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Abstract

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Comments

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Inquiry-Based Environments for the Inclusion of Students With Exceptional Learning Needs

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ABSTRACT

A qualitative study of children's museums' successful inquiry-based learning environments is described, focusing on four students with various exceptional learning needs. Benefits for the students in terms of scaffolded instruction, meaningful and contextualized activities, self-regulated learning, the establishment of learning communities, play, and parental involvement are noted. A discussion of the generalization of learning to the classroom and of positive attitudes and children's museums as inclusive, supplemental environments is included. Implications for future practice involve school–museum partnerships and individualized programming for all learners.

Each year, teachers are faced with a task that is becoming increasingly difficult—meeting the educational needs of *all* students. It seems unlikely that this can be accomplished single-handedly through traditional, teacher-centered instruction or through standardization as in the past. Class sizes are increasing, and the backgrounds of the students in those classes are becoming more diverse. The move toward inclusive education, the societal respect for and celebration of diversity, and the recognition of multiple intelligences and learning styles all emphasize the complex heterogeneity of our students.

We as educators need to move toward more innovative, collaborative, student-centered practices, particularly for students with exceptional learning needs. We need to branch out and use as many resources as are available, including those in the community beyond the classroom (Nicolopoulou & Cole, 1993). The hands-on *children's museum* is one such resource. Innovative in its design to engage each visitor in the hands-on exploration of academic concepts; collaborative as it joins the expertise of school educators and museum educators; student

centered in that each exhibit is accessible to learners in a range of ability and interest, the children's museum may be one answer to the aforementioned questions. Gardner (1991) called for more potent educational approaches, going on to say, "I find clues for these efforts in highly contrasting institutions: the ancient institution of the apprenticeship and the new institution of the children's museum" (p. 13). Other researchers have spoken to the potential benefits for schools in working with museums (American Association of Museums, 1992; Bloom & Mintz, 1990; Brandt, 1993; Danilov, 1986; Maiga, 1995; O'Donnell, 1995; Sykes, 1994; Wall, 1986). More recent studies have spoken to the value of school–museum partnerships for students with disabilities. Tam, Nassivera, Rousseau, and Vreeland (2000) described a team-teaching approach at a science museum that has the potential to increase the learning of students with disabilities and to inform inclusive practices. However, at the time the study described here was conducted, such research was scarce. Therefore, this study was conducted to gain awareness of the potential of children's museums as successful learning environments for learners with exceptional needs, cognitively and socially.

CURRENT STUDY

The qualitative study described here explored a hands-on science museum as a successful learning environment for students with exceptional learning needs. The study was based on the theories of social constructivism and holism, emphasizing the complex and socially interactive nature of children's museums and classroom settings. *Social constructivism*, as put forth by Lev Vygotsky, is the theory that learning and the advancement of knowledge occur through social interaction with more knowledgeable others (Davydov, 1995; Kozulin, 1990; Vygotsky, 1978, 1986; Wertsch & Sohmer, 1995). Through social mediation, learners integrate new knowledge with existing concepts. Lower level concepts are transformed into higher level concepts

(Vygotsky, 1986). Also, as learners interact with others to integrate new knowledge, public actions of communication become private thoughts, labeled *inner speech* by Vygotsky (Kozulin, 1990; Perlmutter & Burrell, 1995).

First, the study sought to determine the extent to which eight factors of successful learning environments were present in the museum setting. These factors were

1. scaffolded instruction;
2. meaningful and contextualized activities;
3. self-regulated learning;
4. activities that are responsive to learning styles, rates, and ability levels;
5. learning communities;
6. the social construction of knowledge;
7. parental involvement; and
8. play.

The first five factors stemmed from the Early Literacy Project, a program established to enhance the success of students with learning disabilities (LD) in the area of literacy (Englert, Raphael, & Mariage, 1994). Because dialogue and the social construction of knowledge underlay the five principles of the Early Literacy Project, the sixth factor was added in an effort to emphasize this. The factor of parent involvement was added because it includes yet another facet to the experiences of learners—the perspective of the home environment. Play was added as the final factor because of its recognition in the literature as an important component in learning environments and in the cognitive development of children (Casey & Lippman, 1991; Karrby, 1990; Goldhaber, 1994; Nicolopoulou & Cole, 1993; Perlmutter & Burrell, 1995; Sykes, 1994; Vygotsky, 1978).

Second, the study sought to determine the ways and the extent to which the first four factors offered cognitive benefits to students with disabilities and the ways and the extent to which the

last four factors offered them social benefits. Finally, the study sought to determine if such cognitive and social benefits, if any, were generalized to the classroom.

METHOD

The methods were chosen for their ability to provide a rich description of the participants, their actions and interactions, and the setting in which they occur. A strength of qualitative research is the data collection in complex and interactive contexts over time, from many perspectives—including those of the participants (Miles & Huberman, 1994).

Smith (1990) contended that qualitative or ethnographic research methods lend themselves well to the museum setting. These methods emphasize the uniqueness of the setting rather than trying to control it for the purpose of generalizability. Madden (1985) agreed that the act of controlling for the many variables of a museum setting detracts from the true understanding of the learning that occurs there. Feher and Diamond (1990) described science centers as excellent research laboratories. They have large audiences and many opportunities for free choice and interaction. Feher and Diamond felt that research in science museums (a) is basic, open research, aiming to advance our knowledge about human cognition and learning behavior; (b) provides basic research results that can enhance a given field and be generalized to environments other than the museum; and (c) should be encouraged, because it fosters the cross-fertilization of ideas and enhances the intellectual stature of science museums.

Design

This study was designed as a case study of an elementary class of students and the adults with whom they interacted. As the students visited a children's museum with their teachers, and as they participated in their classroom routine, a rich description of their actions, interactions, and performances was recorded.

Settings

There were two separate settings for this study—the children's museum setting and the general education classroom setting.

The children's museum.

The children's museum setting was a science museum with the philosophy that children learn best by doing—touching, handling, assembling, disassembling, and using. The aim of this laboratory setting was to clarify abstract concepts as the children experience them firsthand, with their hands. The exhibits helped to bring concepts in science, technology, natural history, mathematics, history, art, and world cultures to life. At the time of the study, the museum had approximately 140 exhibits arranged in four sections: (a) the human body; (b) the natural environment, such as bubbles and fossils; (c) light and optical illusions; and (d) mechanical operations of various objects, such as toilets, circuits, and pulleys.

The classroom.

The classroom in this study was a third-grade general education classroom in a small elementary school (190 students) located outside a midwestern city (population approximately 25,000). The city was once centered on a manufacturing plant. The plant had shut down a few years before, leaving many people unemployed and forcing several families to move out of the area. The result was a damaged economy, with all remaining families in the middle- to low-income bracket. Approximately 50% of the people in the area were African American; approximately 45% were European American; and approximately 5% were Hispanic American.

Participants

There were 26 students in the general education classroom (17 boys and 9 girls). Fourteen of the students were African American, 11 were European American, and one was Hispanic American. This was representative of the population of the city as a whole. Six of the students (4

boys and 2 girls) were eligible for special education services. The six special education students' classifications were as follows:

1. learning disability;
2. learning disability;
3. learning disability and emotional impairment;
4. mild mental retardation with speech and other language impairment;
5. physical and other health impairments with mild mental retardation; and
6. moderate mental retardation.

Five of the students spent half of each school day in the special education classroom. The special education classroom had one teacher, three paraprofessionals, and one student teacher. The paraprofessionals often accompanied the students with disabilities to the general education classroom for one-to-one assistance.

The participants had varied levels of experience in children's museums, but all had a good deal of experience with field trips. Although all of the students in the class attended the field trips, only 18 students returned signed consent forms allowing them to be official participants in the study. All 6 of the students with disabilities were among the participants.

The researcher sent notice of the project to schools in the area of the museum. This classroom was chosen after the general and special education teachers expressed interest in having their students participate. Parents of all students were also invited to participate in the study. Four parents returned signed consent forms indicating the desire to participate. However, three of the parents did not participate at all, because they could not be reached after several telephone calls and notices sent home with the students. The fourth parent—the mother of the student with physical and other health impairments with mild mental retardation—participated to

a small extent. She was able to meet the researcher for an informal conversation and was able to attend one field trip.

Data Collection

Observations.

The participants were observed during four half-day field trips to the museum and during four full-day visits by the researcher to the classroom. Videotapes of the observations were supplemented by researcher field notes. Two stationary cameras were set up in the children's museum on all four field trips. One camera was on the second floor, near the gyroscope exhibit space, focused on the kiosk containing geometric shape puzzles—chosen because they are puzzles that students can work on individually, with a partner, or in a small group. Also, the relatively few steps required to solve the puzzles are more cognitive than physical in nature. The second camera was focused on the “Catenary Arch.” This exhibit was chosen because it can also be done individually, with a partner, or in a small group. However, it requires more steps than the puzzles on the second floor and is more physical than cognitive in nature. It takes a steady hand to complete the arch.

In the classroom setting, one stationary camera and one mobile camera were used during observation. The stationary camera was focused on the classroom as a whole. The mobile camera was used occasionally to record close-ups of student activity, to zoom in on student work, or to record activities occurring in different areas of the classroom.

Interviews.

Interviews were prepared ahead of time by the researcher. There were slightly different interviews for students, teachers, and museum staff. Interviews were conducted four times: (a) before museum and classroom visits started; (b) in the middle of the study (after two field trips and classroom visits were completed); (c) immediately after the museum and classroom visits

ended; and (d) approximately one month after the museum and classroom visits ended. Sample protocols of the interviews are included in Appendix A. These interviews were audiotaped, with the exception of the third interview with the special education teacher (a written interview form was mailed to her, as she was on medical leave) and a conversation with a parent.

Questions in students interviews were asked to assess what and how much the students were learning from their experiences at the museum and how their perceptions were changing regarding the two settings, their peers, and their learning styles and interests. Questions in teacher, parent, and museum staff interviews were asked to assess their perceptions of how the students' performances and behaviors were changing in both settings over time.

During museum and classroom visits, the researcher engaged the students in on-the-spot interviews to expand on or clarify observations made. Examples of questions for on-the-spot interviews in the museum are, (a) Could you explain to me how to do that activity? (b) How did you learn to do that activity? (c) What is the goal of that activity? (d) How did you and your friend help each other complete that activity? These interviews were not audiotaped, but sometimes they were recorded on the videotapes.

Questionnaires.

After each museum visit, questionnaires were distributed to the students, teachers, and museum staff who worked with the school group during the visit. The general purpose of the questionnaires was to ask what was accomplished that day. A sample questionnaire is included in Appendix B. The questionnaires were completed at school the day of or the day after each field trip. In most cases, the students were able to complete the questionnaires without help. Some students, however, required help in reading and writing. These students completed the questionnaires with teachers who read them the questions and wrote their answers on the questionnaire form. The questions asked in this format were used to assess what the participants

remembered about their most recent visit, so these perceptions could be compared and contrasted over time.

Document collection.

Over the course of the study, the researcher requested that teachers put aside any student work samples, lesson plans, or class projects that reflected activities or exhibits in the children's museum.

Researcher's journal.

During the study, the researcher kept a log, consisting of the following: (a) a schedule of observations and interviews; (b) a list of collected documents and questionnaires; (c) methodological ideas, such as predicted data analysis results; and (d) a reflective journal of personal reactions to the study and its progression.

Procedure

On all four field trips, the students toured the four sections of the museum in the same order. The first and second field trips ended with a visit to the special traveling exhibit on bats. The fourth field trip ended with a visit to the special traveling exhibit on the human brain.

Data Analysis

In a qualitative study, the issue of trustworthiness (whether the study is well done and fair) is very important. In a more quantitative study, the concepts of internal validity, external validity, reliability, and objectivity are discussed in respect to the results of data collection and analysis. Lincoln and Guba (1985) pointed to the appropriateness of using different terms in a qualitative or naturalistic study. These terms are *credibility* instead of internal validity; *transferability* instead of external validity; *dependability* instead of reliability; and *confirmability* instead of objectivity (p. 219).

In this study, the degree of credibility was increased by prolonged engagement in the setting, persistent observation, triangulation of data, peer debriefing, negative case analysis, and member checks (Lincoln & Guba, 1985). Data were collected in the settings for a period of 5 months, rather than performing isolated spot checks, such as pretests and posttests. Observations took place the entire time the participants were in the settings. The researcher confirmed units of data by comparing and contrasting them with data collected by different means. As the researcher engaged in formative data analysis, ideas and tentative conclusions were reviewed by the researcher's peers and advisory committee to minimize bias on the part of the researcher. As the study progressed, the researcher modified theories and expectations according to the information that was collected and analyzed. Finally, all information obtained during the study, especially in the interviews and questionnaires, was reviewed by the participants to ensure accuracy and to minimize misunderstandings of meaning.

To increase transferability in this study, the researcher obtained a thorough description of the settings. These settings are unique, and exact matches to other situations are unlikely if not impossible. However, transferability is more likely if the original setting is described carefully, so that similarities among settings can be noted.

Finally, to increase dependability and confirmability in this study, the researcher kept careful notes and logs of the details of the study. In the event of a misinterpretation of data, careful recording of these details could be used in what Lincoln and Guba (1985) called an *inquiry audit*. The researcher and peers could trace back to the information in question and review the circumstances that led to the misinterpretation. Modification could then be made to restore dependability and confirm that procedures were followed fairly and correctly.

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RESULTS

Themes that arose from the data showed that the eight factors of successful learning environments were present to varying degrees in the museum setting. Some factors were prominent, and some were seen only minimally, but they were all present. The pleasantly surprising results showed that *all* of the students in the inclusive, third-grade class (not just those with disabilities) evidenced cognitive or social growth, or both. Unfortunately, very little generalization of this growth was seen between the museum and school settings.

Stories of Four Students

In lieu of discussing the detailed findings for all 18 participants, the focus of this article is to tell the stories of 4 of the students and their progress. These 4 students were chosen not only because they showed marked development in the museum setting, but also because they were so varied in their growth and circumstances. These 4 students represent very different abilities and needs: learning/emotional disabilities; physical/health and mental disabilities; no disabilities; and gifted/talented. Yet the needs of all 4 of these students were met to a degree in the museum setting.

Fiona.

Fiona is 9 years old, African American, and classified as having a learning disability and emotional impairment (see Note). She reads at a first-grade level. Her educational goals, as indicated on her Individualized Education Program (IEP), include continuing to develop her reading ability; developing counting and beginning addition and subtraction skills; identifying feelings; and resolving conflicts without aggressive behavior. She is a very talkative student who is always dressed neatly in the newest fashions, with her hair done in rows of braids and beads.

At the beginning of the study, Fiona showed many signs of aggression toward her peers in both settings. On the first field trip, Fiona approached the Sand Pendulum exhibit, where two other students were engaged. She joined them and soon began yelling loudly at them for interrupting her activity. She repeatedly stated she was there first and raised her hand as if to slap one student who would not give her the sand funnel. The other students quietly let her take the pieces of the exhibit from them and waited until she had left to resume their activity.

A very similar situation occurred at the Circuit Table. This time, the special education teacher approached and, without having been present during the altercation, automatically deemed Fiona to be at fault for starting the argument and instructed her to leave the other students alone.

This type of behavior happened again at the computer that was running the Busy Town software program. Here, Fiona aggressively warded off all other interested students by raising her voice and telling them she would not move. They stopped asking for a turn, and she spent the remainder of the time alone at the computer.

Other students seemed to avoid Fiona. She consistently mentioned in interviews and questionnaires that she liked to play with a classmate named Tricia. However, Tricia never mentioned preferring to play with Fiona, and the general education teacher mentioned a definite rivalry between the two.

At the beginning of the project, her place in the community was that of a person whose peers let her have her way and cleared her a path, so to speak. However, rather than doing this out of respect, they seemed to do it out of fear or self-preservation. They preferred to let her have her way rather than bother with an argument or risk being reprimanded for getting into an altercation with her. To speculate on why Fiona felt the need to force her way into the community is not

possible based on the information gathered in this study. It is possible, however, to see that one incident occurring on her third field trip had a positive effect on her demeanor and subsequently on her place in the community.

On the third field trip, the special education teacher and a paraprofessional praised Fiona profusely for her ability with the Busy Town computer program. Having had her expertise with this activity acknowledged, she immediately became much less aggressive about maintaining her position at the computer, as evidenced by a softer, quieter tone of voice, a pleasant facial expression, and positive peer interactions. She was heard offering to teach Tricia and another student how to play the game. Fiona consistently mentioned in interviews and on questionnaires that she liked the Busy Town computer program and the dollhouse the best.

In the classroom, however, her aggression did not change significantly over time. She continued to be rude and demonstrative with peers, as evidenced by the following example: She came into the classroom, noticed that her chair was a few feet from her desk, and called out in a loud voice, “Who’s been moving my chair? Nobody better be messing with my chair!” Incidents of this nature continued in the classroom setting throughout the duration of the project.

A second difference in Fiona’s behavior over time was the decrease in the degree to which she was distracted by the video cameras. At the beginning of the study, she was highly distracted by the cameras—much more so than any other student.

On the first field trip, Fiona spent 6 of the 19 minutes of the time devoted to the second section in front of the stationary video camera rather than interacting with exhibits or peers. She began by holding up objects and asking questions such as, “What is this strange thing?” She continued by introducing students who walked by the camera. Next, she sang a song for the

camera, and as the group left to change sections, she bowed to the camera, announcing, “Our show is done.”

Also on the first field trip, during the other 13 min spent in the second section, Fiona often placed herself in the view of the researcher’s roaming camera and told the researcher to follow her as she related information and fabricated stories about various exhibits. Most often, the stories were not connected to the museum exhibits or content. Once, however, she began describing the contents of the antique dollhouse to the researcher and soon became engrossed with the display rather than with the camera. This was a particularly meaningful exhibit for Fiona, because she had always wanted a dollhouse but never had one of her own.

These behaviors of being preoccupied by the cameras were also seen in the classroom. During an art activity on the first classroom visit, Fiona did not complete her clay project. Instead, she spent most of the lesson time in front of the camera, putting the clay on her eyes, dancing around, and jumping up and down. After several admonitions from the teacher, she was told that she would have to leave the room if she would not stop playing near the camera. She discontinued dancing near the camera, but she continued to wave at it from her seat for the remainder of the lesson time.

By the fourth museum and classroom visits, Fiona was rarely distracted by the camera. She often requested the researcher’s attention, but most often it was to ask a question about an exhibit or to share her school work, rather than to perform for the camera. Perhaps being recognized for her cognitive abilities in the museum sparked in her the realization that she could be attended to and recognized for other than demonstrative behavior. Furthermore, interest in exploring the exhibits may have replaced attention seeking as one of her top priorities.

In summary, over the course of the project, Fiona exhibited a decrease in aggressive behavior in the museum setting. This served to give her a more positive place among the adults and peers in the learning community. For a student with learning difficulties that are intertwined with emotional disabilities, more positive and productive social behavior is important for increased cognitive development. Also, she demonstrated more interest in activities in both settings. The exhibits were responsive to her interests and, thus, more meaningful to her. Instead of constantly seeking to perform for the video cameras, she developed more appropriate ways of seeking attention, such as sharing her work oroffering to teach a computer game to peers. These behaviors would be beneficial to her in the classroom setting as well.

Matthew.

Matthew is 9 years old, European American, and classified as having orthopedic and health impairments and mild mental retardation. He reads at the pre–first-grade or primer level. His educational goals, as indicated on his IEP, include continuing to improve his reading ability, completing simple addition problems, and identifying place value in mathematics. He is small and frail, with blond hair and very pale skin. He walks slowly and sometimes unsteadily. He *always* wears his Buzz Lightyear cartoon character watch, perhaps as a comfort object.

Of all the participating students, Matthew showed the most marked difference in his behavior between the classroom and museum settings. In the classroom, it was often observed and repeatedly reported by teachers and his mother that he would “shut down” when it came to doing some assignments. When this happened, he put his head on the desk and refused to participate in the activity or even look up from his desk. He did this more often with new or unfamiliar activities, but also with routine assignments, perhaps as an avoidance strategy. He was described by teachers, paraprofessionals, and his mother as being withdrawn on other field trips, with a tendency to hide behind his mother or a paraprofessional. In a conversation with his

mother, she stated that Matthew did not like to try anything new unless heavily prompted and assisted. She also mentioned that he was physically unsteady on his feet and did not like to run or climb. The teachers and mother all predicted that the busy, open atmosphere of the museum would cause him to withdraw and hide behind the paraprofessional who works most closely with him in the classroom.

His mother was wary about attending field trips even when her work schedule allowed because she thought Matthew would spend the whole time hiding behind her. In one note to the researcher, she wrote, “The only reason I don’t want to attend this trip is because [Matthew] won’t do what you need him to do if I’m there. It’s not that I don’t want to participate, it’s just that I know my child. [Matthew]’s performance is greatly different when I’m around.” She reported that her presence on other field trips had caused him to withdraw from any activities and interaction with others. On their weekly bowling trips, he had just begun to feel comfortable participating when she attended a trip. He then stopped participating again until he felt comfortable with the activity in his mother’s presence.

This predicted behavior was not seen in the museum, however. As early as the first field trip, Matthew ventured off on his own, looking at and touching many of the exhibits. He was rarely seen in the company of the paraprofessional or his mother, let alone hiding behind them. Not once was he observed refusing to participate. By the end of the first field trip, he had found a couple of exhibits, such as the Hot Air Balloon, that were very interesting to him, as evidenced by his returning to them frequently throughout each field trip.

The Hot Air Balloon is suspended over a table in a corner of the second section. On the table are two toasters, which can be activated by pushing a single button. The heat emitted by the toasters fills the balloon with hot air and causes it to rise along a wire to the ceiling several feet

above the table. After about a minute without any heat from the toasters, the balloon returns to the table from the ceiling.

On the first field trip, Matthew spent a lot of time trying this exhibit and watching it from about six feet away while the others tried it. On the second field trip, Matthew went to this exhibit first, spending several minutes at it, making the balloon rise and fall many times over. On the third field trip, Matthew began experimenting with the balloon, keeping the toasters on even after the balloon had risen to see how long it would stay up, or letting go of the button just before the balloon rose to see if he could give it just enough (and not a bit more) heat for it to rise.

Another observation regarding Matthew was the degree to which his assertiveness increased over time. On the first field trip, if another student approached an exhibit that Matthew was using, he would immediately back away from the exhibit without a word and let the other student move in. Sometimes, he would stay to watch from a few feet away, but most often he would leave the area entirely. Also, if other students were gathered around an exhibit, he would watch from a few feet away and approach the exhibit only when no other children were present.

On the second field trip, a student approached Matthew at the Hot Air Balloon and tried to reach in and push the button. Matthew pushed the student's hand away gently and told him that it was not his turn yet. This same progression of assertiveness on Matthew's part was observed at other exhibits. He was also observed approaching exhibits occupied by several children and waiting among them for a turn.

On the third field trip, Matthew was observed interacting with others at the Hot Air Balloon. He was showing another student how to let go of the button just before the balloon rose to see if it had just the right amount of heat to rise. This student later mentioned on a questionnaire that she received help from Matthew.

Also on the third field trip, Matthew was at one of the telephones in the first section, making the phone across the room ring. The researcher picked up the second phone and initiated a conversation. After the researcher hung up the receiver and left, Matthew made the second phone ring again. Another student came over and answered the second phone. This time, Matthew initiated a conversation. On the fourth field trip, Matthew demonstrated all of his favorite exhibits for his mother. He reported this to the researcher in the third interview.

By the third field trip, Matthew was seen running and even *skipping* from exhibit to exhibit, trying almost everything on his own without prompting or assistance. He was also observed climbing the ladder to the Whisper Dish to whisper with another student across the room. These are all behaviors that the teachers and his mother predicted he would never show in the museum setting. During interviews and conversations, each reported their surprise and excitement over his unpredicted behavior.

In summary, Matthew responded positively to the museum setting, feeling comfortable enough to try new activities and to venture off on his own without prompts or assistance. He found many exhibits to interest him rather than refusing all activities offered to him, and his immediate caregivers learned new things about his behavior and interests. Over the course of the project, Matthew exhibited the increased ability to be assertive regarding his interests and to take his turn at exhibits. For a student who was usually very withdrawn and timid (perhaps due to his physical and health impairments), assertiveness altered his role in the learning community among peers, increasing his confidence and risk-taking behavior. He was able to break away from a possible cycle of being sheltered and seeking shelter from interactions with people and activities. Continuing this behavior may help him to be a much more independent learner, leading to less required individualized attention, leading in turn to more time spent included in

the general education classroom. Scaffolded by the exhibits, Matthew's problem-solving and inquiry abilities evolved. These skills may serve to increase his independence as a learner in the classroom as well.

Connor.

Connor is an 8-year-old European American boy. He is the youngest student in the class by nearly a year. He has dark hair, wears glasses, and speaks extremely clearly, articulating every syllable. Connor is identified as gifted and talented, particularly in the areas of math and science.

Connor was not a participant for the duration of the project. He was promoted to fourth grade following winter recess. Before leaving the project, he attended two of the four field trips, completing two of the three interviews and two of the four questionnaires.

One of the most profound differences in behavior for Connor was the degree to which he worked cooperatively with other students at the museum as compared to the classroom. The general education teacher remarked several times that she never saw him work with anyone else in the classroom due to his high academic level. He was by far the most academically advanced student in her class, receiving college-level math and science tutoring from engineering students at the nearby university. In the classroom, he always chose to work alone, completing assignments and projects his way.

At the museum, even as early as the first field trip, changes were observed. Connor was heard calling to many other students to come use exhibits with him and to complete activities with him. He spent several minutes at the Ping Pong Maze with another student, creating a maze. He seemed to be the leader of the activity, but he respectfully considered the other student's ideas and contributions. This behavior was much different than what he exhibited in the classroom. The general education teacher stated in conversations and in the second interview that

she was surprised at Connor's cooperative behavior, because he usually did not work cooperatively with any of the other students.

On the second field trip, Connor was at the magnet exhibit surrounded by a few classmates. He was heard explaining to them why the chain with the magnet at the end could stretch straight up on its own toward the large, overhead magnet without actually touching it. These students later named Connor as someone who was an expert in the museum setting.

In summary, Connor already had a good command of complex science concepts. The museum still had a lot to offer him, providing a setting for him to further his knowledge and to develop his cooperative learning skills. The exhibits in the museum were challenging and interesting to Connor. The excitement that he felt for the experience was a common thread he held with his peers, providing him with the opportunity and desire to work and play alongside them. Whether this carried over to the classroom setting could not be determined, as he left the classroom after the second field trip and before the second classroom visit. Particularly important to note for Connor was that he not only demonstrated his academic expertise (for which he was already well known), but he also demonstrated that he could engage in social activities and simply *have fun*.

Hannah.

Hannah is a 9-year-old European American girl. She has long, blond hair, wears pink glasses, and speaks politely with a soft voice. Hannah is not classified as having a disability.

Hannah showed a significant preference for hands-on activities over the pen-and-paper tasks that were typically assigned in the classroom. The general education teacher described her as having a need for more active, hands-on experiences. She said that Hannah is often unfocused and off-task in the classroom. It is difficult to get her started on an assignment and even more difficult to keep her focused on the assignment. During classroom visits, Hannah was observed

many times playing with her shoes or hair accessories, drawing pictures on her class work papers, unbending and rebending paper clips, or staring at the blank wall in front of her while others were busy working. Without hands-on stimulation, she would slip into what the teacher and her parents called the “Hannah Zone.” Apparently this occurred at home as well.

Experiences in the museum setting made a significant difference for Hannah. She thrived in this hands-on, active environment, focusing intently on each activity she tried and seeing each through to the end. She was diligent and determined and did not lose her concentration or attention span, as she did with academic activities in the classroom. She approached exhibits systematically, one by one, read the directions, performed the activities until they were completed, and moved to the next one. Often, it was time to change floors before she had completed very many exhibits. She remained focused during the whole of each visit, and she visited new exhibits each time:

On the first field trip, Hannah spent 7 minutes and 20 seconds out of the 10 minutes devoted to the third section interacting with the Lens Table Exhibit. This exhibit consists of several large lenses, a holder for the lenses in front of a light source, and an adjustable screen. When a lens is placed in the holder, the screen must be adjusted so that the image shown through the lens can be focused on the screen. Hannah systematically positioned each and every lens in the holder, precisely adjusting the screen each time to view the image in focus.

With each subsequent visit, she became more engaged with each exhibit she visited, repeating the activity several times or experimenting with variations not outlined in the instructions. In the last interview, she was able to recount several exhibits, their purposes, and the activities she performed with them.

In summary, Hannah is a learner who prefers interactive activities to keep her on task. In the classroom setting, she did not focus on class activities that were not tactile in nature. The teacher and her parents expressed concern over her distractedness. In the museum setting, over time, she demonstrated prolonged engagement with exhibits and an increased ability to systematically investigate exhibits. She regulated her own learning, setting goals and accomplishing them without the teacher reminding her to stay focused. If these behaviors were to carry over to the classroom setting, the teacher would need to spend significantly less time reminding her to remain on task. Also, with guidance, this student could be aware of her preferred learning style and use it to her advantage in any setting.

Overall Differences in Performance

For the most part, Matthew and Hannah demonstrated cognitive growth, whereas Fiona and Connor demonstrated social growth. However, it is often difficult to separate the two. As Vygotsky (1978, 1986) asserted, social interaction is the keystone to cognitive development. As students become comfortable as part of a social community, they are free to concentrate on cognitive endeavors.

The following common themes emerged across the four students.

Scaffolded instruction.

An example of scaffolded instruction occurred during Matthew's exploration of the telephone exhibit. Matthew rarely if ever initiated conversations with peers in the classroom. After the researcher-initiated conversation over the telephone, Matthew successfully initiated a conversation with a peer who was next to answer the ringing phone across the room. Perhaps the conversation starters modeled by the researcher scaffolded Matthew's ability to talk with his peer; perhaps the distance between the two phones scaffolded Matthew's confidence in speaking

with his peer; or perhaps both contributed to Matthew engaging in a new and (for him) bold social activity.

Meaningful and contextualized activities.

It was a particularly meaningful exhibit for Fiona—the dollhouse—that may have been the turning point for her in the way she sought attention from and engaged the researcher. While showing off for the camera by detailing the contents of the dollhouse to the researcher, she soon became so engrossed in the exhibit that she may have forgotten the researcher and camera were still there, except for the researcher's comments regarding her expertise on the dollhouse. After that, she seemed more interested in exploring the exhibits than in seeking out the cameras.

Self-regulation of learning.

Both Matthew and Hannah exemplified the regulation of their own learning by adjusting the methods and rate at which they approached, manipulated, and mastered the exhibits of their choosing. As there were no preset goals for them in terms of content or rate of learning in the museum, they were, perhaps for the first time, in control of their own learning. Because the exhibits were designed and developed to respond to this individualization, the students were strongly supported in their newfound *control*. For all four of the students, greater choice in what to explore and how to explore it led to greater learner empowerment.

Establishment of a learning community.

There were various instances in the museum when students were seen, either by others or by themselves, as being experts on a certain exhibit or concept. Social groups that were different from those seen in the classroom formed around favorite exhibits; students recognized each others' contributions to games, explorations, and inquiry; new learning grew from students asking each other questions; and the adults even took on new roles as facilitators and learners.

Teachers and classmates stated that Fiona was an expert at the Busy Town computer game. The teachers praised her skills and her uncharacteristic gentleness with peers while tutoring them on the software. Matthew was soon to be the leading authority on the Hot Air Balloon. When asked during interviews if anyone helped them in the museum, a few students indicated that Matthew helped them because they could not figure out how to raise the balloon on their own. Connor was seen as an expert in the museum in general, especially after explaining exhibits the concepts of which still eluded his fellow third- and fourth-grade classmates.

Parental involvement.

Parental involvement in this study was extremely limited. The perceptions of only one mother were available. Due to her unpredictable work schedule, it was impossible to meet with her regularly. A few informal conversations took place between the mother and the researcher when they happened to meet at the school in the morning while she dropped off her son. Of course, this does not mean that she was the only parent involved in her child's education. The teachers and paraprofessionals reported in interviews that many parents were concerned but could not always participate in school activities, having to work or tend to small children at home.

What was gleaned from talking with the one parent participant was that she learned a great deal about her child and his learning over the course of the project. She was pleasantly surprised by the initiative and assertiveness he demonstrated. The teachers and the researcher informed her of his performance on the first three field trips, and she observed it herself on the fourth field trip. She even jokingly commented that she would no longer be able to count on him to be underfoot, right at her side, and that she would start having to keep track of him all over the place like his younger brothers. Also, he was given the opportunity to reinforce what he was learning by sharing it with his mother on the fourth field trip.

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The role of play.

Play served a large role in the setting of the children's museum. The museum was viewed by both teachers and students as a place to play, just as the exhibits were viewed as things to play with. Students and teachers alike appreciated the fun and casual atmosphere that the museum offered.

During one interview, many students said that the settings were different because they could play in the museum and they had to work in school. During another interview, some also reported that the settings were alike because they could read about and learn new things. The teachers also felt that the opportunity to play did not necessarily exclude the opportunity to learn. The general education teacher expressed concerns that the museum setting was too unstructured, but admitted that the students were still learning some things, even if "by accident." She felt that the lack of reinforcement after the field trips was more of a hindrance to learning than the opportunities to play. One paraprofessional felt that the museum offered the opportunity to learn even though the students played there. She stated, "The museum is not just playthings . . . like the bubble things out there where they play; it's something that they're actually learning."

DISCUSSION

Generalization of Learning to the Classroom

The generalization of knowledge and skills from the museum to the classroom setting was minimal. This was of great concern to the general education teacher. She had hoped to see more "carryover" of both facts and skills to the classroom. In the third teacher interview, she reiterated that the exhibits needed to be more connected to class work and to prior knowledge for there to be more purposeful learning. The special education teacher was pleased that cooperative learning skills carried over to the special education classroom, but there were no other data to corroborate

this. This carryover was not observed by the researcher or reported by the general education teacher.

It was difficult to determine if the workings of the learning community seen in the museum setting were carried over to the classroom setting. Certainly, a learning community existed there, but whether the same common goals and respect for each other's areas of expertise existed could not easily be seen. The atmospheres of the two settings were very different. In the museum, interactions between community members and between members and exhibits occurred constantly. In the classroom, interaction was limited to the teacher addressing the students and the students answering questions. Any acknowledgment of their goals, interests, and areas of expertise was kept private rather than shared publicly with the group.

There are two possibilities why little generalization of student differences in learning behavior may have occurred from the museum to the general education classroom setting. First, there was a discrepancy between the learning theories and teaching styles present in the two settings. The children's museum setting was informal, unstructured, and learner directed. The general education classroom setting was formal, highly structured, and teacher directed. The students did not have the same opportunities to display differences across settings. Second, the teachers may have had very different goals for the project than did the researcher. The teachers and the researcher did not share the same perceptions of what was important in order for learning to occur.

The Children's Museum as an Inclusion Setting

The children's museum has great potential for being a successful inclusion setting. No significant differences were discerned between the general and special education students in the museum setting. All of the students enjoyed themselves and found exhibits of great interest to

them. All of the students interacted with each other and helped each other. The general education students were not always the leaders or peer tutors. Special education students were often seen taking the lead at exhibits or teaching the activities to others. Two specific examples of this were Fiona teaching the Busy Town computer program to two general education students and Matthew demonstrating the Hot Air Balloon for his mother and another student.

In fact, it was very difficult if not impossible to identify which of the students were classified as having disabilities based on their behavior and performance in the museum. When asked, a museum employee who worked with the group thought that he could identify one student as requiring special education due to the student's short attention span and confusion over one of the exhibits. However, the student he was describing was not a student with a disability.

Furthermore, little or no modification of the exhibits was needed to accommodate special needs. Once physical access is provided, the exhibits are inherently accommodating. Readers and nonreaders alike can manipulate objects; concrete and abstract thinkers alike can find something to pique their interests and to further their learning.

The Children's Museum as a Supplemental Setting

As nurturing as the children's museum is, it is valuable as a supplement to the classroom setting, not an alternative. Morrissey (1989) stated,

> While museums are an appealing setting, learning is also more difficult in this setting for many reasons, and a large and consistent body of research has shown a lack of learning for most museum visitors. . . .Within the museum setting, the visitor is exposed to vast amounts of stimuli for very brief amounts of time and generally with little or no individual interaction between the visitor and the exhibit. . . . This is contrasted to formal education, where the learner is

> generally exposed to controlled amounts of stimuli for a greater length of time and with the support of an instructor or some type of mediator (p. 88).

Moreover, Byrd (1990) stated,

> There are no alternative techniques that will replace the need for classroom teachers and the traditional approach to instruction. However, in a classroom of up to 35 students with diverse academic and social needs, viable techniques must be available to teachers who seek the best education for their students, whether they are regular or LD students (p. 117).

Generalization of Positive Attitudes

One recurrent theme that emerged from this study was the positive attitude that all participants formed of their experience with the project. The students were highly motivated by the field trips to the museum. Whenever the researcher came to the classroom to observe or meet with the teachers, the students cheered and asked if it was time to go back to the museum. In general, they all reported that they liked the museum a great deal and that they hoped to go there with their families.

Initially, the teachers were a little overwhelmed by the busy, chaotic nature of the museum setting. The first field trip was difficult for them because their reflex was to preserve firm order and quiet in a learning environment. Once they realized that it was not possible to establish the same orderliness as in the classroom or on other field trips, they accepted the “organized chaos” of a children’s museum field trip. They also reported enjoying the museum and learning a great deal themselves.

Conclusion and Implications

Supplementing the classroom experience is not necessary for students to receive a valuable education. However, adding a new setting to the students’ repertoire adds richness to the overall learning experience. It broadens the horizons of their firsthand experiences. It introduces another

place to learn and another way to love learning. The children's museum setting's support of inclusion should be reinforced and continued. The question now is, How can the potential of the children's museum be harnessed and combined with the positive aspects of the classroom setting?

A limitation of this study is the divergent expectations of the teachers and the researcher. Rather than work alongside each other, museums and schools need to work together to meet the needs of all students. Teachers must be prepared to form interagency partnerships and enhance their classroom instruction with the innovative practices found in the setting of a children's museum. Tam et al. (2000) emphasized a collaborative approach to successfully use museums as inclusive settings. Described here are the components of a potentially successful partnership between schools and children's museums or other such inquiry-based environments.

Successful School–Museum Partnerships

Combining formal and informal environments

An effective program combines the benefits of both the museum (hands-on experiential exhibits; open, inviting space; experienced staff members; community resources) and the classroom setting (curriculum areas on which to concentrate; short-term and long-term academic and social goals; measures of student performance; evaluation of student progress). Perlmutter and Burrell (1995) described such a program as "a learning web that supports integrated learning, formal and informal" (p. 16).

Repeat visits to the museum

The chances for deep learning and understanding increase with repeated visits and long-term programs (Blythe & Gardner, 1990; Gardner, 1991; Hein, 1990; Hooper-Greenhill, 1987; Pitman-Gelles, 1981; Sykes, 1994; Waterfall & Grusin, 1989; Winstanley, 1967). The exhibits

do not have to change in order for the visitors to learn more every time they return. The same exhibits can reveal new information each time, as the learner develops.

It is important for all those involved, including the students, to realize that each visit has a purpose. The purpose of initial visits is to familiarize oneself with the learning environment. Just as new kindergartners need to familiarize themselves with the workings of a classroom environment, new visitors need to familiarize themselves with the workings of the museum setting before learning can take place. The purpose of later visits is to concentrate on new stimuli and information and to continue to build on experiences to form new knowledge. The rate at which visitors become familiar with a new environment varies.

Preplanning

The program should begin with extensive planning between teachers and museum staff. Teachers need to know the physical layout of the museum and the concepts illustrated by its exhibits. The museum staff needs to know the daily and weekly schedule of the classroom, the abilities and needs of the students, and the curriculum that the teachers are required to cover.

Once this information is shared between teachers and museum educators, a plan needs to be outlined that intertwines museum exhibits, demonstrations, workshops, and outreach kits with the school curriculum and students' abilities. In the classroom setting, the teachers would introduce concepts with preparatory lessons or outreach kits. Once a foundation of the concept is established and the teacher has evaluated what each student needs to incorporate and master the new knowledge, the class visits the museum. The visit should be structured, so that the students focus on certain exhibits for longer periods of time and perhaps attend a demonstration or workshop.

It is important that the museum visits not be seen as "add-ons," or simply an extra experience for the students. Rather, they should be seen as integral parts of the classroom

schedule (Institute of Museum Services, 1996). Bitgood (1990) described how to get the most out of visits to the museum with the following guidelines:

1. Integrate the museum program into the school curriculum.
2. Conduct a front-end evaluation of student knowledge, interest, and experience.
3. Prepare students for the setting and agenda.
4. Prepare students with pre-visit activities in the classroom.
5. Make the field trip experience driven rather than information driven.
6. Design on-site museum activities with care.
7. Test the impact of the program as it develops.
8. Follow up with post-visit activities.
9. Minimize behavior problems by planning how they will be handled.

Supporting teachers in change

Establishing a long-term program with a community resource such as a children's museum is a monumental change in practice for many teachers. Current research on school reform and change in teacher practice has discussed many issues that must be addressed in order for efforts of change to be successful and long-lasting. First, a change in structure (e.g., new school-day schedule or longer class periods) does not automatically bring on a change in practice (Elmore, 1992, 1995). Second, teachers are not solely responsible for the success of change efforts, and teachers need support from all levels (Elmore, 1992; Sykes, 1996; Wilson, Peterson, Ball, & Cohen, 1996). Third, once changes in practice are in place, they should not become part of a fixed routine. New practices should be continually modified and developed to meet the continually growing and changing needs and knowledge of teachers and learners (Schifter, 1996). Teachers also need to be self-regulating, independent learners, as do their students. Fourth, it must be recognized that all change brings discomfort and discontinuity to those who are involved. Change may cause teachers to feel that they have to weigh "what works" against

"what they are expected to do." Open communication, shared goals among all participants, administrative support, and recognition of their constraints by museum staff are important in helping teachers to work through the discomfort and discontinuity (Sykes, 1996).

Ongoing evaluation of student learning

Throughout the course of the program, students' ability levels must be evaluated regularly, so that the students can be continually scaffolded and gently challenged in both settings to further their knowledge at critical points in the learning process. Any misconceptions should be addressed and corrected as soon as possible. because students build new knowledge on their existing knowledge, misconceptions can lead to further incorrect learning. Also, the learning styles, rates, and ability levels of each student must be continually evaluated. In this way, instruction can be provided that is responsive to individual needs and preferences. The teachers and museum staff must be careful not to assume, based on their own experiences, what is meaningful or familiar to the students.

Establishment of learning communities

To establish a learning community in both settings, the students need to be provided with opportunities to work collaboratively in both settings. All members of the community should be given opportunities to help each other and to take on the role of teacher as well as learner. All members should be recognized for their strengths, interests, and areas of expertise. Both settings can then have atmospheres of collaboration, not competition. Opportunities for dialogue should pervade every aspect of the program. In order for new knowledge to be socially constructed, students need to talk and ask questions about their activities, their observations, and their thought processes. They need to be scaffolded regarding the kinds of questions to ask about activities and about their own learning. The use of dialogue journals in the program may offer the students a

method of expressing and recording their learning in an ongoing, written, yet public format shared with peers and adults.

Involvement of parents and families

It is important to any school–museum program to involve the parents and families of the learners. Efforts must be made continually to solicit parental involvement. When it is not possible for parents to participate in person, they must still stay involved with the happenings of the programs via the dialogue journals and newsletters.

Play

Finally, play must serve a role for a program to be successful. There need to be many opportunities for individual and group play in both settings. At the end of each structured visit to the museum, the students need free time to explore. Outreach kits, centers, and genuine free time provide opportunities for play in the classroom.

To summarize, it is important to recognize that changing structures or schedules is highly visible yet highly superficial. Just as, in this study, sending a class of students on regularly scheduled field trips to a children's museum did not ensure that the teachers would incorporate the theories and styles of the museum into their classrooms, that they would employ similar activities in their classrooms, or that the students would demonstrate significant cognitive and social gains across all settings. Elmore (1995) suggested that

> the relationships between structural change in schools and changes in teaching and learning are mediated by relatively powerful factors, such as the shared norms, knowledge, and skills of teachers, and that changing structure has a slippery and unreliable relationship to these mediating factors. (p. 26)

Therefore, the establishment of a new program structure is just one step. Equally important is the construction of shared goals and visions regarding successful learning for all students.

Instead of creating placements and programs that respond to disability characteristics, we should strive to create placements and programs that respond to *children* and their needs as learners.

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NOTE

All names have been changed.

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APPENDIX A

INTERVIEW PROTOCOLS

FIRST STUDENT INTERVIEW

1. What is your name, age, and grade?

2. Whose class are you in?

3. Have you ever been to the [children's] museum before?

4. What do you think you will see/do/learn there when we visit?

5. What are your favorite/least favorite subjects? Why?

6. What do you learn in school?

7. What do you like best/least about school? Why?

8. What is easy/difficult for you in school? Why?

9. Have you ever visited the museum with your parents or family?

10. Whom do you like to be with in school?

11. If you could pick three other students to work with in school, whom would you pick?

12. Do you have anything else you wanted to say or ask?

SECOND STUDENT INTERVIEW

1. What are your favorite/least favorite subjects in school? Why?

2. What kinds of things do you do in school? At the museum?

3. What do you learn in school? At the museum?

4. How are school and the museum alike/different?

5. What do you like best/least about school? Why?

6. What do you like best/least about the museum? Why?

7. What is easy/difficult for you in school?

8. What is easy/difficult for you at the museum?

9. What do you talk/ask about in the museum?

10. Whom do you like to be with in school? At the museum?

11. If you could pick three other students to work with in school, whom would you pick? At the museum?

12. If you could bring one exhibit home with you from the museum, which one would you pick?

13. Do you have anything else you want to say or ask?

Third and Fourth Student Interview

1. What do you like to do best/least in school? Why?

2. What do you like best/least about the museum? Why?

3. What is your favorite exhibit at the museum? How does it work?

4. What other exhibits do you remember? How do they work?

5. Whom do you like to be with at the museum? At school?

6. What do you talk/ask about at the museum?

7. Does anyone help you at the museum? Who? How?

8. Do you help anyone at the museum? Who? How?

9. Does anyone help you at school? Who? How?

10. Do you help anyone at school? Who? How?

11. How are school and the museum alike/different?

12. Do you have anything else you want to say or ask?

First Teacher Interview

1. What is your name and what grade do you teach?

2. How many years have you been teaching? This grade? In this school?

3. What experience do you have, if any, with the museum?

4. What is the usual nature of field trips for your class?

5. How do you apply field trip experiences to your classroom?

6. What expectations do you have for this project?

7. What are your short- and long-term goals for your students?

8. What role does the museum play in your students' education?

9. What do you hope to learn as a teacher from this experience?

10. What factual knowledge, if any, do you expect your students to gain?

11. What learning skills, if any, do you expect your students to gain?

12. What use, if any, do you expect to make of the museum outreach program, kits, and workshops?

13. To what extent do you see yourself collaborating with museum staff and parents?

14. To what extent are parents involved in your classroom?

15. Can you describe the atmosphere of your classroom? How do you expect that to compare to the atmosphere of the museum?

16. Describe the learning styles of your students. To what extent do you expect those styles to be supported in the museum?

17. Do you have any additional comments or questions?

Second and Third Teacher Interviews

1. What role do visits to the museum play in your students' education?

2. How do you tie museum visits into classroom learning?

3. What are you learning as a teacher from this experience?

4. What factual knowledge, if any, are your students gaining?

5. What learning skills, if any, are your students gaining?

6. What use, if any, are you making of the museum outreach program, kits, and workshops? What would make it easier for you to do so?

7. What differences do you see in your students from one trip to the next?

8. Do students make references to museum experiences when in the classroom?

9. To what extent are the learning styles of your students being supported in the museum?

10. Do you have any additional comments or questions?

Written Interview for Explainer Guides

1. What is your name and position?

2. What is your experience with the museum?

3. What are your goals and procedures for school group visits?

4. What type of atmosphere does the museum offer?

5. What effect does this atmosphere have on student learning?

6. Do the exhibits in the museums relate to the everyday lives of students?

7. What differences, if any, have you seen in the way these students approach and interact with exhibits? Interact with each other and adults? Talk/ask about exhibits? Behave overall?

8. What role do you play during field trips?

9. What role do the teachers/chaperones play?

10. Have you been able to identify any students in this group who are classified for special education? Explain.

APPENDIX B

QUESTIONNAIRES

STUDENT QUESTIONNAIRE

1. What did you see/do in the children's museum today?

2. What was new for you today?

3. What was your favorite thing? Why?

4. What was your least favorite thing? Why?

5. Did any one help you in the museum today? Who? How?

6. Did you help anyone today? Who? How?

ADULT QUESTIONNAIRE

1. What differences, if any, have you noted in the students' behaviors or interactions since their last visit?

2. Did the students try anything new today? What was it? With whom?

3. What questions, if any, did the students ask you today?

4. What was your role in the children's museum today?