

10

RESEARCH AND MUSEUM PARTNERSHIPS

Key Components of Successful Collaborations

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Children's museums and hands-on science centers are popular destinations for families with young children and have become part of daily life for many of them. Over the past decade, museums that attract millions of children and parents annually across the country have also become "learning laboratories" for academic researchers studying children in natural contexts and those looking for access to participant populations (Callanan, 2012; Knutson & Crowley, 2005a, 2005b). As the number of collaborations between university researchers and museums has continued to increase, it has led to the creation of a number of distinct partnership models. These collaborations provide mutual benefits for academic researchers who seek to advance our understanding of children's cognitive, social, and emotional development and museum educators who aim to create an innovative and inclusive learning environment.

This chapter discusses three key components of successful collaborations between developmental researchers and museums that have emerged as a result of

these partnerships: (1) access to participants, (2) mutual professional development, and (3) conducting research in context. To provide some background, we will first describe the Center for Childhood Creativity (CCC) at the Bay Area Discovery Museum and the partnership between the CCC and Professor Alison Gopnik's Cognitive Development Lab at the University of California, Berkeley. We will discuss the three components in relation to the CCC, the Living Lab model (see Corriveau et al., this volume), and the collaboration between the Thinkery and the Cognition, Culture, and Development Lab (CCD Lab) at the University of Texas at Austin (see Legare et al., this volume).

The Center for Childhood Creativity at the Bay Area Discovery Museum

The CCC is a research-focused educational institute within the Bay Area Discovery Museum. The joint mission of the museum and the CCC is to ignite and advance creative thinking in all children. The museum hosts more than 300,000 visitors annually and is located on an unparalleled 7.5 acres at the base of the Golden Gate Bridge in Sausalito, California. Children ages 6 months to 8 years, their caregivers, and teachers engage in open-ended and child-directed activities in which there are infinite ways to play, discover, and create with every visit. The museum has a long history of expertise in the development of creative thinking in children and early exposure to science, engineering, and mathematics concepts. In 2011, the museum launched the CCC—a not-for-profit research and training center exploring the components of creativity—extending its impact beyond the museum. The CCC studies the cognitive, social, emotional, and environmental tools required to support creative thinking, with a focus on children ages 0–12 years. The center's work is informed by a robust advisory board including leading developmental psychologists Alison Gopnik, Andrew Meltzoff, and Carol Dweck, research partnerships with premier academic institutions, and a leadership team with expertise in informal learning, formal academic systems, and child development.

Given the museum and CCC's focus on cutting-edge developmental research, its location in the San Francisco Bay Area close to leading universities, and the museum's access to a large number of young children, one CCC's first goals was to establish an onsite research program to benefit researchers seeking young study participants. In addition, this program would benefit museum guests and staff by making current research available and accessible. To that end, the Creative Thinking Research Lab was established at the Bay Area Discovery Museum in early 2013, and to date more than 1,200 children have participated in studies at the museum on topics ranging from language development to causal reasoning and motivation. Some of the research conducted at the lab was recently published in *Psychological Science*, *The Proceedings of the National Academy of Science*, *Cognition*, *The American Journal of Play*, and *Psychological Bulletin* (Cortes Barragan & Dweck, 2014; Gopnik & Walker, 2013; Walker & Gopnik, 2013, 2014; Walker, Lombrozo,

Legare, & Gopnik, 2014), with several more papers currently under review and in preparation.

Partnership With Alison Gopnik's Cognitive Development Lab

Professor Alison Gopnik was an early supporter of the onsite research program at the Bay Area Discovery Museum and joined the CCC Advisory Board in early 2013. Professor Gopnik's Cognitive Development Lab in the Psychology Department at the University of California, Berkeley explores how children develop theories about the world, other people, and themselves. In particular, Professor Gopnik and her research team have been investigating young children's causal reasoning and how an understanding of causal relationships helps children learn about language, concepts, and the behavior of others.

Caren Walker, a doctoral candidate working with Professor Gopnik, was the first researcher to start collecting data at the Creative Thinking Research Lab, and to date has tested over 500 participants at the museum. Broadly speaking, Caren is interested in the nature of children's early mental representations and how they change. Her approach to these questions is a particularly good fit with the goals of the CCC, because she focuses on how even very young children are able to go beyond their direct observations to generate ideas by thinking alone. To this end, Caren has conducted research in the lab on a suite of thought-based learning phenomena that are particularly widespread in childhood, including learning by explaining, learning from analogies and thought experiments, and learning through fiction and imaginative play.

The CCC's partnership with Professor Gopnik's lab has been easy from the start because of the mutual interest in exploring how children learn about the world through open-ended play and child-directed inquiry and exploration. The average age of the children who visit the museum is also perfectly matched to the ages that the Gopnik lab recruits for the majority of their studies (i.e., toddlers and preschoolers). Furthermore, the staff at the museum and the CCC have benefited from this successful partnership by learning about cutting-edge cognitive development research through a monthly series of talks given by researchers that collect data in the lab.

This collaboration with Professor Gopnik's lab has been extremely successful for both the CCC and the researchers in the Cognitive Development Lab. For example, as a result of this growing and meaningful relationship with Professor Gopnik's research team, the CCC research staff has worked closely with Caren on research grants, including a successful proposal to the National Living Lab Initiative to launch a Research Toy Program at the museum. These research toys are hands-on activities that help to educate parents about the methods researchers use to study child development and some of the important findings in the field. The Research Toy Program at the museum started in late 2014 and has been very successful in presenting the findings from recent studies on sharing and the

benefits of open-ended play to parents and young children. As a second phase in the program, the CCC research staff collaborated with Caren to create a new research toy based on a recently published set of experiments that investigated young children's ability to reason about the abstract relationships "same" and "different" in a causal learning task (see Walker & Gopnik, 2014).

Access to Participant Populations

One of the challenges for developmental researchers in conducting high-quality research with young children is finding a way to reach interested children and parents. Even when an experiment takes only 5 minutes for a toddler or preschooler to complete, researchers can spend countless hours advertising the study to recruit local families to travel to the university lab to participate. With that challenge in mind, a growing number of academic researchers have partnered with museums to provide much-needed access to young participants for their studies. For example, a fruitful partnership between the CCD Lab, directed by Dr. Christine Legare, and the Thinkery began with visitors from the children's museum participating in research studies on the development of children's causal explanations and exploratory behavior (Legare et al., this volume). This partnership has resulted in the publication of more than 10 empirical papers in peer-reviewed journals and, most recently, a collaborative grant funded by the National Science Foundation to investigate cultural diversity in parent-child explanation and exploration. Legare et al. describe how the relationship between the CCD Lab and the Thinkery started with a mutual respect and interest in educational research on children's learning and blossomed into a productive partnership that has advanced our understanding of early science learning.

Corriveau et al. (this volume) describe another successful model for providing access to participant populations—the Living Laboratory model brings academic studies into plain view of the public by having researchers conduct their studies on the exhibit floor. Conducting studies on the exhibit floor allows museum visitors to see research in action and increases the visibility of researchers and their experiments in a museum setting. Parents and caregivers have a unique opportunity to talk to developmental researchers in a relaxed and informal setting, and researchers are able to engage with the public, which is a rare opportunity for young researchers. In fact, researchers often benefit from these interactions by gaining a new perspective on their research topic, which often leads to new directions in their research. For example, Corriveau et al. shared that questions from parents about different types of stories (e.g., fictional versus religious stories) led researchers to consider the effect of religious education on children's judgments of fantasy and reality.

On the other hand, researchers who work within the Living Laboratory model are necessarily limited in the types of studies that they can conduct on the museum floor. That is, procedures that require children to listen carefully to

instructions, pick up on subtle cues from the experimenter, require special equipment (e.g., eye tracking), or last more than 10–15 minutes will most likely not work well in a museum setting where children are easily distracted. As a result, Corriveau et al. identified seven minutes as the “sweet spot” for the length of studies in the type of open museum setting used in the Living Laboratory model. While the protocol that is proscribed by the Living Laboratory approach carries clear benefits—facilitating new researcher–museum collaborations—there are also advantages in deviating from the Living Laboratory model. For example, when the CCC established the Creative Thinking Research Lab at the Bay Area Discovery Museum, the main goal was to give local researchers access to a large number of young children, given the challenge of recruiting participants for developmental research. To that end, the CCC converted a storage space into a research lab to provide a quiet, enclosed space for researchers to conduct studies with our young visitors. Although researchers have the option of conducting studies in one of the museum exhibit spaces, the CCC’s research partners overwhelmingly prefer using the research lab.

Currently, researchers from the University of California, Berkeley; Stanford University; and Mills College are conducting research in the onsite testing lab. Research participants are recruited from the pool of museum visitors, and the CCC’s research partners have been thrilled to find a diverse audience of parents and children, particularly on free admission days, that are willing to volunteer to be part of science. Of the 300,000 annual visitors, approximately 58% of the visitors identify as non-white ethnicity in their households. One of the unique aspects of the Bay Area Discovery Museum is that it caters to a particularly young population (the average age of the museum visitors is around 3 years old). This means that in addition to older children, researchers are able to find a large number of children under the age of 3, who cannot be easily recruited via the typical channels in local preschools.

The CCC research staff anticipates that demand for space and access to the museum’s large and young audience will only continue to increase. To this end, the CCC launched the *Distance Research Project* in late 2014 to allow researchers from across the country to collect data at the museum. This project extends beyond the Living Lab model because researchers are not collecting their own data and are not interacting with the visitors and museum staff. Researchers studying all areas of developmental psychology are invited to submit applications, with special consideration given to projects that seek to better understand and nurture creative thinking in children. Successful applicants will be asked to videotape their procedure so that a trained team of research assistants at the CCC can collect data in the Creative Thinking Research Lab or in one of the museum’s exhibit spaces. Video of each participant will be made available to the researcher at the completion of the study. Researchers will pay a reasonable fee for this service and agree to acknowledge the museum and the CCC in all discussions and publications of the research. Currently, the CCC team is working with researchers

at Yale University in the pilot phase of the project and navigating the process of Internal Review Board (IRB) approval for collecting data at a remote site. One of the most important goals of this pilot phase is to uncover any potential challenges with receiving IRB approval and to establish procedures for working with future research clients to make this process as efficient as possible. As a result, research clients that participate in the pilot phase of the *Distance Research Project* do not pay a fee, and in return have agreed to provide valuable feedback to the CCC research team on the process from beginning to end. This is an exciting addition to the research program at the CCC and museum and a potentially trendsetting innovation in the field of developmental psychology given the limited access to young participants that most researchers face.

Mutual Professional Development

Partnerships between academic researchers and museums bring together seemingly disparate professional audiences, and a key component of a successful relationship is a mutual respect and understanding of the diverse range of talents and experiences of each. The Living Laboratory model is particularly effective in bringing together developmental researchers and museum educators through their philosophy of mutual professional development. Facilitating regular interactions between museum educators and researchers can be challenging given the diverse backgrounds of museum professionals that link to different philosophies about learning and child development. The “daily greetings” that researchers engage in with the museum staff when they arrive at a museum to collect data provide a short and simple way for researchers to practice explaining complex scientific concepts in accessible and engaging language. These brief exchanges also allow museum educators to interact one-on-one with developmental researchers that are investigating child development concepts often embodied in museum exhibits. In other words, museum educators can gain a different perspective of how to best interact with young visitors and possibly spark ideas for future exhibits.

The Bay Area Discovery Museum and CCC have started to foster mutual professional development between academic researchers and the museum staff by organizing monthly research talks. These informal gatherings give academic researchers an opportunity to present their work to a nonacademic audience and provide an accessible and convenient way for the museum staff to learn about the research studies being conducted in the onsite testing lab. Recently, museum staff has started to invite undergraduate and graduate student researchers to some of the museum’s education team meetings to facilitate further dialogue between academic researchers and the museum staff. The researchers provided examples of how they debrief parents on their study procedures and the museum educators provided feedback on how to communicate clearly with parents. In particular, one goal is for the museum educators to help researchers remove jargon that they hardly notice when communicating with colleagues.

Legare et al. (this volume) describe a common challenge for museum–researcher partnerships—the disparate pace with which each institution can set, strive for, and achieve their goals. Academic research adheres to a rigorous and often time-consuming set of guidelines, while most museums strive to implement new ideas and concepts to improve the visitor experience quickly, and often in response to visitor feedback. Legare et al. provide important advice to help alleviate this challenging issue:

Both partners in this collaboration must acknowledge the pace at which the other entity can operate and must work to find common ground in which new strategies can be implemented into the museum without compromising the integrity of the research. (p. 3, this volume)

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At the Bay Area Discovery Museum, the addition of the CCC has provided an effective way to connect academic researchers and museum educators because the CCC staff has experience in both university research settings and children’s museums. Specifically, Dr. Helen Hadani, the head of research for the CCC, is a former developmental researcher with a background in cognitive development and years of experience in applied research in the toy and technology industries. Helen’s role at the CCC involves establishing relationships with academic researchers, many of which have arisen as a result of her previous connections at Stanford University, where she completed her doctorate. These relationships are part of what makes the CCC a unique institution—a research and training center that is incubated within a children’s museum with strong ties to the academic community.

Conducting Research in Context

By conducting scientific studies in the context of a museum, researchers have the unique opportunity to study children in a natural setting that is usually more child-driven and open-ended compared with a lab or school context. From a sociocultural approach, studying children in a natural context, such as a museum, could have important implications for how children respond to a researcher’s questions and support new insights about development (Callanan, 2012). The chapter by Legare et al. (this volume) provides some clear ideas for taking the museum–researcher partnerships a step in this direction. In particular, the authors highlight the potential for work that is designed to use the informal learning environment in the museums as the setting for studying the interaction between explanation and exploration. Indeed, children’s museums are generally interested in this sort of child-directed and playful learning and particularly in methods for using play to maximize children’s engagement in informal learning contexts. However, there are important questions surrounding the best way to study these phenomena outside of the laboratory, and whether they are indeed effective in promoting a variety of cognitive and social skills “in the wild.”

Like the researchers in Legare's Cognition, Culture, and Development Lab (CCD), the CCC also hopes to explore ideas that better capitalize on the unique museum context. Many of the research projects that have been conducted at the CCC to date are not currently capitalizing on the museum setting, although the research topics overlap significantly with the museum's goals. In the near future, the CCC hopes to establish a "blended model" in which some of the studies are conducted in the Lab and others are conducted on the exhibit floor. This would allow the CCC to continue to support their research partners without limiting the types of studies they can conduct at the museum, and also provide opportunities to study children's learning within social contexts. One goal of the blended model is to encourage our research partners in collaboration with the CCC staff to develop research projects that examine how children learn through interactions with parents, caregivers, and other children in a natural context (Callanan & Jipson, 2001; Callanan & Valle, 2008; Crowley et al., 2001).

In an effort to explore best practices for transitioning into this type of research, the CCC is beginning several projects (using different techniques) to study cognitive development in the natural setting of the museum. In each of these cases, findings from studies first conducted in the lab are being reevaluated in the context of the museum. For example, CCC Advisor Carol Dweck and Rodolfo Cortes, a CCC research fellow, have found in a series of studies conducted in a lab setting that when preschoolers play reciprocally (i.e., interactively) with an adult, they are more likely to trust this adult than if they had played in a noninteractive, individualistic way (Cortes Barragan & Dweck, 2014). As a next step in this research, Dweck and Cortes will be investigating if playing reciprocally in an activity that is part of a museum exhibit will enhance learning, facilitate innovation, and promote intellectual risk-taking. In addition, Caren and Professor Gopnik have been working on developing a set of ideas relating the prevalence of pretend play in childhood to early learning and reasoning skills (e.g., Walker & Gopnik, 2013). A challenge when considering how children learn from pretending is that pretense, by its very nature, is spontaneous and child-directed. Given the unique environment provided by the museum, the CCC is currently collaborating with the Gopnik lab to capitalize on the museum's established summer camp program to create an intervention to nurture this type of spontaneous pretend play in children aged 3–5 years.

In addition to creating new research paradigms that seek to exploit the museum setting to answer novel questions in context, there are also a variety of ways that the research currently being conducted in the museums may be incorporated into the museum exhibits and activities. For example, given the findings highlighted in Legare et al.—that simply generating explanations during learning constrains exploration and provides a means to optimize scientific learning, reasoning, and problem-solving (e.g., Legare, 2012; Legare, Gelman, & Wellman, 2010; Walker et al., 2014)—it is easy to imagine incorporating prompts to explain throughout a variety of museum exhibits. Explanation is a potentially valuable malleable

factor (i.e., a variable under the control of the educational system) because simply introducing prompts to explain has been demonstrated to have clear impacts on learning outcomes. As a result, these findings are likely to appeal to a large number of parents and teachers who visit the museum, since they carry implications for informing educational practices and policies both within and outside of the museum. This therefore highlights the possibility of creating a traveling exhibit based on the findings of these studies. This exhibit could potentially visit a variety of children's museums across the country and perhaps target those that are part of the Living Laboratory community. Another way to connect museums across the country, particularly those interested in partnering with academic researchers, is through research collaborations. In fact, given recent collaborations between researchers at UT Austin and UC Berkeley (e.g., Walker et al., 2014), there may be unique opportunities for research projects of this nature that are jointly conducted at the Thinkery and the CCC. In other words, successful museum–researcher partnerships could eventually be leveraged to yield new relationships between different museum sites nationwide.

Finally, Legare et al. (this volume) discuss the success of the Cognition, Culture, and Development Lab (CCD) in assisting the Thinkery with a visitor research project that informed the development of the Thinkery's early learners program. Capitalizing on the data collection and analysis expertise of the researchers involved in these collaborations allows the museum staff to better evaluate their own programming efforts. This may be a benefit of the museum–researcher relationship that is currently under-utilized in the Living Laboratory model. Given that museums are always looking for new ways to improve visitor experience, but often suffer from limited resources, this idea may be a wonderful way for the researchers to further contribute to the growth and success of the museum. Researcher participation in decision-making surrounding core programming will likely benefit the research process as well, given that it may be possible to evaluate the museum visitors' attitudes about participating in research activities during their time at the museum. This will be particularly valuable as these relationships work toward a focus on research topics that are directly applicable to the development of museum programs, activities, exhibits, and research toys. Another clear practical use for conducting this type of research in a museum is providing a unique and productive training experience for undergraduate and graduate students. This seems to be a benefit that is common to many different models of collaboration between researchers and museums, whether there are established channels for formal training or not. Simply conducting research in a museum setting gives students the opportunity to see connections between scientific and practical impact and links between psychology and education.

In conclusion, museums see clear benefits as part of a museum–researcher partnership, including access to cutting-edge research that has not been published yet and gaining credibility as a learning institution as opposed to a fancy playground. At the CCC, our university research partnerships started with connections to

researchers interested in conducting studies at our onsite testing lab. These partnerships form the backbone of our organization by providing a meaningful connection to some of the most recent, relevant, and innovative research on children's creative thinking and guiding our research platform to ignite and advance creativity in all children.

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