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Parent Beliefs about Teaching and Learning in a Children's Museum

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INTRODUCTION

In this article we present a study conducted as part of a larger project to develop new signage strategies to support powerful forms of parent involvement at the Children's Museum of Pittsburgh. Our research team at the University of Pittsburgh Center for Learning in Out-of-School Environments (UPCLOSE) became regular members of a team that included some of the museum's exhibit developers, educators and graphic designers. This study took place in the context of the museum's expansion from 20,000 sq. ft. to 80,000 sq. ft.

The signage project began with a range of front-end research studies intended to develop more specific knowledge concerning parent beliefs about how and what their children might learn from a museum visit, and how parents might be involved in that learning. Drawing from the front-end findings and the expertise of the exhibits and education staff, the team then developed and user-tested prototype signage for the new exhibit spaces.

When the expanded museum opens in November 2004, the team will begin a series of summative studies focusing on the successes and failures of the various signage strategies in terms of supporting family museum learning. The piece of the project that we present in this article was one of the first of the front-end studies.

Prior research has suggested that there is no single, ideal family as the target audience for exhibits and signage. Family agendas for museum visits are often different (Ellenbogen, 2002; Moussouri, 2003) with some families favoring solo exploration while others stick together as a group (Dierking, 1989). Parents have a variety of ways to enter interactions with their children, ranging from play and humor to teaching about content (Diamond, 1986).

Parents use a range of interaction strategies, from simply encouraging their children, to giving directions about using exhibits, to establishing a shared way of describing evidence and objects, to giving explanations that connect the exhibit experience to larger concepts, principles or prior experiences (Ash, 2002; Borun & Dristas, 1997; Borun, Chambers, Dristas & Johnson, 1997; Crowley, Callanan, Jipson et al., 2001; Crowley & Jacobs, 2002). Use of such strategies

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may depend on parent perceptions of children's needs and abilities (Dockser, 1989), or parent knowledge of and beliefs about the disciplinary content of the exhibits they are using with their children (Schauble et al., 2002).

This study builds upon the prior work in three ways. First, because we were working in a children's museum, we focused specifically on parent beliefs about teaching young children (1 to 5 years old). Second, prior work often focused on family agendas and parent beliefs or on specific teaching strategies around exhibits, while this study seeks to put the two levels together into a small number of composite approaches to parent involvement. We felt these composites would help us define the different parent audiences that we would be designing signs to support. Third, prior work often involved parent interviews or parent observations, but rarely both. Thus, we do not yet have a good idea of whether what parents say they do in museums bears any relation to what they actually do. In this study we first videotaped families using an exhibit and then interviewed parents about their beliefs.

We analyzed parent interviews first to identify five general kinds of parent beliefs. These kinds of beliefs reflect differences in the content and skills parents believe to be important, the goals parents have for their children's learning, and the teaching strategies that parents find appropriate for museums. We then compared parent beliefs to the videotapes of them using an exhibit with their children.

METHODS

This study took place at the Children's Museum of Pittsburgh. At the time the data were collected the Children's Museum was explicitly shifting from a child-directed philosophy to a collaborative philosophy that encourages family activity and meaningful roles for parents. This study was conducted in the context of ongoing exhibit prototyping work with the museum.

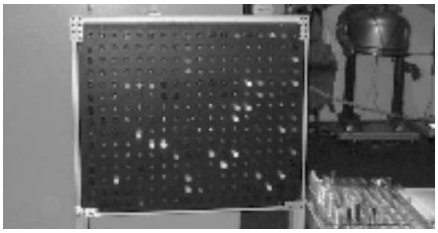
Participants

Participants were 19 parents (17 mothers, 1 father, and 1 grandmother) and their children (10 boys and 14 girls, ages 1 to 5). The average age of children was 28 months. Most parent-child groups were dyads; five included two children. One family was Asian-American; the rest were European-American. Thirty-two percent of the families were museum members.

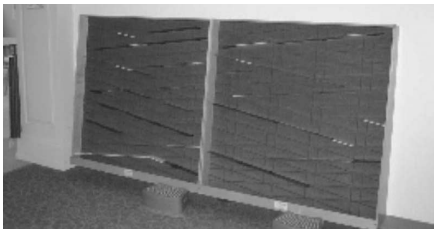
Procedures

There were two phases of participation. First, families were videotaped while they used the Light-Up Wall exhibit (see Figure 1). A wireless microphone on the exhibit recorded their conversations. Families had to use the exhibit for at least two minutes to be included in the second phase. After they finished with the exhibit, included families were interviewed about their use of the Light-Up Wall exhibit as well as three other exhibits: Roll-Away Wall, Pebble Drum, and Light-Up Sand Table (see Figure 1). These three other exhibits were in parts of the museum that most families had already visited when they reached our video cameras at the Light-Up Wall. We included questions about these three exhibits in the interview so that we had a broader set of experiences that parents could draw from as they were asked to describe their teaching beliefs.

Our participant-consent procedure also involved two phases. First, we posted a

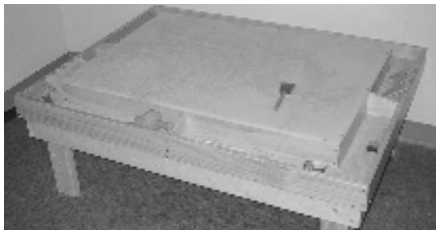


Light-Up Wall



Roll-Away Wall

Pebble Drum



Light-Up Sand Table

Figure 1. Light-Up Wall consists of a vertical board with holes that are backlit, and translucent pegs of various colors that fit into the holes. **Roll-Away Wall** contains rectangular, flat slats that can be placed into slots in the wall to form ramps of various lengths and slopes. Visitors place a ball at various points on the ramps and observe the ball's path to the bottom of the wall. **Pebble Drum** is a 3-foot tall hollow, wooden structure covered by a piece of glass with small holes. Visitors drop small pebbles through the holes. As the pebbles fall through the drum, they hit nails to create musical sounds. **Light-Up Sand Table** contains a flat rectangular surface that lights up from below and is covered with colored sand. Also provided are various instruments with which children can draw, scoop, brush, sweep and make designs in the sand.

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sign at the Light-Up Wall exhibit that explained that families might be videotaped while they used the exhibit. Then, when families disengaged from the exhibit, the researcher approached to ask for written consent to be interviewed and to allow us to use the videotape of the Light-Up Wall interaction for research purposes. All the parents asked to participate gave their consent.

We then interviewed parents about their teaching beliefs. After some quick demographic questions, we began by showing pictures of the four exhibits and asking them to talk about which were their favorites, what they did at each exhibit, what they talked about at the exhibit, whether they were trying to teach anything at the exhibit, whether they thought their child learned anything at the exhibit, and what a teacher or a scientist might think a child could learn from this exhibit. We employed an open-ended interview format where we covered each of these questions with parents, but did so in a way that was flexible with respect to the conversation between parent and researcher. Interviews were recorded and ranged in length from 2 minutes and 50 seconds to 12 minutes, with an average length of 6 minutes and 25 seconds.

The Light-Up Wall exhibit was chosen as the place to videotape families because our prior prototyping research suggested that it would support extended interactions and a wide range of parent teaching practices. In addition, the exhibit could be used successfully by individual children, children working with peers, or children working with adults; thus we could record interactions where families could choose to work together or apart. We chose to include the other three exhibits in the interview for similar reasons; again, based on our earlier prototyping studies.

Coding interviews

All interviews were transcribed. We then read through them several times to identify tentative themes. These included parent models of children as learners, goals regarding content learning, general ideas about appropriate levels of parent involvement in museum learning, and specific ideas about effective parent mediation strategies.

Guided by these tentative themes and by two related prior coding schemes (Crowley, Callanan, Jipson et al., 2001; Schauble et al., 2002), a group of researchers developed specific codes that might be associated with a theme. After an iterative process that included solo coding and group discussion, we settled on a final coding scheme with two dimensions—content learning and nature of mediation—that accounted for most of the interview data. Inter-rater reliability was determined by having two independent raters code all data: agreement exceeded 85% with disagreements resolved through discussion.

Content Learning. This dimension addressed parents' beliefs about content that could be learned in the museum. We broke content learning into two subcategories: "general early childhood" or "discipline-specific." "General early childhood" content included descriptions of basic skills and knowledge: learning basics such as colors, numbers, letters, cause-and-effect; practicing general competencies such as motor skills, social skills, imagination and creativity; and experiencing the senses such as sound and touch.

"Discipline-specific" content included knowledge and skills that were building towards bigger ideas in specific disciplines: identifying concepts such as gravity, sounds waves, or transparency; noting analogies between the exhibit and related phenomena such as how instruments work or how traffic flows; and explicitly stating that the exhibit was about a discipline such as art, science, math or music. We counted the number of instances of these codes for each parent for each of the two subcategories.

In addition to identifying whether statements were "general early childhood" or "discipline-specific,"

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we also counted talk in support of each subcategory so that we could determine the extent to which parents' beliefs were skeletal versus elaborate. Did parents have specific examples and evidence to support their statements, or were they simply making vague references such as "maybe kids would learn something about science?" Did they return to a similar subcategory over multiple exhibits, or did they mention it only once?

To address such questions we counted the number of unique supporting statements that were in each parent's discussion of each content learning code. We then added these counts to the initial counts of content learning codes. Thus, each parent was assigned two scores: One for the number of statements expressing "general early childhood" learning and one for the number of statements expressing "discipline-specific" learning.

Nature of Mediation. This dimension addressed how parents described their own role in supporting or extending their children's museum learning. Coding of this dimension was hierarchical and holistic: Parents were assigned a single code reflecting the highest level of mediation they talked about, with that level being coded from evidence drawn from anywhere in the interview.

The lowest level of mediation, *observation*, was coded when parents indicated that they did not interact with their children at exhibits. The next level, *encouragement*, was coded when parents mentioned giving general praise or encouragement, but did not mention more specific kinds of parent involvement. *Direction* was when parents reported helping their children manipulate exhibits by modeling, demonstrating or giving directions. *Describing* was coded when parents said they described evidence at the exhibit. The highest level, *explaining*, was assigned to parents who said they introduced causal, analogical or principled connections between the exhibit and larger domains in early childhood or in the disciplines.

Coding videotaped interactions

Parent-child interactions from the videotapes were coded for nature of mediation using the same holistic and hierarchical coding scheme as in the interviews. This coding was closely modeled on our prior interaction coding schemes (e.g., Crowley, Callanan, Jipson et al., 2001). Two coders who had not participated in data collection or coding of the parent interviews were first trained on the existing scheme. Then they each coded all of the interactions independently. Inter-rater agreement was 88% and disagreements were resolved through discussion.

RESULTS

Analysis of interviews

Because our primary purpose was to gain a better understanding of how parents see their roles as teachers and their children as learners, we decided to place a qualitative analysis of the interview data at the heart of the study. Our goal was to put together the mediation and content learning codes to identify general parent models of museum teaching.

We began by examining the codes for nature of mediation. Recall that the scheme was hierarchical, so that parents were assigned a single score based on the highest level of mediation that they mentioned. Although almost all interviews contained statements that could be coded as observation or encouragement, all parents also mentioned, at least once, higher levels of mediation: seven parents topped out with a *direction* code; eight with *description*; and four with *explanation*.

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For each of these groups of parents, we then examined content learning scores. For parents who topped out with *direction*, "general early childhood" scores ranged from 0 to 17 (M=9.0) and "discipline-specific" scores ranged from 0 to 3 (M=1.0). For parents who topped out with *description*, "general early childhood" scores ranged from 3 to 27 (M=12.9) and "discipline-specific" scores ranged from 0 to 9 (M=2.5). For parents who topped out with *explanation*, "general early childhood" scores ranged from 17 to 26 (M=19.5) and "discipline-specific" scores ranged from 1 to 18 (M=8.0).

Recall that our content learning scores were constructed to identify both what parents thought children might learn (early childhood versus disciplinary content) and the extent to which parents could elaborate their ideas. The wide ranges for content learning scores suggested that, within the mediation category, there might be some

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meaningful differences in the extent to which parents had well developed teaching beliefs. In other words, a parent who topped out at *description* but had a content learning score of 3 is probably not the same kind of teacher as a *description* parent with a content learning score of 27.

Thus, we decided to split both the *direction* and *description* parents into two groups—those above and below the mean total content learning score (general early childhood + discipline-specific) in each group. We did not split the *explanation* parents because there were only four. Thus, our analysis of parents' beliefs resulted in five approaches to teaching and learning in a children's museum (see Figure 2). We next explore each of these approaches.

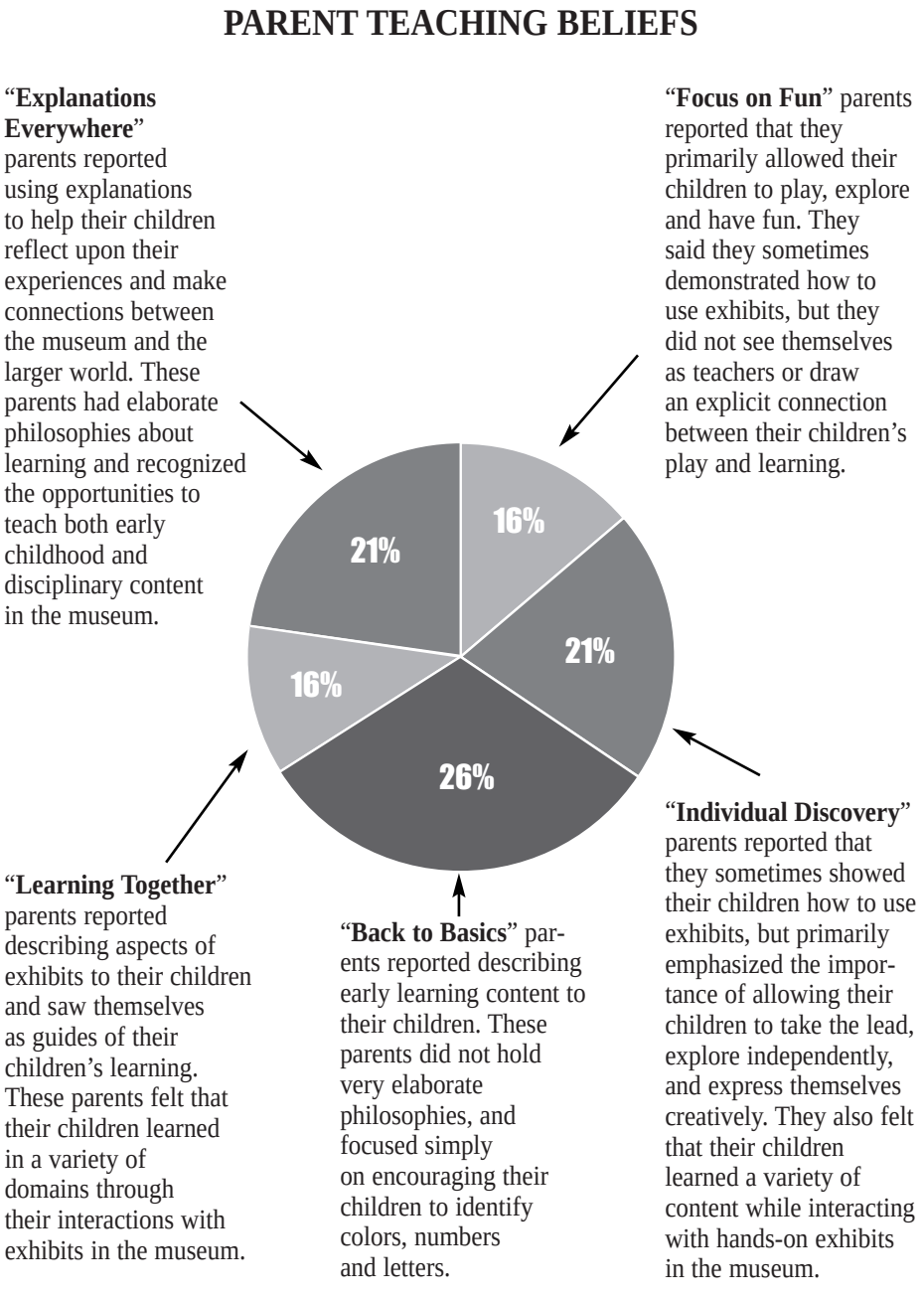

Figure 2. Analyses of teaching beliefs revealed five groups of parents.

Focus on Fun. These parents reported that they allowed their children to primarily play, explore and have fun. They said they sometimes demonstrated how to use exhibits but they did not see themselves as teachers or draw an explicit connection between their children's play and learning.

Interviewer: *When you come to the museum, do you think about teaching* [your son] *anything or can you think of anything that he might be learning from interacting with this exhibit or that one?*

Mother: *I guess I don't really think about it. I just let him play.* (Family 23, 2.5-year-old boy, nonmember)

Another Focus on Fun mother gave some consideration to what her children might be learning but did not emphasize the importance of her own role in the museum.

Interviewer: *Do you think about teaching them anything? Or maybe about what they're learning?*

Mother: *Yeah. It's colors here* [at the Light-Up Wall]. *And here* [at the Pebble Drum], *I'm more interested in seeing if they can pick more than one up with their hand, and I guess what's inside. They have different styles so…different ways to look at that…you know, just to look at how they do it.*

Interviewer: *Would you say that you had a general philosophy about how you wanted them to learn or how you want to teach them? Or is it just based on what you do…?*

Mother: *Um… When there are things that we do, I just talk through it, so that's why… that's how. I don't do anything really special so…*(Family 1, 1.5-year-old girl, nonmember)

While some Focus on Fun parents, like this mother, talked about opportunities to learn basic concepts, for the most part their beliefs centered on allowing their children to explore and enjoy their experiences in the museum.

Individual Discovery. These parents had philosophies that reflected quasi-Piagetian beliefs regarding their children's learning. They reported that they sometimes showed their children how to use exhibits but primarily they emphasized the importance of allowing their children to take the lead and explore independently. These parents also recognized opportunities for their children to learn a variety of content while engaging in hands-on exploration of museum exhibits. They most commonly mentioned "general early childhood" learning concepts like cause and effect, sensory experiences, creativity, imagination, colors, textures, social skills (e.g., sharing, taking turns) and motor skills (or eye-hand co-ordination). Some Individual Discovery parents also briefly mentioned "discipline-specific" learning content, but were not very elaborate in their descriptions of such learning opportunities (e.g., "he learns about music").

The following Individual Discovery mother discussed various learning opportunities that the exhibits afforded. She also felt that socializing with other children was an important part of her daughter's museum experience.

Mother: *So the color grabs you there* [at the Light-Up Wall]. *I mean* [the Pebble Drum's] *about sound*. [The Light-Up Wall's] *about color*. [The Pebble Drum's also] *about movement. Well movement here* [at the Roll-Away Wall] *as well. And this one with the sand, I've seen it in different places…* [And as for] *teaching her…well, you know what I would say really more socialization stuff. Like um, rather than skills of facts or uh, anything of that nature, I'd say interacting with other kids is special…*(Family 10, 2-year-old girl, member)

This mother also encouraged her daughter's independent exploration by allowing her to take the lead in her interactions with exhibits in the museum.

Mother: *I find I take her lead and I don't really talk…we don't really talk so much…and it seems like over the course of her life since she was a little, little kid, every time we come here, there are old favorites but there's always something new that grabs her attention…Maybe I try to give her ideas about how to play with something if I don't see her playing with something.*

Interviewer: *Yeah. So, you kind of let her take the lead and then if she might be stuck or something, you might give her some ideas….*

Mother: *Right. And I'm excited for the time when she's gonna want to start climbing on the climber. She hasn't gotten there yet. She just started to get curious about that today but she's not quite there yet.* (Family 10, 2-year-old girl, member)

This mother reflected upon what sparked her daughter's curiosity and felt learning was most powerful when her daughter followed her own interests. She served as a resource if her daughter needed help, but primarily supported learning by allowing her to explore independently or with other children.

Similarly, the following Individual Discovery mother indicated that she might provide ideas for her child while introducing her to an exhibit or if she needed help, but that for the most part, she allowed her to play independently.

Interviewer: *What about with any of these specific ones? Does anything come to mind that you might try to teach* [her]?

Mother: *I guess maybe the first time that* [she] *would be using this* [Light-Up Sand Table], *I would show* [her] *how to do it to maybe give some ideas. And then after that I would let* [her] *do what* [she] *wanted. Same thing with the art studio or with something like this* [Light-Up Wall]. *I was waiting to see what she would do and she figured it out. She didn't need me to help her. Same with this* [Pebble Drum]. *Her sisters did it so she knew what to do so.*

Interviewer: *Do you think…is there anything…*

Mom: *She needed my help with this* [Roll-Away Wall], *you know, just getting ideas.* (Family 13, 3.5-year-old girl, member)

This mother went on to talk about some concepts that her daughter might be learning in the museum.

Interviewer: *I was just curious if there was anything that you think they might be learning from any of these… Anything that jumps out to you about specific things?*

Mother: *Um…hand-eye coordination probably for this one* [Light-Up Wall]. *And I don't know cause and effect for that* [Roll-Away Wall]…*Yeah. Just how things work, you know, the different elements of sand and light that go on*

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in this one and how what they do effects it…I'm not sure about that [Pebble Drum] *but I think the appeal is the sound. They love that little tinkly sound. It's kind of like a rain stick.* (Family 13, 3.5-year-old girl, member)

In summary, most of the Individual Discovery parents emphasized the importance of their children taking the lead and making discoveries independently. Some did provide scaffolding in order to make tasks more manageable for the children if they had reached an impasse. However, they did not attempt to extend learning if children were exploring successfully on their own. Finally, although parents in this category did not focus on their roles as teachers, they were fairly elaborate in their descriptions of a variety of learning opportunities.

Back to Basics. These parents were coded as topping out with *description* in the mediation coding; however they did not hold very elaborate teaching philosophies. They tended to focus on teaching "general early childhood" content by doing things like quizzing children about colors and letters or by providing labels for children as they use the exhibit.

Mother: *Well, we're trying to do like colors and stuff like that and just point out everything to him right now.*

Interviewer: *OK. And what about at this one* [Light-Up Sand Table]? *What kinds of things did you talk about?*

Mother: *Just name the different brushes, or the shovel, the sand. Just making sure to give a name to everything right now so he picks up on it.* (Family 12, 1-year-old boy, nonmember)

Most Back to Basics parents also had learning goals for their children that stemmed from age-based expectations, and reported using teaching strategies that reflected these goals. For example, the following father discussed what he felt was important for his son to be learning at two years of age. He also emphasized the importance of his own role as a teacher for his children as they interacted with exhibits.

Father: *We try to teach him stuff… either colors…whatever they're doing…we try to make shapes. It's hard to say exactly what we do, but I think it's important to kind of sit and talk with them about what they're doing. And our daughter…my daughter's over there* [at the art table] *and she's a big crafter. She likes to sit and cut things. He's at the stage where I'm just trying to get him to learn the colors and numbers and ABC's and that kind of stuff.* (Family 17, 2-year-old boy, 5-year-old girl, nonmember)

This father went on to say that he would talk to his daughter about "discipline-specific" content like gravity and related scientific concepts, but that his son was too young to grasp these concepts. The comparison that he drew between the abilities of his two children illustrates that his beliefs about his children's development clearly guided his interactions with them in the museum.

Some Back to Basics parents also said they were always ready to assist or direct their children, especially if they felt that a learning opportunity was being missed.

Mother: *I try to get him to…prompt him, you know, to do stuff. Like in the puppy* [another exhibit at the Children's Museum], *of course he likes to open all the flaps but I try to get him to play with the magnetic letters too because he's learning his letters…Of course, at this age, if I'm here two months from now, he'll be totally different, but he's learning his letters so I tried to get him to pick out some of the letters and he did.* (Family 11, 2-year-old boy, nonmember)

Some Back to Basics parents said they were always ready to assist or direct their children, especially if they felt that a learning opportunity was being missed.

This mother felt that her primary role was to focus her son's attention on "general early childhood" learning content (letters). Like other Back to Basics parents, this mother's interview did not suggest a very elaborate teaching philosophy or focus on teaching much "discipline-specific" content.

Learning Together. These parents described aspects of exhibits to their children and saw themselves as guides of their children's learning. In contrast to Back to Basics parents, these parents were more elaborate in describing "general early childhood" learning opportunities and also mentioned several examples of "discipline-specific" learning.

Mother: *We talked about colors and how sand feels and how you can make different...patterns with the different tools. Yeah cause you can do letters, you can do all sorts of things...letters and shapes. You know going to the grocery store or to the post office or even errands, you know they may be mundane, but they can learn how to interact with people and how to be polite, and you know, what the real world is all about.*

Interviewer: *OK. Great.*

Mother: *It's neat because she's at the age where she wants to know where things come from and how things work and it's really cool.*

Interviewer: *So, as far as any of these go can you think of anything specific that you might want to teach her…*

Mother: *This one* [Pebble Drum] i*s really neat… because you learn about music and sounds and cause and effect. It's really interesting… And then the fine motor skills to pick up rocks and actually place them in…That's good practice. She's always had good fine motor skills actually, but some kids you know, I think it's really good practice for them.*

Interviewer: *About the Light-Up Wall…can you think of anything there that you would want to teach her or anything that she might be learning?*

Mother: *I think the colors are really good there and how they change with the light, I guess that would be brightness you're teaching. You know the cause and effect again, I think is something. And it takes quite a bit of strength to be able to put it in the wall and push it in, so…*

Interviewer: *Yeah. Definitely.*

Mother: *Which again is sort of the fine motor, gross motor skills. And then sharing I think with that too. Cause there were a bunch of other kids there so I think they need to learn to take turns and share.* (Family 21, 2.5-year-old girl, member)

This mother also said that she believed what a parent can teach a child sometimes depends on his/her age.

Mother: *I think* [what you can teach children] *varies per age. You know, at her age, I'm just sort of getting the basics of cause and effect, socialization, social skills, and you know, if we get other basics, colors, numbers, shapes, that's great. I think as kids get older, it becomes probably more complex, I would imagine…You know, you could talk about the way light works or… the way vibration and sound, you know, sort of more scientific. So, I see as she gets older it will sort of change, and her interests and things will change, and how she looks at things will change.* (Family 21, 2.5-year-old girl, member)

So, while this mother seemed to concentrate on teaching a variety of "general early childhood" concepts, she felt that parents of older children might be able to discuss concepts that are more closely linked to specific disciplines like science.

The following Learning Together mother also seemed to focus more heavily on "general early childhood" content. However, she also talked about asking her child questions to encourage him to think about and describe what was happening at the exhibits. She was also fairly elaborate in her descriptions of learning opportunities.

Mother: *I think it's good to watch things go down and it's also music, kind of a musical sound. So, he'll probably stay there for a while, it's an interesting experience to him. He likes seeing it go down...it's kind of cause and effect. You put things in the hole and it goes down and gets to the bottom, so...*

Interviewer: *And what kinds of things would you talk about at these different exhibits?*

Mother: *I think maybe just,* [with] *this one* [Light-Up Wall] *maybe different colors, maybe can we count how many red ones are there in a line? Make a shape or something like that. This* [Pebble Drum] *mostly just, probably just, it's cute, it makes noise, I mean, I don't know what I would say at his age…maybe you put rocks down there and what happens? It hits the nails and makes a sound and it can go in different directions.*

Interviewer: *OK, and I'm interested in…you said you would talk about these different things. Is there anything that you would want to teach him at these different exhibits? Or that you think he might be learning...*

Mother: *Um…I mean he already knows his colors, I think. It's more to reinforce what he already knows, so he... it's always good to always reinforce, reinforce, reinforce, colors and shapes and order and that kind of thing so, cause and effect is a good thing to really experience. You know, you can tell them the sun comes up and there will be daylight, but if they see the sun coming up, then they see the light then they remember it.* (Family 18, 2.5-year-old boy, nonmember)

Overall, Learning Together parents helped their children notice aspects of exhibits that they might not have otherwise noticed. They also seemed to reflect more deeply than Back To Basics parents about their children's learning experiences in the museum.

Explanations Everywhere. These parents went beyond using labeling and describing as teaching strategies and encouraged their children to reflect more deeply upon their experiences in the museum. These parents reported using explanations to connect exhibits to the larger world: to help their children understand why something happened, how it happened, or how

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it related to something else they had experienced. They also had more elaborate philosophies about learning and recognized opportunities to teach both "general early childhood" and "discipline-specific" content while engaging with hands-on exhibits. Overall, they saw themselves as teachers who made important contributions to their children's museum learning.

Explanations Everywhere parents were reflective about what and how their children were learning and how this learning transferred or applied to other contexts. For example, the following mother emphasized the thought processes that her son went through at the Light-Up Wall and that her daughter went through at the Roll-Away Wall, and her own role in supporting their learning.

Mother: *It's good for her to understand pathways and how they work because at one point she blocked it off and was like, "OK. The ball's not going anywhere." So I said, "If you move…let's think about it. How can we make the ball go?" And then at that point, it dropped three or four levels because there were no other panels there. So then we created, you know, another level and made panels connect and the ball went all the way down to the bottom…And this* [the Light-Up Wall] *is wonderful because they get to see how things work and he got excited when he put in the orange one and the orange one lit up because he has been working with the dark colors and he didn't understand…like I could tell that he didn't see the dark colors light up and then the light colors light up so...*

Interviewer: *So, I'm interested also in the kinds of things you want to teach them with these different exhibits or what you think they have learned.*
Mother: *With this one, we did talk a lot about pathways and how if you were to turn this board down it would be a roadway or a maze because she's really into mazes. So we talked about if you turned this flat, this becomes a maze, and you know, as opposed to having a ball, you could have a car, you could have a person, it could be like a city, but of course you know, we went crazy with it…And you know, we didn't get far into it but we might have to go play with it again and talk about like city planning and stuff like that cause I actually worked for the Bureau of Transportation. So it just reminded me of a lot of things.* (Family 9, 5-year-old girl, 1.5-year-old boy, member)

This mother helped her daughter make connections between her experiences at the museum and the larger world (mazes, roads and cities). Another mother saw herself as being more directive in her teaching approach, but also acknowledged that her role involved explaining and helping her sons make connections between their immediate experiences and other contexts.

Mother: *I would probably be one to guide them to make a picture* [at the Light-Up Wall] *whereas, you know, maybe somebody would say let them interpret their own or let them just scatter them and make their own thing, whereas, you know, I'm like, "Does that look like a circle or does that look like a tractor?" so maybe that kind of stuff. And also probably explaining how to do* [the Roll-Away Wall]…
Now, this [the Light-Up Sand Table] *doesn't take any directions...But yeah, I like to explain things. We did the earthquake one* [an exhibit at another interactive museum] *and we talked about why its structure has to have a bigger base at the bottom so it doesn't tip over. He's into mechanical things like structure so, trying to explain that.* (Family 19, 3.5-year-old boy, 1-year-old boy, member)

Similar to the previous Explanations Everywhere mother, who emphasized her daughter's understanding of pathways, this mother also focused on her child's thought processes and his attempts to "figure things out" at the Roll-Away Wall.

Mother: *Just figuring out how he wants to lay it out, I think that's something for his thought process, figuring out how he wants the ball to fall. And he's moved different pieces to different spots and I watch him figuring out if it falls here, you know I have a spot open for it to fall to the next and I like that...I do see this one as being more scientific and mechanical, figuring out how things work together.* (Family 19, 3.5-year-old boy, 1-year-old boy, member)

Some Explanations Everywhere parents reported that they continued to discuss and teach related concepts at home, connecting their children's experiences in the museum to those in other settings. For example, one parent mentioned making an instrument like the Pebble Drum; another used interactive cards at home that reviewed the content of an art exhibit they had seen in the museum. The following mother emphasized helping her child remember what she had done at the Children's Museum.

Mother: *So we try to teach her a lot and relate a lot of the things that we do…We do a lot of interactive things. We like to come to the museum and stuff…and she remembers. I mean you don't think that they remember but they do. You know, if she sees sand on T.V., or if she sees certain things, you know, we say, "Do you remember playing with that at the museum? Do you remember?" You know and she says, "yes" and it's familiar to her.* (Family 20, 1.5-year-old girl, nonmember)

Overall, Explanations Everywhere

parents mentioned some "general early childhood" content like social skills, shapes and colors but also emphasized concepts linked to "discipline-specific" content. These parents were highly involved in their children's learning, and encouraged them to reflect upon their experiences. They noticed and made deeper observations of what and how their children were learning and how they might be able to build on that learning in meaningful ways.

What parents say and what parents do

Our next analyses were focused on the question of whether parent beliefs were consistent with their actual interactions at one target exhibit—the Light-Up Wall. Based on the definition of the parent-belief categories, we expected Focus on Fun and Individual Discovery parents to be limited to observing their children or occasionally offering help if children reached an impasse. We expected to see Back to Basics and Learning Together parents doing this, but also to be engaged in labeling and describing aspects of the exhibits for their children. Finally, we expected Explanations Everywhere parents to do all of these things, but also sometimes offer explanations to their children.

Comparisons were generally consistent with the expectations. First, all but one parent from the Focus on Fun and one from the Individual Discovery categories observed or offered occasional help. The two parents who were not consistent with our interview coding were also observed offering descriptions to their children.

Second, every parent in the Back to Basics and Learning Together categories was consistent with our interview coding—they offered labels or descriptions but not explanations.

The Explanations Everywhere parents, however, were the least consistent with our interviews coding: Only one of the four parents in this category was actually observed to explain at the Light-Up Wall. The interviews offer some clues about this inconsistency.

For example, when she later considered the Light-Up Wall during the interview, one Explanations Everywhere mother said to us:

Actually, this [the Light-Up Wall] *is the first time I have sat back to watch him do anything. I usually interact with him at all of them. I just kind of like to watch him, you know, let him play a little bit on his own because I have a two-month old, so he's got to learn to do that a little more because he's so used to me playing with him constantly, that sometimes when I'm feeding the baby, I need him to play a little bit by himself.* (Family 25, 2.5-year-old boy, nonmember)

Whatever the reasons that these parents did not explain at the Light-Up Wall, the overall implication is that parents who believe explanation is important may not engage in explanation at every exhibit. They may target explanation to appropriate opportunities based on their child's activity and the content of the exhibit (Crowley & Galco, 2001).

Factors associated with parents' teaching beliefs

We did not find strong associations between parent teaching beliefs and age of child, gender of child or museum membership status. There were no significant differences in the mean age of children whose parents were identified as Focus on Fun (27 months), Individual Discovery (27.4 months), Back to Basics (27.2 months), Learning Together (25.3 months) or Explanations Everywhere (31.3 months).

Similarly, parents of boys or girls were equally likely to be coded as belonging to each of the parent-belief categories. Finally, although the differences were not statistically significant, there were some suggestive patterns for membership status: Members and nonmembers were both identified as Individual Discovery, Learning Together and Explanations Everywhere; however, only nonmembers were ever coded as Focus on Fun or Back to Basics. These patterns would be consistent with the notion that frequent visitors were more familiar with the exhibits and thus more likely to consider a range of learning opportunities in the museum.

DISCUSSION

Given that there is a range of parent-child activity in the museum, how should we approach the task of designing effective signage to support parent mediation? As we began our work with the Children's Museum this question took center stage. This study represents a first step in answering the question.

We described five composite approaches that involve parent beliefs about how their children learn, what can be learned in a museum and how parents can best support learning. We demonstrated that the approaches are generally consistent with what parents actually do at exhibits and we also demonstrated that the approaches were not strongly associated with the age of child, gender of child or museum membership status.

Before returning to the signage process at the Children's Museum, we should first note that the current study is limited in the extent to which it explores parent factors that may be associated with teaching approaches. For example, while prior research has found only minor differences between the ways in which mothers and fathers

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scaffold their children's learning during joint activities (Gauvain, 2001; Wood & Middleton, 1975; Frankel & Rollins, 1983; Conner, Knight & Cross, 1997), there does seem to be a link between parenting style and scaffolding (Pratt, Kerig, Cowan & Cowan, 1988), as well as more personal characteristics like skill at working with young children (Rogoff & Gauvain, 1986), emotional state (Goldsmith & Rogoff, 1995) and attachment classification (Matas, Arend & Stroufe, 1978; Frankel & Bates, 1990; Fagot, Gauvain & Kavanagh, 1996).

Additionally, one can imagine that factors such as socioeconomic status and educational background may be directly or indirectly linked to the issues at hand. Future research using larger and more diverse samples would be necessary to understand how these factors shape parents' views of themselves as teachers, and how they see their children as learners in museums and in other informal settings.

Future researchers should also design and utilize methodologies that build our understanding of parent-child interactions from parents' perspectives. This could be accomplished by finding useful ways for parents to reflect upon their roles in their children's learning. For example, combining a larger sample with more structured interviews or developing a more in-depth case-study methodology with a smaller sample, might be successful ways to capture the complexities and varied nature of parents' philosophies about teaching their children in informal settings.

Future research could also combine interview and observational methodology to examine the learning outcomes of teaching strategies used by different kinds of parents, and how parents' perceptions of their teaching roles are related to specific measures of learning. It occurs to us that technologies such as Stevens and Hall's (1997) "Video Traces" might be useful here.

We close by considering the role of our findings in our ongoing work as part of the Children's Museum signage project. In our earliest meetings, the team often found itself wandering unintentionally into replaying the classic Piagetian-Vygotskian debate between child-directed constructivist and collaborative socio-cultural models of learning—a debate that is being played out across the museum world as we struggle to find the right ways to conceptualize, create and assess museum exhibits for children and families (Crowley & Callanan, 1998; Falk & Dierking, 2000; Leinhardt, Crowley & Knutson, 2002).

Child-directed constructivist models emphasize the importance of individual discovery and down play the role of teaching. The dominant metaphor for learning is that of accumulating new knowledge, mastering new skills and acquiring more powerful internal conceptual structures. Because learning is thought to be less deep and less general if the child does not actively construct it by herself, discovery-driven inquiry is often viewed as the ideal form of learning.

In contrast, the collaborative socio-cultural approach views the dominant metaphor of learning to be one of participation in social and cultural settings. Rather than seeing learning as general knowledge acquisition, this approach views learning as a process of becoming increasingly competent in authentic activity. Becoming competent involves making more powerful use of individual, social and cultural resources to accomplish goals. Thus, describing the processes and outcomes of learning often involves describing changes in how children see themselves as parts of cultural worlds, how they talk with parents, peers or teachers, and how they use tools and artifacts in problem solving.

One can imagine that factors such as socioeconomic status and educational background may be directly or indirectly linked to the issues at hand. Future research using larger and more diverse samples would be necessary to understand how these factors shape parents' views of themselves as teachers, and how they see their children as learners in museums and in other informal settings.

Although evidence and argument might be mustered to support both positions as reasonable models of museum learning, each has different implications for how museums support parent participation. To support a child-directed constructivist model, there would be little signage and little direct role for parents other than perhaps helping children who are having trouble engaging in the basic activity supported by an exhibit.

Collaborative socio-cultural approaches start with the assumption that there should be meaningful roles for parents at most exhibits. These roles are not about taking control of the interaction away from the child, they are instead about extending and enriching children's activity through assistance and conversation. To support this approach, signage is often required.

It is not always clear to parents, particularly in the context of a children's museum, how they can become seamless participants in their children's activity rather than, as one exhibit developer once put it in a recent signage meeting, "big clumsy adults who step all over their child's learning."

As we began the signage project with the Children's Museum it soon became clear that all of the team members were bumping up against their own beliefs (oftentimes implicit) about parents as teachers in museums. Some of us pushed for more signage to support explanation and interaction, believing that the most powerful kinds of interactions included parents. Some of us pushed for less signage, unless it included directions for parents to step back and let their children discover things on their own. Most of us came down somewhere in the middle. But all of us soon realized that we were trying to make decisions based on our own perceptions of what parents wanted and could make use of in the museum.

It is not always clear to parents, particularly in the context of a children's museum, how they can become seamless participants in their children's activity rather than, as one exhibit developer put it in a signage meeting, "big clumsy adults who step all over their child's learning."

This study was the first step in bringing the voice of parents to the design table. Rather than a tired argument between a false dichotomy, we now had empirically grounded models of parents as teachers that could serve as a basis for exploring the museum's own stance towards parents and the ways that the museum would design signage to invite parents into the world of their children's museum learning.

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