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Creating a Learning Environment that Fosters Parent-Child Interactions: A Case Study from the Animal Secrets Exhibition Project

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"These are things you can do when you go out to a park or in our own backyard like this person [naturalist] did. You can keep a log. Do you have one of these [a net]? You can catch a frog with it." — Parent to young child during formative evaluation of *Animal Secrets* exhibition

Introduction

Research shows that long before young children enter a classroom, they are beginning to develop science literacy (Bredekamp & Copple, 1997; Callanan & Jipson, 2001; Chaillé & Britain, 1991; Lind, 1999). They do this primarily through everyday activities in a collaborative process in which their parents play a fundamental role (Callanan & Jipson, 2001; Crowley & Callanan, 1998; Crowley &

Galco, 2001). Informal science institutions can foster this emerging science literacy by engaging parents and young children in collaborative learning in exhibits (e.g., Crowley et al., 2001; Diamond, 1986; Dierking & Falk, 1994; Schauble et al., 2002). But what strategies work best to encourage parent-child interactions?

In the recent exhibition project *Animal Secrets*, we looked at the impact of three strategies for fostering parent-child interactions in an exhibition for young children: environmental design, types of activities, and labels. Results from our study indicate that all three strategies can support parent-child interactions, but environmental design and activity type were more effective than labels overall in promoting parent-child collaboration. Mixed results for exhibit labels suggest the need for further research into how best to communicate with parents of young children in an exhibition.

The project

Animal Secrets is a 2,500-square-foot, bilingual, interactive natural science exhibition designed for young children (ages 3–8) and their adult caregivers. The exhibition was funded by the National Science Foundation (ESI-0229875) and developed by the Oregon Museum of Science and Industry, Portland.

In the exhibition, visitors engage in hands-on activities and explore a variety of immersive, naturalistic environments (a woodland, a meadow, a cave, a stream, and a naturalists' tent), in which the focus is on developing age-appropriate science skills, such as observing, comparing, and asking questions; gaining an understanding of basic natural science concepts, such as animal behaviors, animal anatomy, and habitats; and developing empathy for nature. A primary goal of the *Animal Secrets* project was to create a science-learning environment that promoted adult-child interactions.

Exhibit designers sought to help parents support their children's science learning through play—by creating an environment that afforded social play between children and adults. To do so, the team identified and applied best practices from several bodies of research.

Puppet play at Racoon Log

Research context

Constructivist and sociocultural learning theory

The approach to exhibit design was grounded in two learning theories that currently drive best practices in early childhood education environments and in museums. First, Piagetian theory addresses the ways in which play contributes to cognitive development for young children (Bergen, 1988). Second, Lev Vygotsky's sociocultural learning theory emphasizes the importance of the "zone of proximal development," essentially the difference between what an individual can do on his or her own and what he or she can do with help from a more able peer or adult (Roschell, 1995).

Jean Piaget's work contributed a cognitive constructivist framework for providing children with a context for play. Piaget posited that children act on the physical and social environment, often through play, to learn through a process he called adaptation. Learning occurs as children's mental structures adapt to assimilate or accommodate new information. The 3- to 8-year-olds targeted by *Animal Secrets* commonly engage in sociodramatic and pretend play. Sociodramatic and pretend play are important intellectual activities that result in preliminary mental representations of the world as well as practice adapting to new situations, experiencing feelings, and developing skills.

Vygotsky's work contributed a framework for providing children with a social environment for play. His notion of the zone of proximal development resulted in this project's emphasis on eliciting parent-child interactions so children would enter into contexts that promoted adaptation—particularly with regard to science skills.

Family learning in museums

Sociocultural theory emphasizes social interaction as a basis for learning, and a number of researchers have looked specifically at how museums can support this type of interaction in family groups (Ash, 2002, 2003; Borun & Dritsas, 1997; Diamond, 1986; Dierking & Falk, 1994). Parent-child interactions in particular have been the focus of several studies in which researchers have examined how parents contribute to the development of their children's scientific literacy (Callanan & Jipson, 2001; Crowley & Callanan, 1998; Crowley & Galco, 2001; Crowley & Jacobs, 2002; Schauble et al., 2002).

Crowley and Callanan (1998) define science as "a way of making sense of the world" (p. 12). Essential to scientific literacy, then, is "a way of building up new theories to explain existing evidence and a way of seeking out new evidence to revise existing theories" (p. 12). They argue that the strength of the museum environment lies not in helping visitors acquire scientific facts but in offering visitors a chance to develop and practice competencies in science—predicting, evaluating evidence, and forming theories.

Parents promote science learning in exhibits in a number of ways. They play the role of "guide and interpreter" and help shape their children's scientific thinking in exhibit activities (Crowley & Callanan, 1998; Crowley & Galco, 2001). They provide explanations based on exhibit activities that help children incorporate evidence into their developing theories about the world. Perhaps even more importantly, parents model meaning-making in the domain of scientific thinking (Callanan & Jipson, 2001; Crowley & Galco, 2001).

Parent participation significantly deepens children's engagement with exhibits, which appears closely related to learning. Researchers have found that when children engaged in exhibits with their parents, their exploration is broader and deeper than when children engage in exhibits alone (Crowley & Callanan, 1998). Parent-child interactions in exhibits may also contribute more broadly to the child's development: "[T]he most important outcome of everyday parent-child scientific thinking may be that children develop an early interest in science, value science as a cultural practice, and form an identity as

someone who is competent in science" (Crowley et al., 2001, p.). This research suggests that the most effective interactive exhibits are those that support parent-child interactions.

A number of studies highlight the importance of parent-child conversations for science learning in exhibits (e.g., Ash, 2002, 2003; Callanan & Jipson, 2001; Crowley & Callanan, 1998; Crowley & Jacobs, 2002). Parents support their children's emerging scientific literacy by responding to their questions, commenting on their actions in exhibits, and connecting exhibit activities to prior family experiences (Callanan & Jipson, 2001; Crowley & Jacobs, 2002). In a study of family conversations in a museum exhibit on biological themes, Ash (2002) asserts that museums are "places where learners do science when they talk science" (p. 358) and that good exhibits engage families in thematic conversations.

Supporting parents in their roles as learning facilitators

Crowley and Callanan (1998) stress that the "[g]uidance of parents is an important bridge between the intentions of the exhibit designer and the experience and knowledge of the child" (p. 12). But how can exhibit designers best support parents in their role as learning facilitators?

Research reveals that parents see themselves playing many other roles besides learning facilitator during a museum visit, including planner, time keeper, rule maker, social mediator, and time-out taker. Thus exhibits (and staff) that help parents perform their noneducational roles may increase the likelihood that parents will be able to spend time facilitating their children's learning (Gyllenhaal & Cheng, 2003).

Providing the right type of information to parents is also key. In a study of parent-child interactions in science exhibits, Schauble et al. (2002) found that parents were often puzzled about how to support learning in exhibits that fostered play and exploration and suggested that exhibit developers need to focus more on helping parents understand ways to facilitate learning, for instance by providing specific questions to ask, rather than just pointing out the importance of asking questions. Schauble also found that parents needed help understanding more about how young children develop scientific thinking.

Communicating with parents in an exhibit

Labels provide one means for communicating with parents in an exhibit. Studies have found that museum visitors do read exhibit labels, and when parents read labels, it is most often in their role as learning facilitators. Parents of young children, however, have little time for label reading because they are busy mediating other aspects of a museum visit. They must be able to quickly find the information they need to facilitate their child's experience. In cases where a young child is engaged with an exhibit for an extended period of time, though, a parent may be able to read more (Gyllenhaal & Cheng, 2003).

Applying research to practice

In order to support parents as learning facilitators, the *Animal Secrets* project sought to provide parents with tools and techniques they could use to promote their child's science learning, by modeling learning-enhancing behaviors in the exhibit and providing information about how play contributes to science learning for young children. Applying ideas from prior research, the team identified specific behaviors they wanted to elicit from the children and adults in the exhibit. To encourage science learning through play, the team determined they needed to elicit sociodramatic play behaviors from children along with the use of age-appropriate science skills. To foster adult-child collaboration and to involve adults in children's science learning through play, the team determined they needed to engage adults as observers of play, supporters of play, and play partners. To foster the learning that occurs from

multigenerational interactions with museum exhibits, the team determined they needed to elicit engagement with the exhibit, conversation about the exhibit, and the reading of exhibit labels.

Dramatic play at Stream

The challenge for the exhibit team was to build an unstaffed exhibition environment that reliably elicited these behaviors from families—and in particular elicited the appropriate interaction behaviors from the adults. The team sought to accomplish this through the environmental design, the exhibit activities, and the exhibit labels.

Research findings were integrated and applied to the exhibition project through the development of a "Measures of Success Framework," a form of logic model (Figure 1). For each project goal, the team identified specific objectives, behavioral measures of success (observable and measurable), and environmental characteristics (physical design and label messages) that would afford the desired behaviors. These measures were assessed during the formative and summative phases of the project.

Figure 1: Animal Secrets Measures of Success Framework (pdf)

Environmental design

To provide the context for parents and children to engage in sociodramatic play, exhibit developers sought to create an immersive naturalistic environment, that is, an exhibition designed to look like a natural setting through the use of realistic murals, large three-dimensional environmental pieces that visitors could enter and move through, dioramas, identifiable animals and plants, naturalistic lighting, and sound. Research suggests that such environments facilitate affective learning and learning through the senses, significant for achieving project goals (Gyllenhaal & Cheng, 2003). Project evaluators also posited that immersive aspects of the exhibition might foster social learning because immersive environments with the appropriate props (e.g., costumes, manipulatives) can lend themselves to imaginative play, and parents can play a role in shaping their children's experiences in immersive environments based on labels and the rich environmental details (Gyllenhaal & Cheng, 2003).

To further encourage parents/caregivers and children to engage in exhibits together, the exhibit team designed exhibits to embody characteristics of "family-friendly exhibits" as identified by the Philadelphia/Camden Informal Science Education Collaborative (PISEC) group (Borun et al., 1998, p. 180):

- Multisided—family can cluster around exhibit
- Multiuser—interaction allows for several sets of hands or bodies
- Accessible —comfortably used by children and adults
- Multioutcome—observation and interaction are sufficiently complex to foster group discussion
- Multimodal—appeals to different learning styles and levels of knowledge
- Readable—text is arranged in easily understood segments
- Relevant—provides cognitive links to visitors' existing knowledge and experience.

The final exhibition includes immersive, naturalistic environments (woods, cave, meadow, and stream), rich in sensory detail, in which children and adults can use costumes, puppets, and other props to engage in dramatic play as "animals." The exhibition also includes a naturalists' field tent, in which visitors can engage in dramatic play as "scientists."

Activities

The exhibit team recognized the need to provide developmentally appropriate activities that support a variety of different types of play—individual, child-child, and parent-child—and accommodate a variety of parenting styles. However, with the goal of fostering parent-child interactions in mind, the exhibit team intended that in the majority of exhibit activities, parents would interact with their children through play and conversation and that adults would assume roles that seemed likely to foster learning: play partner, play supporter, and observer of play.

Project evaluators carried out interviews with other exhibit developers who had developed nature exhibits for young children. These interviews yielded insights into the types of activities that might foster parent-child interactions:

- Activities that provide something for parents to do and a clear role for parents
- Activities that require parents to help
- Activities that physically accommodate adults
- Activities that give parents and children something to talk about
- Activities that take place in relatively quiet areas separated from the rest of the exhibition (Cheng & Beaumont, 2004).

Labels

For label content and design, the team followed best practices as identified by Beverly Serrell (1996) in *Exhibit Labels*, which include:

- Clear hierarchy of functions
- Consistency of message and graphic design
- Legibility (sufficient type size, readable font, sufficient contrast, appropriate placement—close proximity to activity)
- Reasonable length
- Easy to read out loud to children (no need to paraphrase or translate unfamiliar vocabulary)
- Images and words that work together.

To support parents in their roles as play partner, play supporter, or observer of play, the team developed two different types of labels. First, "invitational labels" modeled techniques that support young children's learning (e.g., open-ended questioning) and provided parents with needed science vocabulary. Second, "explanatory labels" provided parents with information about child development, the

importance of play in science learning for young children, and what parents can do to promote their children's science learning.

Invitational labels

These labels were directly linked to the exhibit activities and positioned at point of use. Typically an invitational label included a question or statement designed to be answered or investigated through the activity. This approach was based on the notion that an effective label creates a dynamic between itself, the visitor, and the activity, so that "doing and understanding the experience [becomes] interdependent and mutually reinforcing" (Serrell, 1996, p. 168). For example, an invitational label on the Discovery Tree reads, "Get ready for winter—like a chipmunk. Store acorns in your nest underground."

Rather than presenting detailed natural science content, these labels also modeled techniques, such as asking open-ended questions, demonstrating curiosity about nature, encouraging the use of all senses to make observations, and looking for and evaluating clues/evidence, that parents can use to support young children's science learning (Figure 2).

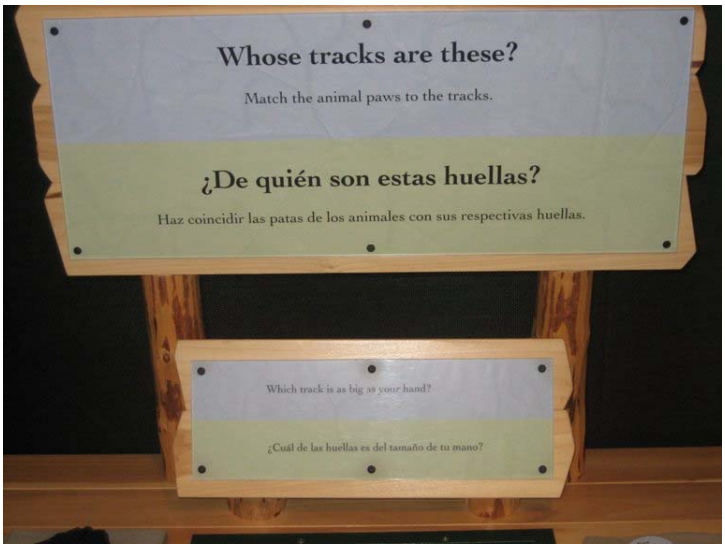

Figure 2: Invitational labels.

Explanatory labels

These labels ("For Parents") were designed to help parents better understand how play contributes to science process skill development and what parents can do to support their children's science learning. One of these labels was positioned in each thematic area, near an activity that was likely to engage a child for a longer period. Each label began with a description of the type of play a parent might observe in the area, followed by an explanation of how that type of play develops science skills and what a parent can do to help, including approaches parents could apply in the exhibit. Based on formative evaluation, the labels were redesigned to reduce the amount of text (average length: 41 words) and to include a large central image to draw attention to the labels and help communicate the main message (Figure 3).

Figure 3: Explanatory labels.

Summative findings

The data from the summative evaluation studies of *Animal Secrets* demonstrated that parents were consistently assuming the roles of play partner, play supporter, and observer of play. Exhibit characteristics that parents mentioned as supporting their ability to play with their children included:

- Feeling invited to participate (e.g., an immersive environment that is attractive to children and adults; modular, lightweight seating that can easily accommodate children and adults and be positioned so that the adult is comfortable and close to the child's activity area; activities like the Naturalists' Lab that are of interest to adults and children, a label in the Eagle's Nest that reads "Parents—there's room for you.")
- Having exhibit components that "fit" them (e.g., a chipmunk den big enough for adults and children, and chipmunk costumes in sizes to fit adults and children)
- Knowing what their role should be (e.g., exhibits that are easy for adults to figure out, labels that offer questions to prompt activities, labels and murals that give adults cues to foster dramatic play, science tools like magnifiers and scales that adults already know how to use).

These responses indicate that environmental design, types of activities, and labeling strategies all contributed to fostering parent-child interactions, but to varying degrees, as discussed below (Beaumont & Garibay, 2007).

The role of activities

Types of activities that were most effective in fostering parent-child interactions included:

- Activities that focused on the development of science process skills, not the acquisition of facts

about nature, e.g., Naturalists' Lab activities and labels that suggested systematic exploration
- Activities that were intriguing to both adults and children, e.g., using magnifiers to examine nature specimens in the Naturalists' Lab
- Activities that fostered dramatic play with a clear role for parents, e.g., care-giving scenarios such as a father eagle feeding its young or a raccoon mother seeking out different types of food with its young
- Activities that required parents to help, e.g., using flashlights to navigate the dark cave or examining specimens with science tools in the Naturalists' Lab.

The role of labels

Parents found the labels to be friendly and accessible and generally well positioned in areas where children were engaged in play. They appreciated their brevity, and the use of images helped parents quickly orient themselves to the focus of exhibit activities. Label types most often used by parents were identification labels (which identified animals or specimens), followed by title labels (which identified areas of the exhibition) and invitational labels (which provided a question or statement designed to be answered or investigated through the activity).

Identification labels may have been used the most because they directly support a role that parents typically play in exhibits—vocabulary supplier. While the invitational labels were less frequently used, parents commented on their usefulness. Parents were observed using these labels to direct children's attention (e.g., examining animal tracks), encourage specific behaviors (e.g., measure), and engage in conversation. Labels that posed questions seemed especially useful in helping parents understand how they could support their children's learning. One parent said, "I liked how questions were asked; this helps adults with interaction, asking children a question instead of telling them information [is good]" (Beaumont & Garibay, 2007).

Although parents who read the explanatory labels ("For Parents") commented that the information was very helpful, only 17% of respondents attended to these labels. When questioned, several parents commented that they were too long to read while they were in the exhibition and needing to pay attention to their children. Perhaps the text on these labels looked longer than it was because it appeared in two languages (English and Spanish). In addition, since these labels were not as directly related to facilitating exhibit activities as some of the other labels were (e.g., invitational labels, identification labels), perhaps they did not seem as immediately useful to parents (Beaumont & Garibay, 2007).

Discussion

The summative evaluation raises important questions about the effectiveness of labels that are targeted specifically to the adult caregiver in the family group, since the "For Parents" panels were rarely read by parents. It may be difficult for parents to attend to "meta" messages with all of the roles they have to play during a museum visit. Thus, it may be more effective to elicit desired behaviors through the activities themselves and their labels, rather than in separate labels (Beaumont & Garibay, 2007).

The evaluation suggests only the invitational labels contributed to the success of the parent-child interactions. These labels seemed successful because they were directly linked to the exhibit activities and strengthened the environmental affordances. The less successful explanatory labels, while related to play and learning, were not directly linked to the activities and did not seem to strengthen the affordances. In exhibit environments, findings like these remind us that visitor behavior is more dependent on the affordances of the environmental design and exhibit activities than on textual explanations.

Implications for the field

The weaker contribution of the explanatory labels is an area that should receive further study by those involved with family learning environments. Over the past 10 years, the trend in early childhood informal learning centers has been to provide parents with information on child development in the form of labels like these. Based on the *Animal Secrets* case study, researchers might look more closely at the value of these labels with respect to different audiences (e.g., infrequent exhibit users, frequent exhibit users) and their congruence with the affordances of the exhibit environment. For example, does repeat visitation increase the likelihood that parents will use these labels? Are there other characteristics of such labels that would make them more likely to be read? Are there better ways to communicate with parents of young children in an exhibit environment?

Conclusion

Exhibits can promote parent-child interactions and provide parents with tools and techniques they need to promote their children's science learning, but exhibit developers may need to re-examine their strategies for doing so. Communicating with parents in exhibit environments is challenging, and more study is needed to determine the most effective ways to support parents in their critical role as learning facilitators.

Karyn Bertschi, Senior Exhibit Developer; **Marcie Benne**, Evaluation and Visitor Studies Division Manager; and **Ann Elkins**, Lead Early Childhood Educator; collaborated on the *Animal Secrets* project at the Oregon Museum of Science and Industry in Portland.

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