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**Locating the Learner in Collaborative Constructionist Design**

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**Upshot.** Involving professionals in the design of c-books is a promising and feasible way for constructionism to influence large-scale educational practice. However, the role of learners as readers of c-books was unclear in Kynigos’ account. Here I review the critical role that learners play in the design process, and make recommendations for centering learners in the process of collaborative constructionist design.

1. In his target article, Chronis Kynigos describes first steps in the design of what he and colleagues call “c-books” – e-books with embedded constructionist ‘widgets’ that allow readers to interact with and create their own examples of mathematical phenomena. These books, Kynigos suggests, offer an opportunity for the Constructionist community to extend beyond our current niche and inform the broader educational enterprise. To explore how Constructionism could both *infuse* and *transform* the existing educational milieu, Kynigos and colleagues assembled diverse collaborative groups (“Communities of Interest”; or CoIs) including design professionals, educators, and other professionals to work together to envision c-book mathematics units that would challenge notions of mathematical creativity, and of interactive pedagogical materials more broadly.

2. I was excited to read Kynigos’ detailed analysis of the CoIs’ design processes. Systemic accounts of design – in particular, early ideation among collaborative groups – are rare. This analysis not only carefully documented such early ideation, but also identified specific moments and tensions that were productive in the advancement of groups’ designs. It traced the trajectories of designers as they worked together to permeate disciplinary boundaries and make collective progress on the design task. One key finding of the work was that ideas that were “put into use” (§37) were more likely to be pursued and refined by CoIs, given the socio-technical nature of the task. Another was that designers came to understand their designs as living documents that were “eternally improvable” (§15). Both of these findings were treated as markers of successful design experiences, as CoI members came to view c-books as living documents. The paper lends new insight into how we can foster successful collaborative constructionist design, thereby involving the very professionals we rely on to connect to actual classrooms, learners, and the educational enterprise.
3. However, I was left wondering where one very critical element – the learners, or readers of c-books – were located within this suggested ecology of collaborative constructionist design. From the guiding questions put forth in the paper, the reader is clearly centered: “How can we design a resource which addresses a reader who can use the same resource to tinker and construct with?,” and “How can we foster creativity in the design and writing of c-books aiming to engage ‘readers’ in creative constructionist activity for mathematical thinking?” However, readers were not part of the design teams. They do not appear to be well-specified or represented in the design tasks given to CoIs. And, designers’ attention to readers as learners were not an explicit focus of analysis.

4. At the same time, it seems that questions and tensions about readers are what drove CoIs to make progress. In the Windmills case, the Critical Episode that led teachers to consider the c-book as a “valise” of resources rather than a static artifact (§23) emerged from concerns about how to engage readers of different ages and preparation levels. In the Cycling in the City case, the new versions of MyGPS were inspired by Sara and Sharon’s concerns about their own students as potential readers. In both cases, these tensions seemed to emerge organically after some time. They each led to the development of multiple versions of the c-book unit, which subsequently propelled each group forward as they thought about the flexibility and novelty of c-books as a medium. In the paper, these spates of progress were inspired by discussions about readers that remained relatively superficial – focused on age, curricular needs, or developmental level.

5. Further and deeper consideration of readers can inspire even more progress by CoIs. But what might it look like to more explicitly center learners in the design of c-books at these early stages of design? Here, I make a few proposals, and consider how such re-centering might further increase the chances for the creativity and feasibility in the resulting products.

6. **Involving learners as co-designers.** There is an existing tradition of involving youth as designers of technology in the Constructionist community (Harel & Papert, 1990; Kafai, Ching & Marshall, 1997). Often, this work focuses on what students learn from design experiences. However, young people are adept at using technology-mediated tools, and are likely to bring new perspectives designers might not expect. Druin (2002) describes a number of ways to involve youth not only as users or testers but informants or co-designers of technology-mediated tools. Like the CoIs described here, youth have even been involved in design pursuits using online, distributed techniques (Walsh et al., 2012). Involving readers early on as members of a Col is feasible and likely to introduce new, creative, and youth-accessible solutions to c-book design problems.

7. **Consulting student work and video.** In the cases presented, questions about readers’ age and curricular experiences helped provide CoIs traction in creating multiple, flexible designs. But even learners of the same age and educational experience exhibit diversity and dynamics in how they approach a task. Teacher educators have found that engaging teachers with student work can help them focus on student thinking and learning, and to develop appropriate
instructional trajectories (Kazemi & Franke 2004). Similarly, reviewing video or examples of student work can offer researchers, designers, and teachers a way to bring together and integrate different perspectives (Sherin, 2003). Just as putting ideas to use can help designers make progress, seeing ideas in use can shed light on what creative learner pursuits might be possible using c-books that may be otherwise difficult in home or classroom settings.

8. **Documenting and building on existing learner and classroom practices.** Youth, families, and classroom communities already engage in a wide variety of creative practices that can serve as bridges to the types of technology-rich explorations emerging within c-books. Readers sketch, tell stories, play games and make use of a variety of classroom materials – these can all feed into and inform their experiences with technology. These practices do not reflect a complete reconceptualization of pedagogical materials. Rather, they are rooted in readers’ existing expressive and cultural practices, and offer ways to build on readers’ existing knowledge and promote creativity, engagement and interactions with one another (Lee, 2003; Horn, 2015). For example, learners quickly appropriate tools that fuse programming with pre-existing creative and play activities such as wooden block toys (Bers & Horn 2010) to create fundamentally new technological experiences. LOGO itself was built upon learners’ embodied experience of movement in the world (Papert, 1980). Exploring whether c-books can be connected to students’ bike trips to school using GPS sensors, or to physical robotic sensors that test windmills constructed in the classroom, can re-center student activity and allow teachers to establish better connections between c-books and the broader pedagogical agenda.

9. It is time for constructionism to enter the broader educational discourse and landscape. The careful, well-documented collaborative design of c-books is a promising and feasible way for this to happen. Involving readers themselves as part of this design ecology as they inform and interact with c-book units, and those units are revised and adapted. In the end, measures of successful design and design learning lie with the students: materials are eternally improvable because learners are ever changing, and learners are ultimately the ones who will make sure those materials are put to use.

**References**


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Michelle Wilkerson-Jerde is an Assistant Professor of Education in the School of Arts and Sciences at Tufts University. She designs and studies *expressive technologies* – tools that bridge practices familiar to youth such as sketching, storytelling, and animation with computationally-rich practices such as simulation and data visualization. Her current projects include SiMSAM (with Brian Gravel), an integrated animation, simulation, and measurement toolkit, and DataSketch, a tool to create programmable data visualizations using digital ink.

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