Monograph Matters

SRCD Society for Research in Child Development

Culp, K. M. (2020). *Deepening the Research-Practice Conversation in Informal Learning Environments*. [Peer commentary on the article "Exploration, Explanation, and Parent-Child Interaction in Museums" by M. A. Callanan, C. H. Legare, D. M. Sobel, G. Jaeger, S. Letourneau, S. R. McHugh, A. Willard, et al.]. *Monograph Matters*. Retrieved from https://monographmatters.srcd.org/2020/03/16/commentary-culp-85-1/

Deepening the Research-Practice Conversation in Informal Learning Environments

Katie McMillan Culp
New York Hall of Science
kculp@nysci.org

The monograph *Exploration, Explanation, and Parent-Child Interaction in Museums* (Callanan, Legare, Sobel, et al., 2020) takes on the mountainous task of examining connections among young children's exploration and explanation of gear exhibits in three children's museums, parents' interventions during shared museum activities, and children's emerging understanding of the causal workings of the gear exhibits. The authors bring together constructivist and sociocultural theoretical models of learning, thereby identifying mechanisms that foster children's conceptual understanding and resoluteness, or persistence. The authors examine these dynamics largely through naturalistic methods which allow them to observe a diverse range of interactions as caregivers and young children talk and play in museums.

A strength of this monograph is the breadth and diversity of the professional backgrounds of its contributors. I read this as a developmental psychologist who has spent my research career working in close collaboration with practitioners and designers, in both formal and informal educational settings. Given this perspective, I perceived many of the strengths of the study as consequences of meaningful (and probably sometimes challenging) negotiations and collaborations among university- and museum-based professionals. I also saw opportunities to further extend that engagement, and to incorporate practice-based perspectives more deeply into the design of similar, future research efforts.

Organizing research and its relation to practice in informal learning environments

When I first read this monograph, I was surprised to discover that parent-child dyads were studied using three quite different gear exhibits at the three museums. The authors' descriptions of the exhibits are detailed and concrete, noting variations in their physical ease of use for small children, how open-ended or goal-oriented they are, and the purposes they serve within the larger thematic exhibition spaces where they are located. Would some readers, I wondered, see this as a source of unacceptable variability that could render findings uninterpretable?

Fortunately, the authors themselves explicitly embrace this diversity of setting and make productive use of these variations to drive specific analyses that add nuance to their findings.

Callanan et al, in my view, made a critical choice to not only set their research in a children's museum but to design a study that embraces the many sources of natural variation that occur in those settings. This choice produced a study with greater external validity and also with greater relevance to practitioners who might benefit from its findings.

The monograph's authors also took great care to interpret their research findings not as directives but as guideposts that can lead practitioners and researchers toward more informed, reflective decisions about how to facilitate the explorations of young learners. For example, the authors note that there are "many paths" of productive exploration and play, but also "critical moments" when adult intervention can be particularly powerful. This formulation could provide a helpful lens for practitioners, by acknowledging the diversity of individual children or family groups' learning experiences, while also highlighting specific patterns of interaction and concrete strategies for effective intervention that one could watch for, or design for. By reflecting on the findings this way, the authors provide practitioners and researchers with an opportunity to identify not only what we already know we see, but also to understand what alternatives or variations might be possible. I can imagine many productive conversations, grounded in further observations of those same gear exhibits, and structured as negotiations between theoretically-grounded insights of researchers and practice-based knowledge of educators and designers.

Extensions of this project could potentially be enriched by drawing some lessons from the wide range of design-based research (Barab.& Squire, 2004; Sandoval & Bell, 2004) that is conducted in museums. In this longstanding tradition of museum-based inquiry, learning is studied through iterative cycles of design and testing of interventions. Much of this work has been reviewed recently by Allen and Gutwill (2016), and by Bevan and Penuel (2017). These authors argue that neither visitors nor museum staff are well-served when museums and centers are used as settings for data collection driven exclusively by theory-driven research agendas. Instead, they prioritize collaborative definition of the research questions themselves, seeking to answer questions derived from practice, rather than theory, that can directly inform the design of exhibits, programs, or modes of facilitation. These types of approaches are central to many recent innovations in the design and delivery of informal learning experiences for museum visitors (Allen, 2007; Honey & Kanter, 2013; Humphrey & Gutwill, 2017).

This monograph, of course, is not the result of design-based research and was not intended to be. The variation in the gear exhibits that the authors describe and attend to in their analysis is a condition of the environments under study, not an intervention being tested and revised systematically. But the presence of such significant variation across settings creates the opportunity for many of the same research-practice conversations that are spurred in design-based research projects. Discussions of trade-offs, for example, become critical, as teams consider how to best generate needed data while also maintaining authentic and appealing experiences for visitors. These kinds of discussions also tend to produce greater clarity about the purposes and potential implications of research questions that may serve theory-building agendas that are not familiar to designers or educators. I choose to imagine that the many-headed team behind this monograph engaged in many such discussions, at multiple points in the research process. While I imagine the discussions were not always easy, they probably brought clarity and nuance to both the conduct and the outcomes of their efforts.

An example from recent research and development project at my own institution, the New York Hall of Science, might help to illustrate some of the concrete ways that researchers and practitioners can inform one another's decisions at multiple points in the design and conduct of a research study. Below, I briefly describe this project, which involved developing and testing a mathematics workshop series for young children and their families. I then reflect on the multiple benefits that can emerge from researcher-practitioner collaborations.

Using design-based research strategies to study children's mathematical thinking

My colleagues and I recently completed an NSF-funded project that sought to explore whether and how we could engage 5- to 8-year-olds and their caregivers in substantive explorations of some of the core concepts and practices of data science. The project's goals and research questions were based in Lehrer and Schauble's sustained (and collaborative, with elementary-grade teachers) investigations of students' data analysis and statistical reasoning skills (2002, 2007a, 2007b). Over the course of three years, we developed a seven-week family workshop series and implemented it three times (Letourneau, Liu, Donnelly, Meza, Uzzo, & Culp, 2020).

In this project, the design and organization of the workshop series was negotiated between the two teams through a process that sought to balance qualities that practitioners knew were critical to ensuring a positive, successful experience for participants (a non-negotiable value of the institution) and those that the researchers knew were critical to creating experiences that would engage participants with the target concepts in ways that would allow the research to progress (a non-negotiable quality of the funded research project). For example, researchers had originally expected that children would work together as a group, while adults would observe and, at times, facilitate children's activity. But practitioners explained that families are motivated to participate in programming like this primarily in order to *spend time together*, and that families would need to work in their own groups to meet that goal. By accommodating this kind of input from practitioners, the research team was able to study multiple iterations of a family learning experience that had high retention, high levels of engagement, and a consistently positive social atmosphere.

Practitioners brought a deep body of knowledge about how to create *positive* and *manageable* experiences for families. Researchers, for their part, consistently pushed for activities to be designed in ways that allowed for divergent approaches to activities and challenges, and that encouraged participating children to pursue questions of interest to them, even if the result of their inquiry was flawed. This was not always comfortable for the practitioners. Over the course of the project, though, practitioners observed families' experiences and discussed them regularly with the research team. Through these experiences they developed new insights about the kinds of mathematical thinking children of these ages are capable of, and the scope of the mathematical activity families could tolerate and sustain while still maintaining a fun, relaxed, and playful environment.

For their part, the research team collected extensive qualitative data and was able to demonstrate rich mathematical talk among children and caregivers. Participants' discussions included developmentally-appropriate consideration of issues related to the collection, aggregation, and representation and interpretation of data that are far removed from the arithmetical tasks that are often central to how children of these ages understand what it means to "do mathematics" (Lesh, 2003; Moss, Bruce, & Bobis, 2015).

This project on mathematical thinking had very different goals and processes than the current monograph which is focused on children's causal reasoning. However, the two share a key quality: both produced evidence that can make the complexity and the nuances of children's learning more visible to practitioners. In our project, new insight for practice was driven not by the co-definition of the question to be answered, as would have been the case in design-based research. Rather, it grew from the co-design and implementation of a program that depended for its success on the expertise and interests of both practitioners and researchers. Through this collaborative process, practitioners were able to lead a learning experience for children that had a depth and rigor that they would otherwise have been unlikely to pursue in an informal, after-school context.

There are multiple moments and strategies within any research agenda when researchers can engage practitioners with the genuine questions at stake in a given research study and with findings as opportunities to enrich, rather than dictate, best practice. As in the work of Callanan et al., though, such an effort needs to be well matched to the needs of visitors and the capacities of an institution. When this level of shared planning occurs, the resulting effort can create new horizons for practitioners, expanding their aspirations for what they can accomplish with their audiences, and new ways to name and value a broader range of learners' behavior and talk.

Conclusions

Powerful results are possible when expert educators, designers, and researchers work together to study learning in informal settings. As this monograph demonstrates, answers to fundamental cognitive developmental questions about how learning occurs can have meaningful implications for the design of resources and facilitation strategies in museums. And the deep practical knowledge and insights of museum educators and designers can contribute to formulating research efforts that are meaningful for participants, and can provoke a rich range of behaviors and conversations. Together, researchers, museum educators, and designers can create experiences that are pleasurable for visitors and sustainable for institutions. They can study those experiences in ways that produce important new insights into fundamental questions about how, where, and through what mechanisms learning occurs. And perhaps just as importantly, they can share with one another their distinctive lenses on the processes of children's learning.

I encourage researchers to extend their work to informal learning environments like children's museums, and to collaborate with the practitioners and designers who bring those environments to life through every stage of the research process. In doing so, I would echo the monograph authors' plea to avoid seeking "the best way for children to learn" and instead search for those "practices that support children's learning." Our searches will be more productive if we combine not only our constructivist and sociocultural theories, but also our academic and practical perspectives.

References

Allen, S. (2007). Exhibit design in science museums: Dealing with a constructivist dilemma. In J. H. Falk, L. D. Dierking, & S. Foutz (Eds.), *In principle, in practice: Museums as learning institutions* (pp. 43-56). Lanham, MD: Altamira Press.

Allen, S., & Gutwill, J. (2016). Exploring models of research-practice partnership within a single institution: Two kinds of jointly negotiated research. In D. Sobel, & J. L. Jipson (Eds.), *Cognitive development in museum settings: Relating research and practice* (pp. 190-208). London, UK: Routledge. https://doi.org/10.4324/9781315667553

Barab, S., & Squire, K. (2004). Design-based research: Putting a stake in the ground. *The Journal of the Learning Sciences*, *13*(1), 1-14. https://doi.org/10.1207/s15327809jls1301_1

Bevan, B., & Penuel, W. R. (2017). *Connecting research and practice for educational improvement: Ethical and equitable approaches*. London, UK: Routledge. https://doi.org/10.4324/9781315268309

Callanan, M. A., Legare, C. H., Sobel, D. M., Jaeger, G., Letourneau, S., McHugh, S. R., Willard, A. et al. (2020). Exploration, explanation, and parent-child interaction in museums. *Monographs of the Society for Research in Child Development*, *85*(1). https://doi.org/10.1111/mono.12412

Honey, M., & Kanter, D. E. (Eds.) (2013). *Design, make, play: Growing the next generation of STEM innovators*. London, UK: Routledge. https://doi.org/10.4324/9780203108352

Humphrey, T., & Gutwill, J. P. (2017). *Fostering active prolonged engagement: The art of creating APE exhibits.* London, UK: Routledge. https://doi.org/10.4324/9781315428291

Lehrer, R., & Schauble, L. (2002). *Investigating real data in the classroom: Expanding children's understanding of math and science*. Ways of knowing in science and mathematics series. New York, NY: Teachers College Press.

Lehrer, R., & Schauble, L. (2007a). A developmental approach for supporting the epistemology of modeling. In W. Blum, P. L. Galbraith, H. Henn, & M. Niss (Eds.), *Modelling and applications in mathematics education* (pp. 153-160). The 14th ICMI study. New ICMI Study Series, *10*. New York, NY: Springer. https://doi.org/10.1007/978-0-387-29822-1

Lehrer, R., & Schauble, L. (2007b). Contrasting emerging conceptions of distribution in contexts of error and natural variation. In M.C. Lovett & P. Shah (Eds.), *Thinking with data* (pp. 149-176). New York: Taylor & Francis. https://doi.org/10.4324/9780203810057

Lesh, R.A. (2003). How mathematizing reality is different from realizing mathematics. In S. J. Lamon, W. A. Parker & S. K. Houson (Eds.), *Mathematical modelling: A way of life* (pp. 37-52). ICTMA 11. New York, NY: Woodhead Publishing.

Letourneau, S.M., Liu, C.J., Donnelly, K., Meza, D., Uzzo, S., & Culp, K.M. (2020). Museum Makers: Family explorations of data science through making and exhibit design. *Curator: The Museum Journal, 63*(1). https://doi.org/10.1111/cura.12348

Moss, J., Bruce, C.D., Bobis, J. (2015). Young children's access to powerful mathematics ideas: A review of current challenges and new developments in the early years. In L. English, & D. Kirshner (Eds.), *Handbook of international research in mathematics education* (3rd ed.), pp. 153-190. New York, NY: Taylor & Francis. https://doi.org/10.4324/9780203448946

Sandoval, W. A., & Bell, P. (2004). Design-based research methods for studying learning in context: Introduction. *Educational Psychologist*, *39*(4), pp. 199-201. https://doi.org/10.1207/s15326985ep3904_1