

5-1-2009

Museum Discovery Rooms Engaging Families Using Learning Theories

Cassandra E. Demski

Follow this and additional works at: <https://scholarship.shu.edu/theses>

Recommended Citation

Demski, Cassandra E., "Museum Discovery Rooms Engaging Families Using Learning Theories" (2009). *Theses*. 242.
<https://scholarship.shu.edu/theses/242>

Museum Discovery Rooms

Engaging Families Using Learning Theories

By

Cassandra E. Demski

Dr. Susan K. Leshnoff, Advisor

Submitted in partial fulfillment of the requirements for the

MASTERS DEGREE IN MUSEUM PROFESSIONS
Seton Hall University

May 2009

Abstract

Museum Discovery Rooms: Engaging Families Using Learning Theories

evaluates the educational potential of museum discovery rooms for families. Museum professionals need to understand successful ways to educate families as they are a major museum visiting group. Contrary to a common belief, discovery rooms are not only entertainment areas, but are also effective museum learning spaces.

Discovery rooms chosen as case studies in this thesis are at the American Museum of Natural History, New York City; the Newark Museum, Newark, New Jersey; and the Smithsonian's National Museum of the American Indian, New York City. It is the author's belief that by including learning theories in discovery room design, these discovery rooms become important educational centers for family visitors. Furthermore, the case study museums are of varying size and typology, demonstrating that discovery rooms are an important topic to all museum professionals.

Acknowledgements

I am grateful to Maressa McFarlane for encouraging me to attend the Museum Professions MA program at Seton Hall University and for her help in deciding between thesis topics. To Dr. Susan Leshnoff, my thesis advisor, thank you for sharing your knowledge and expertise to help refine this thesis. I am especially appreciative of your encouragement and guidance along the way. Thank you to my family, without whose support this thesis would not be possible.

I would like to thank all the museum professionals who helped with the research for this thesis: Ann Prewitt and Daniel Zeiger at the American Museum of Natural History, Ted Lind at the Newark Museum, Stephanie Betancourt and Gaetana DeGennaro at the National Museum of the American Indian in New York City. The insight provided by these individuals was priceless in helping me to understand the educational potential and power of discovery rooms.

Table of Contents

Introduction.....	1
Chapter 1	
Museum Discovery Rooms.....	3
Chapter 2	
Family Units.....	6
Chapter 3	
Studies on Families in Museums.....	8
Chapter 4	
Learning Theories.....	10
Discovery Learning Theory.....	10
Cognitive Development Theory.....	12
Socio-Cultural Learning Theory.....	13
Multiple Intelligence Theory.....	15
Reggio Emilia Philosophy.....	16
Constructivist Learning Theory.....	18
Chapter 5	
Relevance of Learning Theories to Museums.....	20
Chapter 6	
Case Studies.....	23
American Museum of Natural History: Discovery Room	24
Newark Museum: Look/Touch/Learn: Nature & Art	31
National Museum of the American Indian in New York City: Haudenosaunee Discovery Room and Interactive Learning Center	37
Chapter 7	
Application of Learning Theories to Case Studies.....	44
Discovery Learning Theory.....	45
Cognitive Development Theory.....	46
Socio-Cultural Learning Theory.....	48
Multiple Intelligence Theory.....	49
Reggio Emilia Philosophy.....	51
Constructivist Learning Theory.....	51
Conclusion.....	53
References.....	56

Museum Discovery Rooms: Engaging Families Using Learning Theories

Introduction

Families are always looking for enjoyable and educational activities to do together; museums can meet this demand with discovery rooms. A discovery room is a museum area where visitors interact with objects and each other. Discovery rooms play an important role in a family's overall museum experience as a welcoming space that orients visitors to the institution. It is a common misconception that discovery rooms are entertaining spaces lacking meaningful educational value. The purpose of this thesis is to examine the educational potential of discovery rooms for family visitors.

In the 1992 report *Excellence and Equity: Education and the Public Dimension of Museums*, the American Association of Museums asserted a “new definition of museums as institutions of public service and education, a term that includes exploration, study, observation, critical thinking, contemplation and dialogue” (p. 6). In addition to valuing the educational role of museums, the report recommended that museums “develop education experiences for schoolchildren, families, and adults that reflect a knowledge of the different learning styles visitors bring to museums” (American Association of Museums, 1992, p. 17). In order to facilitate learning, museums must consider their audience and create spaces that foster educational experiences for visitors.

According to Lynn Dierking and Robert Kiihne (2006), an astonishing 60-70% of museum visitors are family groups (p. 13). One definition of a family unit is an intergenerational group with members at different stages of knowledge; this challenges museums to create educational experiences that can benefit every member of a family. Nonetheless, since families are a major visiting group to museums, there is an

institutional obligation for museums to provide educational opportunities for families.

An effective way for museums to educate a family audience is through discovery room design that incorporates several learning theories applying to family units.

The structure of this thesis is as follows. Chapter 1 presents a definition of and historical approach to museum discovery rooms. Chapter 2 defines a family unit as applicable to museums. Chapter 3 mentions several studies that show the value of museum experiences for families. Chapter 4 focuses on relevant learning theories for museums and families. Chapter 5 demonstrates how museums can apply learning theories in exhibitions. Chapter 6 furthers the argument for discovery rooms through careful examination of three case studies: the American Museum of Natural History, in New York City; the Newark Museum in Newark, New Jersey; and the Smithsonian's National Museum of the American Indian, in New York City. Chapter 7 connects learning theories to the individual case studies with audience research about effective classroom and other learning environment design. The conclusion summarizes the educational value of discovery rooms, explains effective discovery room design elements and advises museum professionals about issues involving use of discovery rooms.

Chapter 1

Museum Discovery Rooms

A common museum component for families is a discovery room, also known as an information zone, learning lounge or family space. The discovery room is an educationally engaging space particularly suited to the needs of family visitors. The definition provided by the Association of Science and Technology Centers' Workshop on Discovery Rooms in 1982 describes a discovery room as "a restricted space within a museum in which individuals of all ages have access to quality specimens normally unavailable to sensory touch and, through a systematic organization, come to learn independently the basic principles" of the subject under consideration (cited in Munyer, p. 43). Thus, a discovery room takes a theme from the museum's exhibitions and provides different learning modalities to investigate the subject in an active manner. It is important to note that while this official definition does not explicitly state anything about families, it implies factors that make the space successful for this demographic: it is for visitors of all ages, that is, multigenerational and it allows active participation.

Discovery rooms evolved out of earlier exhibitions designed for young learners and families at museums. According to Victor Danilov (1986), one of the earliest such exhibitions was the Children's Gallery at the Science Museum in London which opened in 1931, featuring interactive stations and models that visitors could manipulate (p. 6). Danilov (1986) found that in the United States one of the first exhibitions designed for the learning needs of children and families was Halls of Adventure at the Schenectady Museum in New York state, which opened in 1961 (p. 6). This exhibition featured everyday items broken down into their essential parts, inviting visitors to explore the

questions of how and why objects work. According to Danilov (1986), the popularity of this type of exhibition was soon followed by similar projects at the Children's Museum in Boston and the James Ford Bell Museum of Natural History in Minneapolis during the 1960s as well as the American Museum of Natural History's Discovery Room in the 1970s (p. 6). Danilov (1986) noted several common attributes of early discovery rooms: the activities were designed for "comprehension and interest level of young children," activities made "extensive use of hands-on techniques," and were "playful [and] enjoyable" (p. 7). Many early museums to include discovery rooms were science based, yet today museums of varied typologies feature discovery spaces.

Effective discovery room design alleviated possible staff concerns about object care. Often, museums own items that are of little monetary value or are easily replaceable. Using such specimens in a discovery room is an ideal use since they can be replaced if broken. By placing discovery rooms in a segregated location it is likely that visitors will understand that touching items is not acceptable in other museum areas. According to Edward Munyer (1982), visitors recognize this distinction as discovery areas are described as "much more inviting than the disciplined, quiet somberness of traditional halls" with the result that "hands-on rooms become minds-on rooms for children and family groups" (p. 44).

According to Hope Jensen Leichter, Karen Hensel and Eric Larsen (1989), museums adapted technologies such as "video presentations, computer games, large-screen film showings, and interactive" computer stations within discovery rooms as early as 1989 to present information by using new learning trends (p. 23). Justifying this trend, Marjorie Schwarzer (2001) stated that it has become impossible for museums to resist

incorporating technology into discovery rooms as “new technologies outside of a museum’s four walls alter how people process information inside the museum” (p. 6). Thus, the prevalence of technology in people’s lives has led many museum visitors to expect technology as part of their visit and has forced museums to adopt technologies to remain relevant. The incorporation of such technologies by museums can be problematic if the educational value of the technology was not considered. A study by Patrick Hughes in 2001 found that technological interactives demonstrate “little sign that they [visitors] were learning much” and “attracted less attention than traditional static exhibits” or physical interactives (p. 182, 184).

What is it about discovery rooms that make them so educational and enjoyable for families that they are still common features at museums almost fifty years after their first inception? The following case studies explore discovery rooms at museums of different typologies – the American Museum of Natural History in New York City, the Newark Museum in Newark, New Jersey, and the Smithsonian’s National Museum of the American Indian in New York City – to understand what is effective discovery room design, how learning theories are incorporated, and how to best facilitate an educationally engaging experience for families in museums.

Chapter 2

Family Units

In order to understand the educational potential of museums for family visitors, it is necessary to clarify the term family. Since the structure of a family can take many forms, museums must recognize the great variety of family units. While providing educational experiences for such a wide array of family visitors may seem a daunting task for museum staff, this can be a rewarding challenge, met by creating programming with multiple learning theories.

A unifying factor among families is that this social unit consists of at least one child being cared for by at least one older individual. Thus, an appropriate definition of family in a museum context is that of a child accompanied by an older caregiver, regardless of the biological or social relationship. This definition of family will be used throughout this paper. The caregiver's role in a family is to nurture the physical, emotional and intellectual development of the child. Sociologist Marvin Sussman describes several purposes of a family as to "socialize children," to provide "an environment for the development of identities and affectional response," to create "a mentally healthy environment intrinsic to the well-being of the family" and to enrich "life by enabling the family members to expand their intellectual and aesthetic horizons" (as cited in Wolins, 1989, p. 7). Families need environments that promote the healthy development of children and that nurture the family unit as a whole. Museums can meet this need with family spaces that are rooted in appropriate learning theories.

An effective way that museums foster family learning is through interactive learning spaces, such as discovery rooms or information zones. Discovery rooms may be

placed directly in exhibitions or in separate rooms, depending on the institution, and provide objects and activities that encourage family dialogue and learning.

Chapter 3

Studies on Families in Museums

Three studies on families in museums shed light on the importance of museums for family learning and the educational impact of such spaces.

In a literature review about family visitors, researchers Pat Sterry and Ela Beaumont (2006) found the primary reasons that families visit museums is for “entertainment and social reasons, but also to learn” (p. 225). Thus, while families may view a trip to the museum as enjoyable, they also value the educational benefit of such a trip. Furthermore, Sterry and Beaumont (2006) found that families prefer informal learning experiences; that is, “they want to learn without realizing it” and adults enjoy “learning from their children” while in the museum (p. 227).

Christine Brown (1995) found that parents took on different roles, either passive or active, while in a museum with children, and that a majority of parents observed “took little or no part in the hands-on activities” and were passive visitors (p. 68). When considering how children learn within a family group, uninvolved parents limited their child’s and their own learning potential from the visit. Thus, it is critical for museum family programs to engage all members of the family unit through program design. Brown (1995) concluded that museums should consider what “exhibits and experiences can involve parents more readily” and thus prevent passive adults (p. 71).

Patrick Hughes (2001) found that some museums were creating an overall feeling or “brand image ... as a site of family fun,” often at the expense of educational effectiveness (p. 178). While the aforementioned learning theories often revolve around the concept of interaction, it is important to note that not all interaction is educational. To

be truly educational, Hughes (2001) found that museum interactives need to create “reciprocity or mutuality between two elements, in which the action or behavior of one has an effect on the other” (p. 178). The museum must consider the educational outcome of their family programs as more important than the entertainment factor. Museums designing new discovery rooms may consider conducting their own front-end evaluations to learn what families in their community are looking for in a museum experience.

Chapter 4

Learning Theories

Several learning theories have potential to facilitate successful learning experiences for family visitors to museums. These learning theories provide a basis for museum discovery rooms, which use these theories to foster quality family interaction and education.

Discovery Learning Theory

A learning theory popular at museums is Discovery Learning, created by John Dewey in the early twentieth century. A progressive thinker, Dewey (1938) described his theory as “the idea that there is an intimate and necessary relation between the processes of actual experience and education” (p. 20). Melvin C. Baker (1965) explains that in Dewey’s theory, “the educative process begins from within” as an individual’s actions require the person to use critical thinking to make a decision (p. 24). In Dewey’s theory, actions and decisions are stored in memory with other experiences, resulting in learning that will be used in future situations. One of the key benefits of this theory is that it creates deep learning: Alison Grinder and E. Sue McCoy (1985) found Discovery Learning to be the “most successful in bringing about the highest levels of cognitive learning,” as well as promoting affective learning and skill acquisition, when implemented properly (p. 38).

A classroom example of Discovery Learning is a science experiment where students test the buoyancy of different materials to discover which items float in water. Dewey would argue that students are more likely to understand and remember

information they discover themselves, rather than if they had to memorize the buoyancy of objects by reading a textbook or through a lecture.

Discovery Learning has noticeable parallels with the educational theory of educator Maria Montessori. Montessori believed that all children, even the very young, were intelligent in a unique way that differed from the intelligence of adults. According to Carolyn P. Edwards (2006), Montessori agreed with John Dewey that children learn through actions or “Practical Life Exercises,” such as “washing, pouring, polishing, typing and buttoning” (p. 184). This is emphasized by Montessori’s belief that education should be rooted in concrete, rather than abstract, contexts.

Dewey’s writing clarifies his theory and reinforces the educational value of museums for families. *Democracy and Education* (Dewey, reprinted 2005) explains the philosophic reasoning behind his educational theory, beginning with the observation that “an ounce of experience is better than a ton of theory” (p. 86). This preference for experiential learning promotes family learning in museums, since it is natural for family members to interact with each other and exhibitions at a museum. Interestingly, the age disparity between family members enables Discovery Learning in museums by encouraging families to work collaboratively toward a single goal, with older caregivers providing assistance to younger learners.

Environmental design can promote this learning theory by encouraging an individual to undertake an active experience related to a theme or lesson; according to Baker (1965), an adult “must guide the child in problem-solving situations” for Dewey’s theory to be successful in such a setting (p. 24). Discovery Learning takes many forms in museums, such as: physical interactives, objects which can be handled, discovery tours

where the educator asks questions of the visitors, kits with parts that can be assembled and discovery rooms or similar family spaces.

Cognitive Development Theory

Also important for museums is Jean Piaget's Cognitive Development Theory, created in the 1920s. Piaget was one of the earliest psychologists to believe that the child's brain functions differently than the adult's. In order to prove this assertion, he studied emotional and intellectual development of children. As explained by Margaret Gredler (1992), Piaget viewed intelligence as "a broad enduring trait," which differs from learning, "a specific process" that contributes to the development of intelligence (p. 221).

According to R. B. Sund (1976), Piaget determined that a child has four stages of development: sensory-motor, preoperational, concrete-operational and formal-operational (p. 4). From birth through two years is the sensory-motor stage, when a young child develops the physical ability to interact with the world and with family members. In the preoperational stage, ages two through seven years, the child begins internal thinking, yet the thoughts are illogical and unconnected. Sund (1976) explains that a preoperational child can "think of past and future," but is not able to make rational associations between memories and the present (p. 10). According to Sund (1976), a child is in the concrete-operational stage from ages seven through eleven and thinks logically like an adult when thoughts connect to "actual objects" or concrete experiences (p. 11). The final phase is formal operations, ages eleven through fourteen years, during which abstract thinking becomes possible. Piaget (1970) believed that "the average age at which children go through each stage can vary considerably from one social environment to another" (cited in Sund, 1976, p. 5).

In classroom lessons, Piaget's theory has many different applications. For example, studying a foreign culture, such as Chinese, can be done according to Piaget's developmental levels. A teacher of pre-operational children could play active games from China with the students or take them on a field trip to a Chinese teahouse. Concrete-operational students could learn about China through reading stories of children in China and then comparing their own lives to those of the characters in the book. A class of formal operations students could discuss social issues in present day China and connect these issues to Chinese history. Each class will learn about Chinese culture but in a way that is appropriate for the age and mental ability of the students.

The role of the family is important in the process of intellectual development in this theory. Families that provide a child with engaging opportunities help the child's brain develop and enable the learner to progress quicker to the next stage, according to Piaget's theory. This is especially important during the concrete operations stage, when a child needs tangible objects and experiences to promote internal thinking ability.

William Crain (2000) found it critical for parents or older caregivers to "look closely at the child's actions, to learn from the child, and to be guided by the child's spontaneous interests" when using Piaget's theory, since the child will select experiences that are relevant, which will ultimately contribute to an understanding of the world (p. 120).

Socio-Cultural Learning Theory

Especially intriguing for museum education is the Socio-Cultural Learning Theory developed by Russian psychologist Lev Vygotsky in the early twentieth century. Vygotsky believed that social interactions are necessary to understand new knowledge and lead to learning. According to Falk and Dierking (2000), Vygotsky found that within

social groups “mediation was extremely rich,” leading him to theorize that all “higher mental functions have social origins and are first expressed between individuals before they are internalized within the individual” (p. 44). Gredler (1992) explains that by higher mental functions, Vygotsky means “logical memory, conceptual thinking and the self-regulation of learning” (p. 265). For example, in a family setting, adults interacting with a child help the child understand concepts that are beyond what the child could comprehend autonomously. In time the child will be able to synthesize information independently as a result of what was already learned in a social setting. According to Falk and Dierking (2000), Vygotsky deemed these groups socio-cultural learning groups, a primary example of which is a family unit, as evidenced by Vygotsky’s study of dyads, “particularly adults with children” (p. 44).

A common example of Vygotsky’s learning theory is how young children learn language by immersion. The child recognizes the connection between words and their associated objects as they hear the language spoken. A classroom example of socio-cultural learning theory is group work, where students work together with their peers to write an English paper or develop a history presentation. Since each student has a different level of knowledge, the group members will learn from each other through discussion as they work together on the assignment.

Social communication played a central role in Vygotsky’s concept of learning. According to Viven Golding (2004), who studied groups of adults with children meeting the basic definition of family, people have a *zone of proximal development*, a range between what they were able to learn on their own and what they could learn with the guidance of a more experienced individual (cited in Moffat, H. & Woollard, V., p. 58).

Golding (2004) also found that adults are able to guide children to complete more complicated tasks and “to think more deeply ‘with assistance’,” through verbal signals or what Vygotsky termed *scaffolding* (cited in Moffat, H. & Woollard, V., p. 58). As described by Falk and Dierking (2000), scaffolding is the “creation of processes and ideas between two or more individuals,” where one person uses these ideas to help the other person understand a new concept (p. 44). This often takes the form of questioning that helps a young learner reach a new realization on his or her own.

Multiple Intelligence Theory

Howard Gardner’s Multiple Intelligence Theory, developed in the latter part of the twentieth century, is also relevant to family programs in museums. This theory describes the several different ways people learn, each of which is “a unique cognitive style for understanding the world,” as explained by George Hein (1998, p. 165). These different modalities, deemed intelligences, are: linguistic, musical, logical-mathematical, spatial, bodily-kinesthetic, interpersonal and intrapersonal (Hein, 1998, p. 165). Every person is able to use all the intelligences, but as individuals develop they gravitate towards certain intelligences, which can manifest themselves as talents or career choices. According to N. Gage and David Berliner (1998), each intelligence is “distinct” and only “slightly correlated or interdependent” to the others (p. 75). According to Harvey Silver, Richard Strong and Matthew Perini (1997), Gardner’s intelligences are “not abstract concepts, but are recognizable through common life experiences,” which reinforces the belief in experience found in many of the learning theories mentioned in this paper (p. 24). Jeanne Ellis Ormrod (2008) believes that people “benefit when they are encouraged to think about a particular topic in several ways,” using different intelligences (p. 152).

Multiple Intelligence Theory is applicable to different subjects and for students of different ages. A classroom example about the stock market illustrates how the different intelligences could be used to teach a single area of study. Students can read about the stock market using the linguistic intelligence, compose songs inspired by the stock market using the musical intelligence, buy and sell imaginary stock using the logical-mathematical intelligence, create charts about stock prices using the spatial intelligence, enact a play about the stock market using the bodily-kinesthetic intelligence, create a group presentation about the stock market using the interpersonal intelligence, and write a journal entry about their personal feelings about the stock market using the intrapersonal intelligence. Each lesson does not have to use all the intelligences, but this example illustrates that there are different ways to teach the same information using Gardener's theory.

Since traditional schools focus on a limited number of intelligences, according to Gage and Berliner (1998), "other institutions," such as families and museums, "should be relied upon to cultivate the other kinds of intelligence" (p. 79). In addition, Gardner (2000) believes his theory is especially applicable to museums, where exhibitions can incorporate "materials that deliberately arouse and use a range of intelligences in a provocative mix" to reach more learners and to help visitors develop all their intelligences (p. 185).

Reggio Emilia Philosophy

Reggio Emilia, an Italian city where psychologist Loris Malaguzzi started a method of instruction in city schools, has become a model for other education systems around the world. This approach is used in early childhood education, or from preschool

through approximately first grade. Nancy Hertzog (n.d.) found that the basic principles of this theory are respect for the child, emphasis on relationships, art as a representation of thinking, importance of communication and a relaxed pace of education (p. 1-5). An important component of this theory is the emphasis on relationships rather than factual knowledge.

Reggio Emilia stresses the significance of providing a creative space as a learning environment, which is similar to a discovery room within a museum. According to Gandini, Hill, Cadwell & Schwall (2005), each classroom in Reggio Emilia has an attached art studio, known as an *atelier*, which is used for creative expression and ongoing exploration of topics chosen by the students (p. 2). Gandini, Hill, Cadwell & Schwall (2005) identified several principles of the *atelier* as:

Organizing rich experiences in the world and with materials alongside children. Wondering with children about what they see, think, and feel and how they make sense of experiences. Hypothesizing and posing new questions as adults and with children. Looking for and uncovering underlying or overarching ideas. Making meaning as adults and children through connecting experiences, ideals, materials, the culture of the school, and the wider community. (p. 2).

As Gandini (2005) explains, the *atelier* is a learning environment that encourages “specific and interconnected events, making it possible to transfer new knowledge acquired about form and content in the daily educational experience” (as cited in Gandini, Hill, Cadwell, & Schwall, p. 7). Students in Reggio Emilia are not hurried from one topic to the next but are allowed to change activities when they feel they are ready or have finished an earlier project. A museum employing this learning theory allows family members to learn from each other and their surroundings by providing a creative space for families to explore together.

Classroom examples of lessons using the Reggio Emilia approach are often loosely structured, allowing teachers to be guided by the spontaneous interests of the students. For example, if students express an interest in outer space, teachers may allow students to create paintings of outer space, enact a trip to the moon, build a space ship, or redesign the classroom so that the physical design resembles a different planet. Generally, the lesson will continue until students express that they have a new interest or until the topic has been explored in great depth.

Constructivist Learning Theory

Constructivism is based on Dewey's belief in active learning but extends this concept further. According to Ormrod (2008), constructivism is a process of learning as "learners take numerous, separate pieces of information and use them to create an understanding" of a topic (p. 195). Constructivism, as explained by Hein (1991), means that "learners construct knowledge for themselves ... as he or she learns" from experiences (p. 1). Janette Griffin and Lynn Baum, et. al (2007) explain that constructivism negates the belief that knowledge exists outside of an individual and instead teaches that all knowledge comes from within the learner and encourages individuals "to challenge assumptions and received knowledge" from outside sources (as cited in Falk, Dierking and Foutz, p. 163). According to Hein (1991), the form of constructivist lessons appears similar to discovery learning lessons by featuring "activities, with hands-on learning, with opportunities to experiment and manipulate the objects of the world;" yet, the goal is not to reach a predetermined result, but rather to reach personal conclusions and understanding (p. 1). As such, constructivism does not validate or invalidate a learner's conclusions.

Classrooms which use the constructivist approach allow students to work together to reach their own conclusions about a given topic. For example, if a class is studying ancient civilizations, a teacher using the constructivist approach may allow students to work on a recreated archaeological dig. After they have uncovered artifacts, students would each develop their own hypothesis about the objects and the culture they represent, with minimal guidance from the teacher. Students may talk to their peers to see if their conclusions might be altered by information that others have found or discovered.

Inevitably, constructivism alters how educators present lessons, either in classrooms or in museums. Constructivist education, according to Thomas Duffy and Donald Cunningham (1996), views “instruction as a process of supporting that construction [of knowledge] rather than communicating knowledge,” which emphasizes the importance of lesson design, or exhibition design in museums, rather than information transfer (p. 2).

Chapter 5

Relevance of Learning Theories to Museums

The aforementioned epistemologies all have relevant applications for family learning in museums and for discovery room design.

The Discovery Learning Theory is extremely relevant for family visitors to museums. As a basic unit of human society, families exist to promote both socialization and education, two concepts linked by Dewey as components of learning. Perhaps because they have others with whom to work towards a goal, researchers Adriana Briseño-Garzón, David Anderson and Ann Anderson (2007) found family members “are more likely to interact with exhibits for a longer time” than other museum visitors (p. 301). Thus, the family is determined to complete the necessary steps for learning when using the Discovery Learning Theory. Both adults and children benefit from becoming actively involved in discovery learning in a museum setting. In a 2007 study of the Vancouver Aquarium Marine Science Centre, the same researchers found that adults who visited with their families “learned in a multiplicity of domains including the cognitive, the social, and the affective,” proving that all members of a family group learn when visiting a museum (Briseño-Garzón, et. al., p. 299).

Piaget’s Cognitive Development Theory can be seen in museums where families interact together with new and stimulating objects to promote higher order thinking in children, since as Piaget wrote, “logic ... stems from actions” (as cited in Crain, 2000, p. 120). In this way, Piaget’s emphasis on action for healthy thought development reiterates John Dewey’s philosophy of experiential learning, which can be achieved in family

spaces in museums. Exhibition design can also promote Piaget's theory, especially when activities or information is geared towards several different developmental stages.

Well-formulated museum programming for families relies on Vygotsky's Socio-Cultural Learning Theory to ensure intergenerational interaction and to create a meaningful and educational experience. Falk and Dierking (2000) argue that "sociocultural facilitation of learning is a typical component of most museum learning," and is the reason why museum programs are educationally successful for a family audience (p. 46). This learning theory works well with families because members of family units are able to help each other learn by providing scaffolding and discussion.

Of importance for museums, according to Hein (1998), is Gardner's Multiple Intelligence Theory, which describes that humans possess "a range of unique cognitive forms for expressing thought and creativity and it argues for valuing all these forms," not only the traditional intelligences that are learned in school (p. 165). In a free-choice learning environment, such as a museum, the opportunity exists to allow expression in alternative intelligences. This ensures that learners with different abilities and preferences are able to thrive in a museum setting and that families, made up of several individuals with several intelligences, can all have an educational experience from a single museum visit when opportunities exist for using several intelligences in the exhibition. Thus, Hein (1998) advocates museum programming that will "provide opportunities for learning using maximum possible modalities both for visitor interaction with exhibitions and for processing information" (p. 165). Gardner (2000) himself has stated that his theory "has appealed to institutions that bear some resemblance to schools

– particularly museums,” which are less constrained than schools but still aim to educate (p. 65).

The successful instruction in Reggio Emilia, Italy, serves museums as a philosophical model for valuing a child’s interests and talents by providing opportunities to “learn, practice and apply techniques” that a child encounters in his or her daily life with family members, as educator Nancy B. Hertzog (n.d.) observed while in Italy (p. 4). The relaxed pace of education using this theory parallels the family experience at a museum, which is unlike a school program in that it does not have specific objectives within a preset timeframe. When a family visits a museum they do so on leisure time and can allow the child’s interests and abilities to guide the visit and activities.

Museums that employ Constructivist Learning Theory are especially well suited to family visitors because this theory allows families to work together to reach a conclusion connected to their lives. Seven design principles for a constructivist learning environment are explained by Peter C. Honebein (1996):

- (1) provide experience with the knowledge construction process, (2) provide experience in and appreciation for multiple perspectives, (3) embed learning in realistic and relevant contexts, (4) encourage ownership and voice in the learning process, (5) embed learning in social experience, (6) encourage the use of multiple modes or representation, and (7) encourage self-awareness of the knowledge construction process. (p. 11-12).

Of particular interest to museums designing areas for families are the principles of using multiple entry points, grounding actions in real-world context and the social nature of museum learning. Using these guidelines as the basis for museum family spaces is an effective way to encourage learning in this visitor demographic.

Chapter 6

Case Studies

Examining three discovery rooms in museums in the New York City metropolitan area sheds light on the educational impact of museum family spaces. The three museums considered have varied typologies, illustrating that discovery rooms can be implemented in museums with a wide range of subject matter. In particular, family education is encouraged through design incorporating several learning theories.

Discovery rooms at the American Museum of Natural History, the Newark Museum and the National Museum of the American Indian share several common features observed by the author. Each discovery room incorporates entry point objects, which grab visitors' attention, welcome visitors into the space and signal that the area is family-friendly. All three museums feature technology in their discovery rooms, albeit to different extents. Another shared feature of the case studies are physical interactives on topics related to museum exhibitions.

Furthermore, the author observed that these discovery rooms use similar exhibition design techniques. All three family spaces are separated from other museum galleries. Age-appropriate design for different developmental stages can be seen in each case study. All three museums use exhibition design to incorporate learning theories appropriate for families.

Despite these commonalities, the author believes each discovery room has unique features that link it to its larger institution. At the American Museum of Natural History, the Discovery Room is subdivided into different areas based on museum collections as well as age. Thus, the Discovery Room presents a comprehensive museum experience

for a younger audience. This room is always staffed by volunteers, who help teach scientific concepts to both adults and children.

At the Newark Museum, the family space relates specifically to one exhibition in the museum but tries to unite the art and science areas of the museum's collection. This space is not staffed and it is designed for adults to assist accompanying children. Both technological and physical interactives are used in this area. A printed family guide encourages families to interact in this area and look for related objects in other galleries.

The Haudenosaunee Discovery Room at the National Museum of the American Indian is a small space, yet features a great amount of information. This room was intended for use by both school groups and families and is only open when staffed. Many sides of Haudenosaunee culture are explored in this discovery room, attempting to fill a void in the museum's collection. Since there is little technology in this family space, the museum links the discovery room to the Interactive Learning Center, a nearby resource center open to the public.

American Museum of Natural History: Discovery Room

The Discovery Room at the American Museum of Natural History [AMNH] in New York City opened to the public in January of 1977. According to Malcolm Arth and Linda Claremon (1977), the Discovery Room had two goals: "providing visitors with hands-on experience with materials and artifacts and stimulating thoughtful questions" (p. 169). Several lessons can be learned from this early Discovery Room. In the development phase in the late 1970s, staff members tested prototypes of interactives and

arrived at several conclusions. According to Arth and Claremon (1977), testing demonstrated the following:

(1) Children and parents often did not read labels. (2) Parents sometimes read and/or summarized a label for the youngster. (3) Children over nine who read labels tended to read them alone. (4) Objects often were taken from a box at random, not in the order suggested in a direction label. (5) Some materials were consistently taken first; some were ignored entirely. (6) If something could be tried on, such as mukluks, it usually was. (7) Materials were generally handled carefully and returned to the correct compartment. (8) Time spent with each artifact was under two minutes unless there was an associated activity such as a pole/toss game, in which case it could extend to four minutes. (9) Parents appeared as involved as children with the contents. (p. 174).

Arth and Claremon (1977) found that creating a separate “intimate area” within “a major institution” helped to facilitate family interaction and learning (p. 169). It was also determined by Arth and Claremon (1977) that labeling should be kept to a minimum and that activities should include “maximum use of several senses” (p. 171).

According to Ann Prewitt (2009), Director of the Discovery Room, this space had become outdated by the early 1990s leading to a redesign of the Discovery Room (personal interview). The project took several years before reopening in a new location within the museum in 2001. Today, the Discovery Room is designed to complement the overall museum experience for families. According to the museum website (2009), the mission statement of the museum is “to discover, interpret, and disseminate – through scientific research and education – knowledge about human cultures, the natural world, and the universe” (American Museum of Natural History [AMNH]). According to Prewitt (2009), the Discovery Room covers all the content areas of the museum and simulates real science (personal interview). Furthermore, the Discovery Room allows visitors to imitate the activities of scientists who work in the museum. Prewitt (2009)

stated that the current Discovery Room has two goals: (1) to present the process of science in a way that children can enjoy and (2) to encourage visitors to become scientists while in the museum (personal interview).

Physical description. The Discovery Room is adjacent to the West 77th Street entrance and the Grand Gallery. According to Prewitt (2009), the new location is ideal for the Discovery Room, since this area is approximately 2,000 square feet and has several exterior windows, which allow natural lighting (personal interview). The room is separated from other galleries by glass doors. After entering the room, there is an information desk where a greeter welcomes families.

The Discovery Room has two floors: the first floor is for young children, exploring simple sciences, and the second floor is for older children, delving into more complex sciences. According to Prewitt (2009), each area of the Discovery Room has an entry point object that serves as an icon for that scientific field of study (personal interview). Prewitt (2009) explained the first floor is for children ages five through twelve and is divided into three distinct areas denoted by physical design (personal interview).

After passing the information desk, the first area focuses on Biodiversity. The entry point object for Biodiversity is a two-story replica of a Baobab tree, which has taxidermal animals and insects placed throughout the tree. In the center of this area is a table with several child-sized chairs, surrounded by open shelves containing books, games and handling objects.

To the right is an area about Anthropology, which is represented by the entry point object of an “authentic Kwakiutl totem pole carved at the Museum in 1992,”

according to the Discovery Room brochure (AMNH, n.d.). The Anthropology area is the only Discovery Room area that changes exhibitions on a regular basis, according to Prewitt (2009, personal interview). The display as of February 2009 features hats from around the world, puzzles of different cultures and related books.

The final area on the first floor of the Discovery Room is Paleontology, which is located on the far right of the room. Prewitt (2009) stated that the entry point object for this section is a fourteen foot long recreated *Prestosuchus* skeleton (personal interview). This *Prestosuchus* links with an authentic *Prestosuchus* skeleton on view in the museum's galleries. Children construct and deconstruct this dinosaur themselves – they are invited to pick replica bones from drawers and attach them to a base using magnets. Also on view are many fossil specimens and related books.

The second floor of the Discovery Room is reached by a staircase behind the information desk, or by a staff operated elevator. While the floors in the Discovery Room are carpeted, the stairs are covered with a slip resistant rubber. According to Prewitt (2009), the second floor is intended for children ages twelve and up (personal interview). The design of the second floor reflects the intended age group with larger furniture, more label copy, a subdued color palette and lower ceilings.

The area for older children includes more scientific technology than other areas of the Discovery Room. The first area for older visitors is about Seismology, featuring an operating seismograph connected to monitors to display recent earthquake activity. In the middle of this area is a table with a microscope attached to a monitor. As of February 2009, the microscope shows a slide of pond water and visitors are allowed to manipulate

the microscope to change the view. Nearby are an additional two microscopes with slides of rock crystals where visitors can compare crystal sizes.

The rear of the second floor is separated by two glass doors, which can be closed to allow privacy for staff. This area is known as the Resource Room and has advanced scientific books, reference materials, live specimens, a reading table and three computer terminals. According to Prewitt (2009), the museum included computer games and interactives only in the area for older children since staff believe younger children benefit more from physical interaction (personal interview). The computer programs allow visitors to group living organisms into different categories and to explore the relationship between species. Prewitt (2009) explained that visitors are allowed to handle the live specimens with the supervision of staff to investigate metamorphisms and adaptations in nature (personal interview).

Staffing. According to Prewitt (2009), staffing is vital to the AMNH's Discovery Room since the space is never open without a staff member (personal interview). Two full-time staff members cover the Discovery Room, although it is run mainly by volunteer facilitators. Prewitt (2009) explained that ideally four facilitators operate the Discovery Room and that the volunteer base trained for the Discovery Room is approximately fifty to sixty individuals (personal interview). Facilitators greet visitors at the door, ensure that materials are neatly arranged at the information desk and also monitor the condition of interactives. According to Prewitt (2009), if the Discovery Room is messy, visitors do not respect the space and handle interactives inappropriately (personal interview). Therefore, facilitators must ensure that the Discovery Room is always clean, tidy and well-organized.

Discovery Room staff is responsible for creating and maintaining exhibitions and interactives. According to Prewitt (2009), Discovery Room staff mount specimens and design interactive puzzles and games (personal interview). When an interactive or exhibit is worn or broken, Discovery Room staff repair the component, which Prewitt (2009) mentioned consumes a majority of the staff's time (personal interview).

Target audience. According to the Discovery Room brochure (n.d.), the primary audience for the Discovery Room is “families, and especially children ages 5-12.” Prewitt (2009) stated that families with older children can visit the second floor of the Discovery Room, but that this is a secondary audience (personal interview). Another audience for the Discovery Room is kindergarten through second grade school groups, who visit the Discovery Room on weekday mornings. According to Prewitt (2009) the Discovery Room was designed as an inquiry-based learning environment (personal interview).

Institutional identity. The Discovery Room is a well-known aspect of the AMNH and is closely linked to the rest of the museum. As stated in the Discovery Room brochure (n.d.), this family space functions as “a gateway to the wonders of the Museum and a hands-on, behind-the-scenes look at its science.” Thus, the Discovery Room is an orientation center for families to the museum's collections, which can be further explored by a visit to related galleries. Admission to the Discovery Room is free with general admission and hours follow the museum's operating schedule. Prewitt (2009) stated that the Discovery Room follows the New York City public school schedule and is open extended hours on school holidays (personal interview). Prewitt (2009) explained that

families are a major audience for the museum, and the Discovery Room is marketed to families through a brochure and the museum's website (personal interview).

According to Prewitt (2009), the Discovery Room was funded by outside donors, including charitable foundations and corporations (personal interview). Prewitt (2009) mentioned one downfall of using outside sources for funding: the museum did not ask for an endowment to fund the Discovery Room, making funds for upkeep and future projects uncertain (personal interview).

Special programs. The Discovery Room features two special programs, *Meet the Scientist* and *Gateway Story Hour*. *Meet the Scientist* is a bimonthly program that features scientists from the museum talking about their area of expertise. According to the Discovery Room brochure (n.d.), this program invites visitors to “find out how scientists become interested in their fields” and to “see some of the cool stuff they work with.”

A program for preschoolers and their adult companions is *Gateway Story Hour*, which runs Mondays during the school year. According to the Discovery Room brochure (n.d.), each session “highlights a topic in natural science or a cultural theme. There is a period of free play followed by a story, a song and a visit to a related Museum Hall.” Prewitt (2009) stated that these special programs were effective in teaching the scientific process and accomplishing the goal of the Discovery Room (personal interview).

The Newark Museum: Look/Touch/Learn: Nature & Art

The discovery area, *Look/Touch/Learn: Nature & Art*, is located in the Newark Museum whose mission statement is to “educate, inspire and transform individuals of all ages” using objects (Newark Museum [NM], 2009). This discovery room was designed to connect the museum’s two areas of concentration, art and natural science, and to coincide with the exhibition *Small But Sublime*, in an adjacent gallery. According to Ted Lind (2009), the Newark Museum’s Deputy Director for Education, the goal for *Look/Touch/Learn: Nature & Art* is to show visitors how science and art are connected to nature and the world around us (personal interview). The area’s interpretative plan (2007) describes the area’s main idea as “to help people look more closely at the beauty and structure to be found in the wilderness” and to “inspire us today to conserve and protect our natural resources” (p. 1).

Lind, the project director for the family space, has created several discovery rooms at other institutions and built upon this experience when planning *Look/Touch/Learn: Nature & Art*. Lind (2009) envisioned *Look/Touch/Learn: Nature & Art* to serve two functions: as a space for families to rest and orient themselves to the museum’s American art collection and to allow exploration of exhibition topics in greater depth and in a different way (personal interview).

Physical description. *Look/Touch/Learn: Nature & Art* is located on the first floor of the museum at the beginning of the American art galleries. It encompasses two rooms: a hallway and a connected room. According to Lind (2009), the total space measures approximately 700 square feet (personal interview). At the end of the hallway is a computer monitor with a rotating slideshow of natural scenes; this is the entry point

object because it is visually intriguing. Lind (2009) describes the technology in this space as a magnet to draw visitors into the area, since the second room cannot be seen from the entrance to the hallway (personal interview).

The design of this family space is distinguishable from that of the surrounding galleries. The two rooms are carpeted, whereas other galleries have tiled floors. Natural tones were used as the theme in this area, from the pale yellow and light green walls, to the deep natural wood finishes used for stools and frames, to the foliage designs along the edge of labels. The interpretative plan (2007) describes the physical design as “well-lit and inspired by the colors of nature” in order to “definitely communicate that it is a place to spend some time in a worthwhile way” (NM, p. 3). The master label is near the entrance to the first room from the American art galleries and welcomes visitors by explaining they are “invited to spend time to discover how the close observation of nature has inspired some artists to create art” (NM, n.d.). The first room features two computers with an immersive landscape that allows users to change the perspective and time of day of the scene. Next to the computers is a collection of touchable rock specimens, a taxidermal bird, and illustrations with interpretative labels.

The second room of *Look/Touch/Learn: Nature & Art* is more spacious and has several interactives. There are two lounge chairs near a bookshelf with reading material for children and adults. There is another taxidermal bird, as well as a taxidermal bobcat with a bobcat skull, and a moose antler mounted low on the wall so it can be touched. A low-tech interactive box has wooden shapes of various landscape components that visitors can arrange to create their own landscapes. In the interpretative plan (2007), the purpose of this interactive is described as “a manipulative that focuses on spatial depth

depicted in landscapes (foreground, middle ground, background) using sliding panels that represent features in nature” (NM, p. 3). A video of natural scenes is projected on a wall, which visitors are invited to sketch on paper mounted on two drawing boards with attached stools. Lind (2009) explained that this video projection would have been more effective if the resolution of the images were sharper, but that this was not possible because of the cost of a more advanced projector (personal interview).

A major component of the second room is an authentic, large Hudson River School landscape painting behind Plexiglas, *Summer Afternoon* by Sanford Robinson Gifford. Visitors are invited to use non-magnifying viewing tubes to look at tiny details in this artwork with an extensive question label nearby. As the space’s interpretative plan (2007) describes, the room is “moderately ‘youth-friendly’ but should not communicate that the space is only for children,” and therefore features objects intriguing to an older audience (p. 3).

Staffing. Look/Touch/Learn: Nature & Art is not staffed. There are gallery attendants positioned in other nearby exhibitions. Therefore, a staff person is never far away from the area, but is not trained for interpretation. Lind (2009) explained that staff is unnecessary, because the space is designed to be used independently by families (personal interview). Families are aided in this space by a written gallery guide that helps them interact and encourages them to look for related works in the museum. By using this gallery guide, Lind (2009) hopes that visitors will feel enabled to look at art in other galleries and to become more comfortable in museums in general (personal interview). Since this family space does not require a staff member, it is open regular museum hours, Wednesday through Sunday.

Target audience. The interpretative plan lists the primary audience for the space as “families with school age children (5 – 12 years old),” and the secondary audience as “school groups, teens, general adults” (2007, p. 1). To engage a family audience, Lind (2009) explained that the family space is designed to employ the Constructivist Learning Theory and the Multiple Intelligence Theory (personal interview). Many labels invite visitors to interact with exhibition components or to look closely at objects, but they do not force the visitor reach a predetermined conclusion or thought. Furthermore, the interpretative plan states that there are a variety of learning modalities in this area, such as “reading, low-tech hands-on, computer terminals, drawing/sketching” (2007, p. 3).

Institutional identity. According to Lind (2009), this family space bridges the two areas of the museum’s collection, art and science, and welcomes families into the galleries (personal interview). The creation of the space was a team effort involving staff from both the art and science departments of the museum. The funds came from the museum’s general operating expenses, specifically the exhibitions budget line. Lind (2009) estimated the cost at \$25,000, which he felt was inexpensive for an exhibition of this type (personal interview). The most expensive component was the development of the contracted immersive computer program, costing roughly \$7,000 (Lind, 2009, personal interview). According to Lind (2009), the success of this family space has received enough attention that a potential benefactor has expressed an interest in creating an endowment for interactive family learning areas at the Newark Museum (personal interview).

Furthermore, Lind (2009) stated that the museum is considering the creation of a similar discovery room near the main entrance to serve as an orientation area for families,

which would encourage the inclusion of more spaces like *Look/Touch/Learn: Nature & Art* throughout the galleries (personal interview). Currently, there is one other discovery space in the museum, *Tibetan Information Zone*, in the Tibet galleries, reflecting that families are a major audience for this museum and are part of the institution's branding.

Look/Touch/Learn: Nature & Art has been marketed to families via several outlets. It is listed on the museum's website and was featured in the summer 2008 edition of the Newark Museum's magazine, *Access*. The article, by Ted Lind (2008), cites the statistic that "40 percent of our [the Newark Museum's] visitors come with children under the age of 12," explaining the need for a gallery "to enhance the adult/child experience" (p. 3, 2). Within the museum, stanchion signs direct visitors to the area and the gallery is listed on the daily family programs brochure as a family-friendly gallery. In the interpretive plan (2007), the intended marketing message is listed as "visitors will have a hands-on and minds-on experience that brings to life the world of the 19th c. [sic] American artists who loved nature" (p. 1).

Observation study. The museum conducted an observation study of *Look/Touch/Learn: Nature & Art* on December 26 and 29, 2008 that revealed several findings about how families use this space. The Observation Study Summary (2009) reported that of 146 visitors in the space, 51 were children under the age of eighteen, and that the average group size was 2.76 people (NM, p. 1). The study (2009) also found that the object that visitors stopped at first was the monitor at the end of the first room, which was used by nineteen visitors (NM, p. 1). This indicates that the technological component is an effective entry point object, which was its intended use according to Lind (2009, personal interview). Furthermore, the study (2009) found that the object

used the most by visitors was the computer area, used by 34 visitors (NM, p. 2).

Following the computer stations, the researchers (2009) found that the second most popular component was the introduction wall label, used by 30 visitors, followed by the touchable rocks and minerals, used by 19 visitors (NM, p. 2).

It is worthy to note that those conducting the study observed there were different levels of family interaction while in *Look/Touch/Learn: Nature & Art*. For instance, “adults with school age children seemed to appreciate the two sofa chairs for a moment of respite” while the children interacted independently with the exhibition (NM, 2009, p. 2). Similarly, the researchers observed that “most children explored on their own,” even though some families were engaged as a unit, such as “sketching side by side or taking turns to place pieces on the 3-D landscape model” (NM, 2009, p. 2). Length of time spent by 31 visitors was 15 minutes or less in the area, although 11 visitors spent between 15 and 30 minutes (NM, p. 1). Lind (2009) explained that since this space and its corresponding gallery, *Small But Sublime*, have been well-received by visitors, the length of time both the exhibition and the discovery area *Look/Touch/Learn: Nature & Art* is open to the public has been extended (personal interview). Furthermore, Lind (2009) stated that *Look/Touch/Learn: Nature & Art* will remain open after the temporary exhibition closes because of its connection to permanent galleries (personal interview).

As part of the observation study, visitors were invited to participate in a written questionnaire. A significant question on this survey (2009) was, “In your opinion, how valuable are ‘interactive’ learning areas such as *Look/Touch/Learn: Nature & Art* to your overall museum experience?” (NM, p. 3). The survey (2009) found that “extremely was cited by 5” and “very was cited by 3” out of 10 respondents (NM, p. 3).

National Museum of the American Indian: Haudenosaunee Discovery Room and Interactive Learning Center

The National Museum of the American Indian in New York City [NMAI] is part of the Smithsonian Institution and is one of three locations in the United States. The New York City branch, the first of the three institutions, is discussed in this case study. The NMAI was founded in 1989 with the mission of “preservation, study, and exhibition of the life, languages, literature, history and arts of Native Americans,” according to the museum’s website (National Museum of the American Indian [NMAI], 2009). There are two related areas of interest at the NMAI for this study, the Haudenosaunee Discovery Room and the Interactive Learning Center.

Staff person Stephanie Betancourt (2009) explained that the idea for a discovery room resulted from the museum’s first exhibition as part of the Smithsonian Institution (personal interview). The exhibit featured a section on the Iroquois, popular among visitors since the tribe is from the New York State area. Betancourt (2009) mentioned that it was not until after this exhibition closed that the museum realized their other exhibitions were lacking information about local Natives (personal interview). Visitors, especially families of school aged children, expressed interest in these tribes as the tribes are covered in the New York State, New Jersey and Connecticut learning standards.

Betancourt felt it was imperative that the museum incorporate the story of local Natives into their exhibitions. The solution was for the museum to create a discovery room focusing on the Northeast Woodlands Indians. According to Betancourt (2009), the discovery room has two goals: (1) to highlight nations that are less well-known and (2) to show Natives as living cultures (personal interview).

The Haudenosaunee Discovery Room is located on the second floor of the museum, near the Interactive Learning Center. It is at the end of a hallway, adjacent to a classroom. During the planning phase, museum staff collaborated on what subjects to cover within the discovery room. Originally, Betancourt (2009) had hoped to cover the entire Northeast Woodlands Indians; however, this was not possible because of the limits of the space and the great diversity in these tribes (personal interview). Museum staff decided to focus on the Iroquois Confederacy, Haudenosaunee in the native tongue, and specifically the Seneca Nation. Betancourt (2009) explained that this choice was one of practicality: the museum staff had the most Native contacts within the Seneca Nation, thus allowing for the most accurate depiction of this culture (personal interview).

Physical description. According to DeGennaro (2009), another staff member, the Haudenosaunee Discovery Room is 295 square feet with a single entrance and no visible windows (personal interview). The information inside the discovery room is presented on large text panels, chunking the information into smaller sections based on themes. Accompanying objects or interactive components are placed near the wall panels on low-level shelving, drawers or in baskets. In the center of the room is a three-sided freestanding panel that creates a circular path around it and through the room. Topics covered in this space are: the Seneca Nation's history, wampum and trade, traditional housing, seasonal activities, ironworking, games and the Seneca people in modern times.

Since this room was designed specifically for school aged children, either as part of a school group or accompanied by family members, many features of the room are directed to young learners. The entry point object that catches visitors' attention is a life-size image of a Seneca girl, to the left of the doorway. Her caption reads:

Nyaweh Skannah, or Greetings! My name is Angel and I am Seneca. I am Heron Clan. I am Haudenosaunee. Come along with me and learn about the Haudenosaunee. (NMAI, n.d.).

Angel is dressed in what Betancourt (2009) described as “street clothes,” simple jeans and a t-shirt, which allows visitors to relate to the Native girl, as well as to understand that Native cultures are alive today and have assimilated with American culture (personal interview). Angel reoccurs in the discovery room to guide visitors. The text is a first person narrative from Angel’s point of view (Betancourt, 2009, personal interview).

Functional design elements ensure a visitor-friendly space. There is ample lighting from both track lighting and spotlights, which makes it easy to read the labels and clearly view the objects. Cool, natural tones are used throughout this room’s design. Walls and text panels are a combination of tan, pale blue and pale green. The flooring is a combination of two surfaces: the right section of the room has a pale wood floor, while the left half of the room has beige, rubber flooring with a raised texture. While the room is small, the setup of the text panels helps the visitor navigate through the space without feeling confined or “overwhelmed,” according to Betancourt (2009, personal interview). Betancourt (2009) expressed that the design of the discovery room was compliant with all accessibility standards (personal interview).

The Haudenosaunee Discovery Room features interactive components, both physical and technological. Visitors can handle authentic American Indian artifacts, such as a wampum belt and animal pelt. The original design for the discovery room included space for a monitor to show films or multimedia presentations. However, Betancourt (2009) stated that due to rising costs, this technology was not included (personal interview). This space remains empty today, but because it is in a corner near the door, it

is not a glaring void. The museum was able to incorporate technology in the discovery room by using a television and DVD player on a rolling cart. Betancourt (2009) is pleased with this, because the museum can roll the video into the hallway so that large groups using the discovery room can be split in half, as the maximum group size allowed in the room is 15 (personal interview). On days that the discovery room is open to the public and families, Betancourt (2009) mentioned the video cart is anchored outside the discovery room in the hallway, as a means of luring visitors within (personal interview). Currently, *Snowsnake: Game of the Haudenosaunee* is the only video that has been produced for the discovery room. Betancourt (2009) explained that there are plans to make three additional films for the discovery room (personal interview).

Staffing. The NMAI only opens the Haudenosaunee Discovery Room when there is a staff person in the room. Betancourt (2009) explained this is especially important with school groups, who require an educator's guidance and scaffolding to learn all the concepts in the discovery room effectively (personal interview). Whenever possible, the museum strives to have Native American interpreters in the discovery room, for a personal view and as the best resource for visitors' questions, according to Betancourt (2009, personal interview). Unfortunately, staffing is an issue for the NMAI and the discovery room hours have recently been reduced accordingly. Ideally, Betancourt (2009) explained that the discovery room hours would correspond with the hours of the museum, which is open every day except Sunday (personal interview).

Target audience. The target audience for the Haudenosaunee Discovery Room is school aged children, especially fourth graders, accompanied by teachers or families. This audience was chosen because the core curriculum standards in the surrounding states

feature the study of Native Americans in the fourth grade. Betancourt (2009) explained that the room is designed for this age; for example, low shelves and baskets are within children's reach (personal interview). The interests of this age group were considered when selecting what stories to tell about the Seneca Nation and influenced such selections as cornhusk dolls and Native sports. The museum included design elements for older visitors as well, especially in label copy, which contains more detailed information geared for adults. Thus, the role of the accompanying adult is to help the younger learner make sense of all the information presented through dialogue related to the interactive experiences of the child.

Institutional identity. The Haudenosaunee Discovery Room was created to fill a void in the NMAI's collections about Northeast Woodlands Indians. Thus, Betancourt (2009) sees the discovery room as a logical fit within the larger museum (personal interview). However, it was hard to receive the initial funding for the creation of the discovery room, according to Betancourt (2009, personal interview). Funds did not come directly from the Smithsonian Institution; the startup funds were provided by the government and other private foundations. The project was over budget with a total cost of approximately \$97,000, not including the cost of staffing or objects, according to Betancourt (2009, personal interview).

The NMAI promotes the Haudenosaunee Discovery Room in a variety of ways. Since this room is popular with school classes, it is included in the Education Department Brochure sent to schools, as well as general museum literature. Information about the discovery room is on the museum's website and in the Community and Constituent Services Department Guide, both of which are more likely to reach potential family

audiences. Betancourt (2009) explained that the rest of the exhibitions at the NMAI are not family or youth oriented and that the discovery room provides a place where such visitors can feel comfortable and welcomed by the institution (personal interview).

Interactive Learning Center. Supplementing the Haudenosaunee Discovery Room is the Interactive Learning Center, which features books, handling objects, discovery boxes and computers for all visitors to use. The goal of the Interactive Learning Center is, according to DeGennaro (2009), “to document Native people in their everyday lives,” and to show visitors that Native culture is ongoing (personal interview). The room is open the same hours as the NMAI and no credentials or prior appointments are necessary to visit (NMAI, 2008). Gaetana DeGennaro (2009), Manger of the George Gustave Hye Resource Center, explained that the center started out as a small table of books related to the exhibitions for visitors who wanted more information (personal interview). Technology added to the Resource Center in 1994 quickly became obsolete and was replaced by what is currently at the museum.

The Interactive Learning Center features four computer workstations with authentic Native objects and books placed around the computers. Each computer has two chairs; DeGennaro (2009) feels this setup encourages group use and interaction (personal interview). Resources assessable on these computers include: exploring an exhibition topic, finding information about the Resource Center and the NMAI, a virtual coloring activity, visiting the NMAI website, listening to Native music and hearing Native languages spoken. DeGennaro (2009) stated that the main audience using the Interactive Learning Center are schools but that families do use the space, primarily on weekends (personal interview).

DeGennaro (2009) stated that the NMAI plans to upgrade and replace all the technology in the Interactive Learning Center within the next few years, depending on funding (personal interview). The goal of this renovation is to make more resources accessible on the computers. While the Haudenosaunee Discovery Room currently functions as a separate space, DeGennaro (2009) would like to see more coordination in the content and lessons of the discovery room and Interactive Learning Center in the future (personal interview).

Chapter 7

Application of Learning Theories to Case Studies

The three case studies illustrate that discovery rooms are carefully designed to encourage education. Both the physical design of the exhibition as well as design of interactives and activities is an important way to incorporate several learning theories. Research conducted at various museums demonstrates that exhibition design often involves learning theories, reinforcing the author's observations of these case studies.

According to Grinder and McCoy (1985), museum discovery rooms are informal learning environments, where "learning occurs all the time, consciously and unconsciously, through observation, and experience" (p. 44). Informal learning environments are places where the visitor is in control of what objects to view or activities to participate in. Since the visitor is in control, it is imperative for the museum to "encourage visitors to interpret exhibitions for themselves and help them gain knowledge on their own," through intentional exhibition design using several learning theories, according to Grinder and McCoy (1985, p. 44). Furthermore, Claudia Haas (2007) states that intentional discovery room design can "allow exploratory learning and facilitate child-parent communication" (as cited in Lord, B., p. 72).

Rita Frank (1992) states that the major role of the "exhibit developer is to create an environment that helps people construct optimal representations," or personal understandings about the exhibition (as cited in American Association of Museums, p. 56). One strategy for making concepts understood is the inclusion of learning theories in the exhibition's design. According to Lucia Pierce (1992), it is important for exhibitions to be designed using different learning theories since "there are different ways of getting

the information out” (cited in American Association of Museums, p. 9). Meredith Davis, Peter Hawley, Bernard McMullan and Gertrude Spilka (1997), found that the design of a learning space “plays a key role in ... any active, project-based learning,” such as occurs in museums (p. 94).

Incorporating technology in discovery rooms also requires a careful design to ensure a learning experience. A research study conducted by Flavia Sparacino, Kent Larson, Ron MacNeil, Glorianna Davenport, and Alex Pentland (n.d) found that allowing visitors to interact with and manipulate technology, “derives from the constructivist nature of the interactive experience. Empowering the public with the ability to cause” a change “enriches the learning with an actual experience and stimulates memory and curiosity” (p. 2).

The following design elements and activities show how learning theories have been incorporated into the discovery room case studies, as observed by the author.

Discovery Learning Theory

Discovery Learning Theory can be encouraged through exhibition design, according to Sue Allen (2007), who found that “it is, in fact, possible to create exhibition environments where visitors are simultaneously in a constant state of free choice and in the process of learning,” while in a museum environment (cited in Falk, Dierking & Foutz, p. 44). At the American Museum of Natural History, an activity in the Biodiversity area incorporates Dewey’s theory. This game features insects in plastic cases that must be placed in the proper location on a board, demonstrating scientific classification. Each container is a different size so that each will fit in only one space on the board. Therefore, although families may solve this puzzle completely on their own,

there is only one proper answer, which has been predetermined for them by the Discovery Room staff who designed this project.

In *Look/Touch/Learn: Nature & Art* at the Newark Museum, an exhibition component featuring different rock specimens allows visitors to examine the rocks by touch. There are several comparison questions nearby on the wall, which encourage visitors to feel the different rocks to discover the answers on their own, but again are led to a predetermined solution through the questions.

At the National Museum of the American Indian, a popular game in the Haudenosaunee Discovery Room is a seasonal matching wheel, which demonstrates that certain Native chores or pastimes only occurred during certain seasons. This activity uses Discovery Learning Theory as visitors are free to match any activity with any season. However, the correct answers are labeled and the background colors of different game pieces only correspond with the color of the appropriate season.

Cognitive Development Theory

Piaget's theory is most recognized in the use of age-appropriate activities for learners at different developmental stages. According to Dierking (1992), museums employ this learning theory "when they teach visitors how to ...read an object," a basic function of hands-on family spaces, which employs more advanced thinking (cited in American Association of Museums, p. 27). Another way that Piaget's theory can be seen in discovery rooms is through the use of entry point objects, which, according to Frank (1992) function as "landmarks," which are "especially important to children" who are still developing their notions of space (as cited in American Association of Museums, p. 62). Frank (1992) continues that without entry point objects "young children may be

literally lost in space” requiring museum exhibition designers to “think carefully about the salience of landmarks for children” (p. 62). For children in the concrete stage of thinking, entry point objects are tangible items that enable learning.

The use of the Cognitive Development Theory is widespread at the American Museum of Natural History’s Discovery Room, which uses entry point objects and also has a separate area especially for the needs of older children and adults. This allows the museum to present involved scientific concepts to more advanced learners, as well as to ensure that all families can find something in the Discovery Room appropriate for them. For example, in the area for older children, visitors can independently create microscope slides and view them using advanced microscopes. The amount of space dedicated to the needs of children at older developmental stages demonstrates that discovery rooms are also effective at educating older children and adults.

At the Newark Museum’s family space, different activities are incorporated for a wide range of ages and developmental levels. The activity geared to the youngest age group is a box where visitors can arrange wooden shapes to create a landscape. Another station for younger visitors is a touchable rock and mineral box that encourages visitors to feel and compare surface textures of the specimens. One example of an activity for an older developmental stage is the close observation of a landscape painting, where the visitors can use a viewing tube to find specific details in the artwork. Furthermore, visitors who sketch the projected images of nature are using higher-order cognitive skills. An array of books features works for visitors of all ages and interest levels mixed together on an open bookshelf. Books are a key way to stimulate visitors’ imaginations in a manner appropriate for varying age and developmental levels.

Piaget's theory can also be seen in the design of the National Museum of the American Indian's discovery room. Examples of activities for a young age group are an activity using blocks to construct a design and authentic dress-up clothes. Older children can appreciate the video about the game of Snovsnake or use the related computer games in the Interactive Learning Center.

Socio-Cultural Learning Theory

Socio-Cultural Learning Theory has been studied as a major way that families learn from museums. Kristen Ellenbogen, Jessica Luke and Lynn Dierking (2007) state that research has been done to "identify the characteristics of exhibits that encourage family interaction," proving that there is a "correlation between families' physical and verbal interactions and their learning" (as cited in Falk, Dierking and Foutz, p. 21). Thus, the more exhibition design requires families to interact, the more likely related conversations leading to learning will take place. Cathleen Donnelly (2007) suggests that exhibition designers "write labels to be read aloud – either between a parent and a child or a sibling and a sibling" in order to best facilitate socio-cultural learning in family units (as cited by Ellenbogen, Luke, & Dierking, in Falk, Dierking, and Foutz, p. 28).

At the American Museum of Natural History, Vygotsky's Socio-Cultural Learning Theory and concept of scaffolding can be observed in questions inside discovery boxes as well as questions that facilitators ask visitors. According to Prewitt (2009), it is important that facilitators model how to interact with young learners in the space for adults, but that facilitators should not try to control the family's experience (personal interview). This theory is best witnessed in the Seismology area, where Prewitt (2009) stated that adults become the most engaged with younger learners at this station

(personal interview). There are also several books on the second floor written for an adult audience, who can then explain the concepts to children.

In the family space at the Newark Museum, a family guide to *Look/Touch/Learn: Nature & Art* encourages the use of the Socio-Cultural Learning Theory among family units. This is especially important in this case study because there is no staff in this family space. Direct scaffolding questions for adults to pose to children are included in the brochure, as well as other activities that can be completed together in nearby galleries.

At the National Museum of the American Indian, Vygotsky's theory is included through the use of Angel's narrative voice, a Seneca girl who talks about her family. As she speaks of her heritage, visitors may think of their own ancestors and speak about their family, which will prompt socio-cultural learning discussions and help visitors process the exhibition information. This theory is also demonstrated in the wall labels, which are written for an adult audience, who then explain these concepts to the children they are accompanying.

Multiple Intelligence Theory

At the Discovery Room at the American Museum of Natural History, several of Gardner's intelligences are used in exhibition design. Prewitt (2009) explained that scientific classification is an organizing theme in the Discovery Room and the Biodiversity area has a chest of drawers from which children can pick objects that can be grouped together based on several criteria (personal interview). This emphasis on classification utilizes the logical-mathematical intelligence. Additionally, visitors use the intrapersonal intelligence when they take on the role of scientist to experience scientific principles firsthand, such as when visitors construct the *Prestosuchus* skeleton.

Furthermore, constructing the dinosaur skeleton allows visitors to use the bodily-kinesthetic intelligence as physical actions help them to understand how the skeleton fits together and is constructed. Since the Discovery Room is always staffed, the interpersonal intelligence is used as staff members interact with visitors and when members of family units interact with each other.

In the family space at the Newark Museum, the linguistic intelligence can be seen in the selection of books that visitors can read. Visitors use their spatial intelligence through looking closely at a landscape portrait with a simple viewing tube and also by constructing their own landscape with background, middle ground and foreground. Another use of the spatial intelligence is the activity where visitors sketch from photographs. A display of pressed leaves and plants encourages visitors to use their logical-mathematical intelligence as they observe how these objects are scientifically classified and relate to each other. The interpersonal intelligence is used when visitors interact with others in their group, which is encouraged by the activities in this discovery room's family guide.

The National Museum of the American Indian's discovery room uses Gardner's multiple intelligences as well. The bodily-kinesthetic intelligence is used through the ability to dress up in Native American clothing and thus take on the imaginary role of a Native. The interpersonal intelligence is used as visitors learn about and experience a culture different from their own, which allows them to compare it to their personal experience. The musical intelligence is important in the Interactive Learning Center, where different Native folk music can be listened to and compared.

Reggio Emilia Philosophy

By the nature of the exhibition design, all three discovery rooms use principles illustrated by the example of classrooms in Reggio Emilia. The case studies were all distinct spaces within the museum that are less restrained than traditional museum galleries, similar to the creative spaces found within the Italian classrooms. Furthermore, visitors inside these discovery rooms are allowed to spend as little or as much time on a topic as they wish. Authentic objects are also a major component of both the discovery rooms observed and the Reggio Emilia model. Also important in the Reggio Emilia approach is the use of age-specific lessons and materials. This principle is demonstrated in the American Museum of Natural History's Discovery Room and its areas for children of different developmental stages.

Constructivist Learning Theory

Peter Honebein (1996) outlined several design principles for encouraging constructivist learning, which can be applied to museums. Honebein (1996) explains that visitors must be given the freedom of "determining the topics or subtopics in a domain they pursue," which is true in all three case studies, since they are free choice learning environments (p. 11). Furthermore, Honebein (1996) states that "rather than the teacher determining what students will learn, students play a strong role in identifying their issues and directions, as well as their goals and objectives" (p. 12). In a museum setting, this translates to visitors creating their own meanings from their experiences, instead of having a predetermined realization embedded into a museum activity.

Some exhibition elements at the American Museum of Natural History used the constructivist approach. For example, microscopes where families are free to change the

slides as they wish had no structured outcome. Also, the chance to observe and handle live animals did not have a didactic goal either; visitors are free to make what they wish of this experience.

At the Newark Museum, an activity where families can draw what they see projected is a constructivist setup, since it does not require visitors to draw anything specific. As the projected image rotates, visitors do not feel constrained to draw exactly what is shown, but rather to create their own images.

The National Museum of the American Indian uses Native American dress up as a constructivist experience, since visitors can combine any articles of dress they wish, and they are not guided as to how a traditional Native would dress. Furthermore, in the Interactive Learning Center, a computerized drawing activity allows visitors to use any color on any object in anyway they wish, which again is a constructivist approach as traditional Native use of color is not encouraged.

Conclusion

Museums have historically been, and continue to be, a major destination for families. Families expect an enjoyable visit at a museum, yet the museum experience can be much more profound for families. Museums provide a unique setting for families to learn together in meaningful ways. An effective way that museums can educate a family audience is through a discovery room.

This thesis explored three case studies of museum discovery rooms to demonstrate that these spaces do have educational value for families. The American Museum of Natural History, the Newark Museum and the National Museum of the American Indian in New York City each created a successful discovery room that educates families. Family learning is encouraged through the intentional incorporation of learning theories into the physical design of the space and associated interactives. Common design principles observed by the author, which are important to fostering an effective learning environment, are:

- physically separating the space for visitor comfort,
- use of prominent entry-point objects to engage visitors' curiosity,
- incorporation of physical and technological interactives,
- family-friendly physical design, including: carpeting, nonslip flooring, objects placed at children's level, activities for different age groups, and seating for both adults and children.

The author believes that the case studies are effective because each uses several learning theories. Discovery room design incorporates learning theories in order to guide family interaction using different epistemologies. Learning theories observed at the

American Museum of Natural History, the Newark Museum and the National Museum of the American Indian in New York City include the Discovery Learning Theory, the Cognitive Development Theory, the Socio-Cultural Learning Theory, the Multiple Intelligence Theory, the Reggio Emilia Philosophy and the Constructivist Learning Theory. By using a wide range of learning styles, museums ensure that all visitors will find areas or activities within the discovery room that appeal to their personal learning preferences. Inclusion of activities for varying developmental levels shows that discovery rooms provide an important educational experience for older children and adults as well as younger children. This is especially important in family units made up of several individuals of different ages with different learning styles.

Despite the compelling argument for discovery rooms, the case studies reveal several shared concerns, which provide cautionary guidelines for museum professionals. The availability of space for the discovery room was an issue discussed by both the American Museum of Natural History and the National Museum of the American Indian in New York City. The importance of funding was discussed by all three museums, with the best advice given by the Newark Museum, which is to create an endowment to fund not only the creation of the discovery room, but to ensure its continued upkeep and operation. Another concern mentioned by all three case studies is the difficulty of having a discovery room staffed. The American Museum of Natural History and the National Museum of the American Indian in New York City find staffing imperative for family learning in the discovery room, yet a lack of volunteers can affect the discovery room's availability. Staff at all three museums mentioned issues related to the cost and inherent

obsolescence of technology. Nevertheless, the three discovery rooms incorporated technology because visitors expect and enjoy using computers at a museum.

In order to continue attracting families, museums must meet the needs of this demographic, which can be done through a discovery room. Discovery rooms are welcoming museum spaces for families that orient families to the overall museum experience. It has been the goal of the author for museum professionals to see the educational value in discovery rooms as evidenced by the case studies presented in this paper. In the words of Edward Munyer (1982), discovery rooms are a proven way for a museum to facilitate “family learning,” which “happens every day in every discovery room in every museum fortunate enough to have one” (p. 45). Hopefully, additional museums will be inspired to create discovery rooms using learning theories in the design, allowing more families to have educational experiences at museums.

References

- Allen, S. (2007). Exhibit design in science museums: Dealing with a constructivist dilemma. In J. Falk, L. Dierking, & S. Foutz (Eds.), *In principle, in practice: Museums as learning institutions*. (pp. 43-56). New York: AltaMira Press.
- American Association of Museums. (1992). *Excellence and equity: Education and the public dimension of museums*. Washington D.C.: the American Association of Museums.
- American Museum of Natural History. (2009). *Mission statement of the American Museum of Natural History*. Retrieved January 7, 2009, from <http://www.amnh.org/about/mission.php>
- American Museum of Natural History. (n.d.). *Discovery room at the American Museum of Natural History* [Brochure].
- Arth, M., & Claremon, L. (1977). The discovery room. *Curator*, 20(3), 169-180.
- Baker, M. C. (1965). *Foundations of John Dewey's educational theory*. New York: Atherton Press.
- Briseño-Garzón, A., Anderson, D., & Anderson, A. (2007). Adult learning experiences from an aquarium visit: The role of social interactions in family groups. *Curator*, 50(3), 299-318.
- Brown, C. (1995). Making the most of family visits: Some observations of parents with children in a museum science centre. *Museum Management and Curatorship*, 14(1), 65-71.
- Crain, W. (2000). *Theories of development*. New Jersey: Prentice Hall.
- Danilov, V. (1986). Discovery rooms and kidspace: Museum exhibits for children. *Science and Children*, 23, 6-11.
- Davis, M., Hawley, P., McMullan, B., & Spilka, G. (1997). *Design as a catalyst for learning*. Virginia: Association for Supervision and Curriculum Development.
- Dewey, J. (1938). *Experience & education*. New York: Kappa Delta Pi.
- Dewey, J. (2005). *Democracy and education*. Stilwell, KS: Digireads.com Publishing. (Original work published 1916)
- Dierking, L. (1992) *A historical survey of theories of learning*. In American Association of Museums (Ed.), *The audience in exhibition development*. (pp. 24-28). Washington D.C.: American Association of Museums.

- Dierking, L. D., Kiihne, R., et al. (2006). Laughing and learning together: Family learning research becomes practice at the USS Constitution Museum. *Museum News*, 12-15.
- Duffy, T. M., & Cunningham, D. J. (1996). *Constructivism: Implications for the design and delivery of instruction*. Retrieved January 24, 2009, from Educational Resources Information Center (ERIC) database.
- Edwards, C. P. (2006). Montessori education and its scientific basis. *Applied Developmental Psychology*, 183-187.
- Ellenbogen, K., Luke, J., & Dierking, L. (2007). Family learning in museums: Perspectives on a decade of research. In J. Falk, L. Dierking, & S. Foutz (Eds.), *In principle, in practice: Museums as learning institutions*. (pp. 17-30). New York: AltaMira Press.
- Falk, J. H., & Dierking, L. D. (2000). *Learning from museums: Visitor experiences and the making of meaning*. New York: AltaMira Press.
- Frank, R. (1992). The development of spatial knowledge: Children to adults. In American Association of Museums (Ed.), *The audience in exhibition development*. (pp. 56-67). Washington D.C.: American Association of Museums.
- Gage, N., & Berliner, D. (1998). *Educational psychology*. New York: Houghton Mifflin Company.
- Gandini, L., Hill, L., Cadwell, L., & Schwall, C. (2005). *In the spirit of the studio: Learning from the atelier of reggio emilia*. New York: Teachers College Press.
- Gandini, L. (2005). From the beginning of the atelier to materials as languages: Conversations from Reggio Emilia. In L. Gandini, L. Hill, L. Cadwell & C. Schwall (Eds.), *In the spirit of the studio: learning from the atelier of Reggio Emilia* (pp. 6-15). New York: Teachers College Press.
- Gardner, H. (2000). *Intelligence reframed: Multiple intelligences for the 21st century*. New York: Basic Books.
- Golding, V. (2004). Working with diverse communities. In H. Moffat & V. Woollard (Eds.), *Museum & gallery education: A manual of good practice* (pp. 56-68). New York: AltaMira Press.
- Gredler, M. (1992). *Learning and instruction: Theory into practice*. New York: Macmillan Publishing Company.
- Griffin, J., Baum, L., et. a.l. (2007). Optimizing learning opportunities in museums: The role of organizational culture. In J. Falk, L. Dierking, & S. Foutz (Eds.), *In*

- principle, in practice: Museums as learning institutions* (pp. 153-165). New York: AltaMira Press.
- Grinder, A. L., & McCoy, E. S. (1985). *The good guide: A sourcebook for interpreters, docents, and tour guides*. Scottsdale, AZ: Ironwood.
- Haas, C. (2007). Families and children challenging museums. In B. Lord (Ed.), *The manual of museum learning*. (pp. 49-76). New York: AltaMira Press.
- Hein, G. E. (1991). *Constructivist learning theory: International Committee of Museum Educators Conference*. Retrieved January 24, 2009, from Educational Resources Information Center (ERIC) database.
- Hein, G. E. (1998). *Learning in the museum*. New York: Routledge.
- Hertzog, N. B. *Reflections and impressions from Reggio Emilia: It's not about art!* Retrieved October 31, 2008, from <http://ecrp.uiuc.edu/v3n1/hertzog.html>
- Honebein, P. C. (1996) *Seven goals for the design of constructivist learning environments*. Retrieved January 24, 2009, from Educational Resources Information Center (ERIC) database.
- Hughes, P. (2001). Making science 'family fun': The fetish of the interactive exhibit. *Museum Management and Curatorship*, 19(2) 175-185.
- Leichter, H. J., & Hensel, K. (1989). Families and museums: Issues and perspectives. In B. Butler & M. Sussman (Eds.), *Museum visits and activities for family life enrichment*. (pp. 15-50). New York: Haworth Press.
- Lind, T. (2008) Look/touch/learn: nature & art: A new hands-on, family-friendly exhibition in the american galleries. *Access the Newark Museum*, 2(3), 2-3.
- Munyer, E. A. (1982). Museums and their discovery rooms. *The Living Museum*, 44(3), 43-45.
- National Museum of the American Indian. (n.d.). *Haudenosaunee discovery room introduction label*.
- National Museum of the American Indian. (2008). *Resource centers*. Retrieved November 3, 2008, from <http://www.nmai.si.edu/subpage.cfm?second=resource&subpage=visitor>
- National Museum of the American Indian. (2009). *About the National Museum of the American Indian*. Retrieved January 7, 2009, from <http://www.nmai.si.edu/subpage.cfm?subpage=visitor&second=about&third=about>

- Newark Museum. (n.d.). *Look/touch/learn: Nature & art master label*.
- Newark Museum. (2007). *Interpretive plan*. Unpublished manuscript.
- Newark Museum. (2009). [Observation study summary: Look/touch/learn: Nature & art]. Unpublished raw data.
- Newark Museum. (2009). *About the museum*. Retrieved January 7, 2009, from <http://www.newarkmuseum.org/About.html>
- Ormrod, J. E. (2008). *Educational psychology: Developing learners*. New Jersey: Pearson Merrill / Prentice Hall.
- Pierce, L. (1992). *An educator's perspective*. In American Association of Museums (Ed.), *The audience in exhibition development*. (pp. 7-12). Washington D.C.: American Association of Museums.
- Schwarzer, M. (July/August 2001). Art & gadgetry: The future of the museum visit. *Museum News*. Retrieved October 28, 2008, from http://www.cimi.org/whitesite/Handscape_Gadgets_Schwartz.htm
- Silver, H., Strong, R., & Perini, M. (1997). Integrating learning styles and multiple intelligences. *Educational Leadership*, p. 22-27.
- Sparacino, F., Larson, K., MacNeil, R., Davenport, G., & Pentland, A. (n.d.) *Technologies and methods for interactive exhibit design: from wireless object and body tracking to wearable computers*. Retrieved February 24, 2009, from http://alumni.media.mit.edu/~flavia/Papers/flavia_ichim99.pdf
- Sterry, P., & Beaumont, E. (2006). Methods for studying family visitors in art museums. *Museum Management and Curatorship*, 21(1), p. 222-239.
- Sund, R. B. (1976). Piaget's theory of cognitive development. In American Association of Museums (Ed.), *The audience in exhibition development* (pp. 103-107). Washington D.C.: American Association of Museums.
- Wolins, I. S. (1989). A case for family programs in museums. In B. Butler and M. Sussman (Eds.), *Museum visits and activities for family life enrichment* (pp. 7-14). New York: Haworth Press.