

Informal Science Education: Critical Conversations and New Directions

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This special issue of the *Canadian Journal of Science, Mathematics and Technology Education* explores teaching and learning that occurs both within and outside the traditional, formal schooling context. The burgeoning field of informal science education encompasses real-world learning that humans engage in daily: learning that occurs across a broad range of spatial and temporal contexts (Dierking, Falk, Rennie, Anderson, & Ellenbogen, 2003). At the heart of efforts to understand real-world science learning is the belief that learning in general—and science learning in particular—is cumulative and emerges over time through a myriad of human experiences. Science centres, museums, botanical gardens, zoos, butterfly conservatories, nature centres, community-based science programs, aquariums, and classrooms, for example, are but a few informal science settings that contribute to our construction and understanding of scientific knowledge—our attitudes towards, and participation in, science. These institutions offer a particular and unique blend of free-choice experiences that are typically voluntary, open-ended, non-sequential, self-directed, hands-on, and evaluation-free.

In the past ten years, interest in the area of informal science education has increased rapidly. In an effort to recognize and support the role of community organizations as rich resources and essential partners in the educational process, special interest groups and strands have emerged. In 1984, the National Science Foundation created the Division of Informal Science Education, dedicated to promoting scientific literacy, public understanding of science, and participation in the scientific and technological enterprise. Notable recent events include the establishment of the Informal Science Education Strand Nine of the National Association of Research in Science Teaching (NARST), the Informal Learning Environments Research Special Interest Group of the American Educational Research Association (AERA), and the Special Interest Group in Museum Studies of the Canadian Society for Studies in Education (CSSE). The journal *Science Education* founded a permanent special section devoted to the topic of informal science education, with two special issues devoted entirely to the topic in 1997 and 2004. Recent review articles in the field include Pedretti (2002), Rennie and McClafferty (1996), and Hofstein and Rosenfeld (1996). Indeed, it is appropriate and timely that the *Canadian Journal of Science, Mathematics and Technology Education* dedicate an entire issue to informal science education.

The contents of this special issue cluster around three themes that are significant to teaching and learning in the field of informal science education. The first theme looks at informal science institutions' increased attention to issues in science and technology and their attempts to develop contemporary science and technology installations with all the social and political trappings. Discussion and exhibition development in science museums is evolving to include social responsibility, the raising of social consciousness, and action. Many of these kinds of exhibitions are issues-based, inviting visitors to consider socio-scientific material from a variety of perspectives, to engage in decision making and healthy debate

of complex issues, and to critique the nature and practice of science and technology. These perspectives are addressed in the Barrett and Sutter article and, to a lesser extent, in the Pedretti and Soren article.

The second theme is that of partnerships—and the growing recognition that schools and informal science settings need to work together for the benefit of all children. Formal and informal science educators are working together, inhabiting each other's worlds, in the interests of science education, research, and the general public. Three of the articles (Tal & Steiner; Rahm; and Astor-Jack, Balcerzak, & McCallie) address partnerships in various forms, as the authors explore creative collaborations among school districts, teachers, and scientists.

The third theme to emerge is the role of affect in informal education. Interest in the affective domain in informal learning environments is growing, as non-formal science education facilities become recognized as being uniquely suited to facilitate affective learning. While recent research has acknowledged various dimensions of learning, there has been almost exclusive attention paid to cognition, with only a few attempts to describe and discuss affect. The role of affect is particularly evident in the Pedretti and Soren article although this theme cuts across all of the papers, as teachers, students, museum personnel, scientists, and visitors engage in teaching and learning in informal settings.

In the first article, Barrett and Sutter examine socio-scientific issues in the context of schools and a museum located in Saskatchewan. Their goal is to inquire into the experiences of students, teachers, and other participants involved in an action-oriented educational process and to explore how museums might engage high school students in complex issues related to sustainability. In particular, the authors examine the experience of participants in a high-school youth forum on sustainability—an action-oriented project. The authors suggest that fostering sustainability and action through museum education is a complex and difficult process that requires both concrete lived experiences and a deep understanding of the narratives within which participants are embedded. The article presents a vivid example of research and pedagogical processes shedding light on the cultural narratives experienced and reproduced by teachers, students, and institutions.

Tal and Steiner provide a rich and detailed study of school–museum relationships. Their research, conducted at the Science Education Centre of the Israel National Museum of Science, Technology and Space, explores interactions and communication between teachers and museum personnel as they plan for and implement field trips. In particular, the authors focus on how teachers and guides perceive their own roles and each other's roles and on how these perceived roles contribute to the educational experience created for students at the science museum. What is particularly noteworthy in this study is both the depth and breadth of data collected and analysed. In total, 144 elementary and secondary teachers and school administrators and 25 museum employees participated in the study. Surveys, field observations, and interviews comprise the data. The research illuminates the nature of communication between teachers and museum guides and patterns of teachers' participation in field trips.

In Rahm's article, meaning making in science is explored through three school–scientist–museum partnerships in Québec. In particular, Rahm examines the mediated nature of learning and the ways in which scientific knowledge is created among the participants in the different partnerships. The manner in which scientific knowledge is “talked into being” paves the way for analyses of how language is used by children, teachers, and scientists to convey and make meaning of science. Unlike much of the literature that focuses on school–museum partnerships in the context of one-day visits, this study presents research focused on ongoing partnership projects. These projects include teachers, students, and scientists, working together, over time, at different sites.

Astor-Jack, Balcerzak, and McCallie's article also focuses on partnerships, but from a different perspective. Their study considers what constitutes effective professional development from the perspectives of providers at four informal science institutions—a zoo, a science centre, a botanical garden, and an ecological field science outreach centre—located in the United States. It is one of the few studies that document the contribution of informal science institutions to teacher professional development. Each of the aforementioned informal sites is involved in professional development for K–12 science teachers with school districts from their local regions. Findings are framed within the historical tradition of informal science institutions and the effect that convergent and divergent views of providers may have on the development of coherent regional professional development. Principles of autonomy, free choice, and hands-on experiences (often with exhibitions) characterize effective professional development. Opportunities for reflection and the creation of a safe and unthreatening environment for teachers were also key. Further results highlight the need for professional development that is relevant to classroom practice and includes engaging, student-centred activities that bring science into the everyday lives of children, while addressing equity. However, the authors found that much research still needs to be conducted on equity, diversity and inclusion, and the nature of inquiry-based teaching and learning.

The final contribution by Pedretti and Soren reports on research conducted at the Niagara Parks Butterfly Conservatory, Ontario, a site visited by more than half a million visitors a year. This article represents a slight departure—thematically—from the earlier ones. Specifically, the authors explore how this immersive environment offers casual visitors connections to the natural world and how far their experiences enhance ecological knowledge and action. Findings are presented in relation to an environmental psychology framework that identifies four properties of restorative experiences—*being away*, *fascination*, *extent* or *immersion*, and *compatibility*. To this framework, they add a fifth and significant dimension—*synergy*. The study reveals that visitors feel restored and replenished—emotionally, physically, and spiritually—after having visited the butterfly conservatory. However, the research also suggests that restorative experiences do not necessarily translate into learning about stewardship or into raising ecological awareness in visitors. Like Barrett and Sutter, these authors suggest that *action*, as an outcome of visits to informal science settings, needs to be problematized and critiqued.

How do these international papers extend our knowledge and understanding of informal science education? First, they speak to the growing body of literature in the area of informal science education and to the merging of fields such as science education, informal science education, sociology, and museology. These papers are part of an emerging interdisciplinary dialogue whose goal is enhancing teaching and learning in science, mathematics, and technology. Second, these studies suggest that schools and informal learning environments are increasingly working together in very innovative ways. Long-term partnerships, the involvement of scientists, and the delivery of professional development for teachers at informal sites are but a few examples of such creative collaborations. Finally, as informal science education sites increasingly position themselves as socially valuable resources for the public, it becomes important to engage in critical conversations while simultaneously exploring new directions in the field. The articles contained herein are a contribution to that dialogue.

References

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