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8-2022

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Lee, Victor R.; Clarke-Midura, Jody; Shumway, Jessica F.; and Recker, Mimi, ""Design for Co-Design" in a Computer Science Curriculum Research-Practice Partnership" (2022). *Publications.* Paper 1.
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"Design for Co-Design" in a Computer Science Curriculum Research-Practice Partnership

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Abstract: This paper reports on a study of the dynamics of a Research-Practice Partnership (RPP) oriented around design, specifically the co-design model. The RPP is focused on supporting elementary school computer science (CS) instruction by involving paraprofessional educators and teachers in curricular co-design. A problem of practice addressed is that few elementary educators have backgrounds in teaching CS and have limited available instructional time and budget for CS. The co-design strategy entailed highlighting CS concepts in the mathematics curriculum during classroom instruction and designing computer lab lessons that explored related ideas through programming. Analyses focused on tensions within RPP interaction dynamics and how they were accommodated when RPP partners were designing for co-design activities, a critical component that leads to curricular co-design itself. We illustrate these tensions with examples of clusters of activity that appeared repeatedly among the research and practice team members when "designing for co-design".

Introduction

Research-practice partnerships (RPP) are gaining traction as a model for supporting practice-driven lines of inquiry and educational improvement in the learning sciences. While this represents an encouraging development for those interested in working on persistent problems of educational practice, Coburn and Penuel (2016) have also observed that "given new investments in RPPs, we need parallel investments in research on the dynamics and outcomes of partnerships. Studies of partnership dynamics are crucial to enable new partnerships to learn how to do this work and for existing partnerships to learn from each other's experiences" (p. 52). In this paper, we report on early empirical work designed to heed Coburn and Penuel's call to intentionally study partnership dynamics. Specifically, we examine one type of RPP, the design research partnership (Coburn et al., 2013), and specifically the curricular "co-design" model (Penuel et al., 2007; Voogt et al., 2015). Our goals in this paper are to illustrate some of those partnership dynamics interactionally – through actual descriptively analyzed researcher and practitioner conversations - and argue more broadly that a part of that partnership dynamic research should attend to the meta-design work involved in RPP teams designing for co-design.

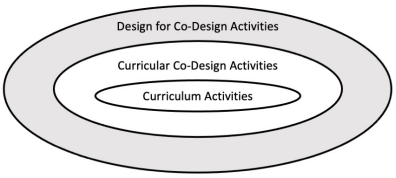
Framework: Design for Co-Design

While the RPP structure is key to our endeavor, our emphasis is on the work that surrounds the co-design activity itself. As a genre of curriculum development, co-design and related collaborative approaches (e.g., work circles; Shrader et al., 1999) are intended to be activities in which educators and design-oriented education researchers jointly do the ideational and prototyping work of curriculum improvement (Arce-Trigatti et al., 2018), rather than following a more typical sequence of late-term educator involvement using researcher-created curriculum and post-hoc feedback. This co-design configuration can serve to disrupt perceived and common imbalances between researchers and practitioners. However, there are a number of challenges to navigate in co-design because it brings together different communities with distinct histories, norms, and commitments to engage in joint work. Parts of this will ultimately be negotiated during the co-design activity itself, but that opportunity to do that negotiation is itself designed. Thus, we assert that there is an additional layer of design work that takes place to prepare for the co-design activities. We refer to this additional layer of work as "designing for co-design" and show how it is also a critical component that contributes to successful curricular co-design (see Figure 1).

For our partnership (funded by National Science Foundation Grants 2031382 and 2031404), design for co-design was necessary work because the co-designing educators (e.g., teachers) became involved after the grant supporting this RPP had been awarded. However, we contend that designing for co-design is necessary and common work done by RPP teams with longer partnership histories, particularly when new members (e.g., new teachers, district personnel, research assistants) are invited to join and take on active roles following natural turnover. In similarly-oriented work, this type of effort to open up space for full participation in co-design work has been characterized as organizing for teacher agency (Severance et al., 2016) and has lent itself to retrospective

analyses of field notes and artifacts from co-design sessions. The present study complements and is informed by Severance et al., although it examines a different geographical context, a different subject matter and age group, and paraprofessional educators in addition to classroom teachers. Moreover, we articulate in this paper the conditions and constraints that were managed during this case's design for co-design.

Figure 1
Concentric circles of design involved in curriculum design research-practice partnerships.



RPP Context: An Integrated Math-Computer Science Co-design Project

The study context comes from an RPP that seeks to support and co-develop elementary school computer science (CS) instruction that involves paraprofessional educators (whose position title in the district is "computer lab specialists") and classroom teachers in a rural-serving U.S. school district. A key problem of practice addressed in this RPP is that very few elementary school teachers have backgrounds in or comfort with teaching CS. The computer lab specialists were newly being asked to provide the CS instruction. The strategy being pursued by this RPP was to identify and highlight CS concepts in the already adopted mathematics curriculum and then structure the computer lab lessons as activities for exploring the same related mathematical ideas through a computational medium (i.e., Scratch). Adequately supporting the professional learning of paraprofessionals represents another set of persistent problems of practice.

Data, Interpretive Methods, and An Illustration

Our project was designed to study partnership dynamics from conception. Project personnel were assigned to lead an empirical study of the interactional dynamics within the RPP itself. This was in addition to other team members conducting research on educator learning and student experience with the newly designed learning activities. This self-examination component provides the data for this study, which took place during the COVID-19 pandemic when social distancing and remote work measures were in place. As such, virtually all activities up until this writing had taken place via Zoom, and video recordings of these meetings serve as the primary data source. In addition, the team members leading the RPP dynamics research conducted interviews with all participants and collected artifacts such as agendas and common documents. Data included 14 recorded weekly meetings (each 1-1.5 hours) involving 7 university-affiliated researchers (Principal Investigators and Graduate Researchers) from two institutions and 2 school district central office employees (Curriculum Leads). In addition, there were three, hour-long co-design meetings that included three classroom teachers and one computer lab specialist.

The analysis essentially involved recording RPP interactions, coding and curating them, and then engaging in more detailed descriptive analysis of the content of the curated interactions. These analyses were vetted by the larger group. This bears some resemblance to interaction analysis (Jordan & Henderson, 1995), which involves obtaining recordings and iteratively engaging in group analysis and argumentation of clips to forming an interpretation that is justified by evidence apparent in the record (e.g., specific utterances or words used by a speaker).

To illustrate, an example excerpt that was coded as **DESIGNING CO-DESIGN** and curated from the corpus appears below. This example excerpt, while long, is presented to give a sense of the type of interactional speech data that were examined and also to illustrate how **DESIGNING CO-DESIGN** episodes fit the following criteria: 1. The conversation had contributions from members of both the research and practice organizations, 2. The topic of conversation was related directly to how to structure the curricular co-design activities, and 3. From review of other meeting records and artifacts, the conversation ultimately led to a decision about the organization of the co-design activities themselves. In this excerpt, the first co-design meeting was scheduled to take place. It was the first time the classroom teachers and computer lab specialist explored how to design integrations between classroom mathematics content and computer lab instruction. In thinking about this meeting, researcher M raised the concern that it was unclear how to introduce the goals of the planned co-design. Researcher J offered a suggestion, and then district leader B offered her support for J's suggestion. Then B and district leader S voiced constraints: there was a lack of crossover content knowledge between the teachers and computer lab specialist.

University Researcher M: *You know, thinking about this first meeting, and, you know, the teachers as partners, but not overwhelming them. I mean, yeah -- I'm just trying to envision how we can talk about sort of the objectives here and get meaningful input on what units makes sense to them. Any suggestions?*
University Researcher J: *They don't know anything about Scratch or what the capabilities are, it may be hard for them to envision that. So I wonder if there's a way we can kind of, without too much information, but to give them some kind of like overview of some examples in Scratch or something, maybe this other curriculum that you mentioned -- something that gives them an idea, something to kind of think about, they can envision it.*
District Leader B: *I was gonna say, I think that that would really help our teachers, especially where they do have limited exposure to computer science, giving them a kind of a -- an idea of what it looks like, would be helpful for sure. And I know with this team, too, they have interest in computer science, but they haven't had a lot of experience with it. With the classroom teachers, for sure. So I think that would be a great idea.*
District Leader S: *And how much is the computer specialist going to need to understand about the math concepts to teach it properly? That's also going to be a potential constraint.*

In this segment, a common underlying question explored by all four speakers was how to make the work of co-design feel tractable and approachable for the teachers and lab specialist who would, at a designated and time-limited future meeting, begin this work for the first time. Following Severance et al (2016) in wanting to "present the vision" for innovative learning activities as stimulus for curricular co-design, researcher M questioned how the co-design could be presented to "get meaningful input". This question led to articulation of two fundamental challenges for the planned co-design. First was the unfamiliar end goal of integrated lessons needed to be envisioned but the team wanted it to be rooted in the ideas of the co-design team. They did not want to overly constrain the co-design team's thinking nor provide examples that already solved the design problem nor provide poor examples that did not encourage ambitious integrated instruction. Utterances from M and J expressed this, as did other utterances during the meeting. Second was how to negotiate two different content areas while recognizing what knowledge was necessary to teach integrated lessons. On the one hand, CS as a focal topic was unfamiliar to the classroom teachers (speaker B). On the other, the specialists were not assumed to have the degree of mathematical knowledge for teaching that the classroom teachers would have (speaker S).

It ended up taking several additional RPP planning meetings to get there, but a decision was eventually reached to introduce a Scratch programming sample and view it together in addition to a small set of practitioner-facing examples from practitioner publications to express that there were numerous viable possibilities that could be developed. Regardless, this excerpt serves to model the challenge, show the data used, and illustrate how our analysis worked to maintain accountability to the transcript data as we analyzed interactions.

Additional Examples of Design for Co-Design Challenges

As a short paper reporting on a project that is still in progress, our goal is to argue that design for co-design is a component of RPP co-design structures and that it contains worthwhile design questions for learning scientists to explore. While longer post-hoc analysis will come in the future, we consider it worthwhile for the learning sciences community to already begin recognizing and discussing this design for co-design space that many RPPs already have and are encountering. Given that, the remaining empirical examples are illustrative to name some design for co-design challenges. These were derived and analyzed in the fashion briefly modeled above.

Negotiating Technological Infrastructure Across Partners

One recurring set of concerns we have seen across "designing for co-design" meetings, especially leading up to the first co-design session, was how to manage digital systems. A concern among partners was that the university team might appear as having the greatest amount of influence. This extended to what technologies were used and how co-design engaged with those technologies. The university had contracts with various vendors including Box.com, and the university's institutional review board (IRB) required that Box be used for security purposes with human subjects data. This led to the university defaulting to Box for its online storage infrastructure. However, a district team member expressed that Box was not familiar to district personnel: "*I just think it needs to be easy for teachers -- Box is not intuitive by any means. And I think it, you know -- teachers are used to Google drive*." The university team was bound by IRB rules to use Box, yet opted to maintain both Box and Google-based volumes, with Google Drive used exclusively for co-design so that district partners would not feel like they were encumbered with needing to use 'the university's preferred tools'. While this is one decision, there were several others. For instance, the project created a design group email list through Google groups so administrative control and email names did not have the university's address in them, further detaching those aspects of co-design

communications from the university's tools. Elsewhere, it extended to questions about calendaring systems and Zoom accounts to use as those could represent influence in the partnership.

Moving Away from Researcher-favored Dialects

Another topic that came up in "designing for co-design" work was what language to use. While education researchers are currently enthusiastic about RPPs, it is unclear how widely known the term is among practitioners and how enthusiastically it is endorsed. To illustrate, district team member S, who had been part of writing the grant referred to the entire endeavor in a meeting as: "*You know the design, you know the practice design practice partnership*". While we were confident this person valued and enthusiastically supported the partnership, the RPP term itself was not one that seemed of great importance to S. One of the university project leaders was sensitive to this and explicitly acknowledged it during a meeting and at one point mentioned "*the things I'm planning to say -- I'm trying to avoid too much jargon – 'research-practice partnership' would certainly be under the umbrella of jargon*". Thus, the point here is that there are different language communities coming together where terms are bestowed different status. Forcing or policing these could inadvertently signal power or influence on the partnership and in designing the co-design, decisions were made to recognize and avoid giving those signals.

This question of terminology even extended to the terms 'design' and 'co-design'. Researchers, and especially learning scientists, value design and treat it as agentic and generative activity. However, a district partner commented that "design" implied a lot of time and effort. For example, many teachers do not think of their work leading up to classroom instruction as "designing" their lessons but rather "planning" their lessons. This was illustrated by the following comment during a meeting about what to call the team of (what we as learning scientists call) curriculum co-designers.

> District Member B: *I do think that, from the teacher's perspective -- going to the word adapting makes the challenge less overwhelming, because when you're talking to a teacher about designing units -- that's a long-term time-intensive process -- but adapting I think is a better word for that.*

As we, the authors of this paper, are participants in and are addressing the learning sciences community where "design" is discussed, we comfortably use the term here. However, the RPP team that was designing the co-design elected to leave this determination to the co-design team. "Design" was offered as a descriptor, but the teachers and specialist viewed it as "integration". This became part of the collective identity that emerged, and that group even gave themselves the name "Code Math integration group" that did not use the "design" term.

Conclusion

RPPs and co-design have been proposed as newer vehicles for joint work between researchers and practitioners. There is a need and call (i.e., Coburn & Penuel, 2016) to not only study RPP outputs but also their internal dynamics. Among those, we argue, are the steps taken within a design RPP to design for co-design activities. We believe and sought to illustrate that this additional layer of work is productive and that such work is quite common but unstated. Our examples in this paper show what some of this work looks like, and we invite the learning sciences community to further explore this space so that more generative and equitable RPPs can be developed and maintained in the future.

References

Arce-Trigatti, P., Chukhray, I., & López Turley, R. (2018). Research-Practice Partnerships in Education. In B. Schneider (Ed.), *Handbook of the Sociology in Education in the 21st Century* (pp. 561-580). Springer.

Coburn, C. E., & Penuel, W. R. (2016). Research-practice partnerships in education: Outcomes, dynamics, and open questions. *Educational Researcher, 45*(1), 48–54.

J Coburn, C. E., Penuel, W. R., & Geil, K. E. (2013). *Practice Partnerships: A Strategy for Leveraging Research for Educational Improvement in School Districts.* William T. Grant Foundation.

Jordan, B., & Henderson, A. (1995). Interaction analysis: Foundations and practice. *Journal of the learning sciences, 4*(1), 39-103.

Severance, S., Penuel, W. R., Sumner, T., & Leary, H. (2016). Organizing for teacher agency in curriculum design. *Journal of the Learning Sciences, 25(*4), 531–564.

Shrader, G., Williams, K., Walker, L., & Gomez, L. (1999). Work in the 'work-circle': A description of collaborative design to improve teaching practice. Paper presented at the Annual Meeting of the *American Educational Research Associatio*n, San Diego, CA.

Voogt, J. M., Laferrière, T., Breuleux, A., Itow, R. C., Hickey, D. T., & McKenney, S. E. (2015). Collaborative design as a form of professional development. *Instructional Science, 43*(2), 259–282.