Constructionism at Scale

Celia Hoyles, *c.hoyles@ucl.ac.uk*
University College London

Richard Noss, *r.noss@ucl.ac.uk*
University College London

Yasmin Kafai, *kafai@upenn.edu*
University of Pennsylvania

Kylie Peppler, *kpeppler@indiana.edu*
University of Indiana

Deborah Fields, *Deborah.Fields@usu.edu*
Utah State University

Moderator: Nathan Holbert, *holbert@tc.columbia.edu*
Teachers College, Columbia University

Abstract

Constructionist designers have used new technologies to engage leaners in rich opportunities to build personally meaningful artifacts for decades. In recent years, new technologies have brought these experiences to large numbers of learners in distributed places. In this symposium we bring together expert designers and scholars that have successful developed constructionist innovations using emerging technologies in a range of domains and have brought these innovations to scale. In a panel discussion format, participant highlight key challenges for scaling constructionist design and discuss how these tools and environments evolve as the community of learners increases by orders of magnitude.

Keywords

Programming; construction; making; mathematics; scale

Introduction

Constructionist designs have engaged children in the public construction of games (Berland & Lee, 2011; Harel & Papert, 1990; Kafai & Burke, 2015), participation in virtual communities (Resnick et al., 2009), the construction of tangible artifacts and toys (Blikstein, 2015; Buechley & Perner-Wilson, 2012; Holbert, 2016), and have done so in schools and informal learning spaces across the world. Despite the mainstream adoption of many constructionist ideas, engaging learners in the construction of personally meaningful artifacts is still perceived as a niche activity by some—something only possible with a high student:teacher ratio and unlimited resources. And yet, we have multiple examples of constructionist tools, communities, and activities which have been adapted by thousands, if not millions around the globe

In this panel we bring together scholars that have successful developed and deployed constructionist innovations at large scales or have shepherded constructionist practices as they become adopted and disseminated by mainstream educational movements. Leveraging emerging technologies this work has occurred in a range of domains including gaming, making, and coding and in a variety of contexts including schools, the home, and in virtual worlds. Using a discussion format, participants will each have four minutes to introduce themselves and their work. Following introductions, moderator Nathan Holbert will pose questions to the panel to highlight key requirements and challenges for successfully scaling constructionist design and discuss the ways in which constructionist tools and environments evolve as the community of learners increases by orders of magnitude. The final 15 minutes of the session will offer an open Q&A format so that attendees can address questions to the panel directly. The following sections indicate participating panelists and provide a brief overview of the relevant work.

Are We There Yet? A Journey Through Programming and Mathematics

Celia Hoyles and Richard Noss, University College London

UK education might seem close to Papert's tipping point for meaningful learning with digital technology, in which schools have easy access to hardware, an awareness of the importance of the teacher's role, well-designed materials, and syntactically meaningful programming languages. In addition, there is mandatory engagement with programming by children starting age 6. However, all is not straightforward. To understand why, we draw on findings from the implementation of the ScratchMaths project - a curriculum intervention across English schools to promote mathematical thinking among students aged 9-11 years through programming. Finally, we discuss implications for sustaining and spreading coding as a modeling tool for learning more broadly.

Expanding Constructionist Gaming: Make, Code, and Play

Yasmin Kafai, University of Pennsylvania

Over the last decade, video games designed to teach academic content have multiplied. The emphasis on this instructionist approach to gaming, however, has overshadowed the constructionist approach, in which students learn by designing their own games. The educational benefits of constructionist gaming—coding, collaboration, and creativity—suggest the move from "computational thinking" toward "computational participation." Recent developments support a shift to game making, including the game industry's acceptance, and even promotion, of "modding" and the growth of a DIY culture. Future directions of serious gaming should be inclusive of instructionist and constructionist approaches, promoting connected gaming in which both making and gaming play a part.

Reclaiming Feminine Practices and Materials in the Modern Maker Movement

Kylie Peppler, Indiana University

History demonstrates repeated patterns of innovation that have stemmed from traditionally feminine practices and materials. One prominent example arcs back to the history of computing, which is rooted in weaving, crocheting, and other textile crafts. Kylie examines the contemporary case of e-textiles, textile artifacts embedded with interactive electronics, and how a community built around their development has successfully recentered traditional practices and materials in computing fields. In addition to serving as an example of new technologies diffusing throughout society by merging with existing communities and practices, e-textiles also offer a theoretical framing for understanding how to reclaim historically under-represented fields and practices in ways that disrupt stagnant practices and spur innovation.

Shaping Constructionist Learning Online

Deborah Fields, Utah State University

As children's do-it-yourself (DIY) media creation increasingly takes place online, it is important to investigate the social networking forums where children create and share their own work. Debbie and Sara examine the design and structure of a large Kids DIY Media Partnership to identify the kinds of regulatory, infrastructural, and technical support systems that foster children's DIY cultural participation. By analyzing several popular cases of web community designs they also provide examples of how these designed spaces promote, support, or even limit children's opportunities to engage in making, sharing, and, critically, understanding their rights and responsibilities in what they publish.

References

Berland, M., & Lee, V. (2011). Collaborative strategic board games as a site for distributed computational thinking. *International Journal of Game-Based Learning*, *1*(2), 65–81. https://doi.org/10.4018/ijgbl.2011040105

Blikstein, P. (2015). Computationally enhanced toolkits for children: Historical review and a framework for future design. *Foundations and Trends® Human–Computer Interaction, 9*(1), 1–68.

Buechley, L., & Perner-Wilson, H. (2012). Crafting Technology: Reimagining the Processes, Materials, and Cultures of Electronics. *ACM Transactions on Computer-Human Interaction, 19*(3), 21:1–21:21. https://doi.org/10.1145/2362364.2362369

Harel, I., & Papert, S. (1990). Software Design as a Learning Environment. *Interactive Learning Environments, 1*(1), 1–32. https://doi.org/10.1080/1049482900010102

Holbert, N. (2016). Leveraging cultural values and "ways of knowing" to increase diversity in maker activities. *International Journal of Child-Computer Interaction*, 9–10, 33–39. https://doi.org/10.1016/j.ijcci.2016.10.002

Kafai, Y. B., & Burke, Q. (2015). Constructionist Gaming: Understanding the Benefits of Making Games for Learning. *Educational Psychologist, 50*(4), 313–334. https://doi.org/10.1080/00461520.2015.1124022

Papert, S., & Harel, I. (1991). Situating constructionism. In S. Papert & I. Harel (Eds.), *Constructionism*. New York: Ablex Publishing.

Resnick, M., Maloney, J., Monroy-Hernández, A., Rusk, N., Eastmond, E., Brennan, K., … Silverman, B. (2009). Scratch: programming for all. *Communications of the ACM, 52*(11), 60–67.