) Students work on a CBI program geared to their topic problem.

b) Students work on the program in a small cooperative group.
c) Each small group discusses the game and its relationship to solving the problem.

8) Possible solutions to the problem
   a) Small groups discuss and brainstorm solutions to the topic problem.
   b) Small groups summarize their solutions, using electronic means. Students might create a website or they might build physical models.
9) Summary of solutions
   a) Small groups present their solutions to the larger group using electronic web-authoring or presentation software.
   b) Large group critically discusses other's solutions and attempts to reach some sort of consensus.
   c) Individuals write a short essay in which they explain those solutions to the problem they most support and why. Individuals could choose to publish their personal thoughts on a web site.
10) Final assessment of unit. Assessment of unit should come from work in the problem-solving assignment, end of unit tests (if any), and any other assignments associated with the unit of study. Self-assessment measures would be quite appropriate in a constructivist approach such as this one.