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Agency at Scale: Embedding Interpersonal Interaction and Collaboration in an Online Professional Development Platform

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Abstract: Responding to an increasing demand for scalability, designers have begun creating online teacher professional development (oTPD) platforms and curricula. However, researchers have also critiqued the field for overlooking the role of teacher voice and interpersonal interaction within the instructional design of most oTPD programs. In response, we explore the design and initial implementation of Zodiac, an online professional development platform specifically designed to amplify teacher agency within oTPD contexts through the application of activity theory. Using this tool, we developed and piloted a curriculum (called PathsPD) centered on helping teachers implement project-based learning in their classrooms and increasing learner-learner and learner-instructor interactions in online settings. In analyzing our design and post-interviews with users, we show that the technology/curriculum we developed attended to the community and division of labor aspects of the activity theory framework and amplified teacher choice and interpersonal interactions within this oTPD experience.

Introduction

Due to multiple intersecting social and institutional factors (ranging from climate instability and economic defunding to social demand for high quality teaching and expanding public education), there exists a growing need for high quality and scalable teacher professional development that can reach educators regardless of their geographic location (Kleiman et al., 2013; Laurillard & Kennedy, 2019; Lindvall, 2017; Lim et al., 2020b). In response, designers have relied on the ubiquity of internet enabled devices across the globe and turned towards online teacher professional development (oTPD) curricula and technologies to address this need (Kennedy & Laurillard, 2019). While numerous approaches to oTPD exist, instructional designers have relied heavily on massive open online courses (MOOCs) as a reliable model for delivering content to broad and dispersed populations, an approach that research has shown to be effective (Kennedy & Laurillard, 2019; Kleiman et al., 2013; Viswanathan, 2012; Wang et al., 2018). However, extant research has also shown that poorly designed oTPD can undermine professional development efforts, especially if those programs overlook teacher voice (Kennedy & Laurillard, 2019; Richardson, 2018). MOOCs specifically can exacerbate these issues by restricting how teachers interact with these technologies. As Gamage et al. (2020) argue, "MOOC platforms are high in learner-system interactivity and learner-content interactivity. Learner-learner interactions and learner-instructor [interactions] are significantly lacking" (p. 107). By only attending to the former kinds of interaction, oTPD technologies such as MOOCs can create a one-sided conversation and drown out teacher voice within online learning contexts. Stated differently, only providing opportunities for learner-system or learner-content interactions reproduces an instructivist approach to MOOCs that greatly limits teacher agency while systems that amplify learner-learner and learner-instructor interactivity achieve the opposite (Gamage et al., 2020).

In response to these concerns about MOOCs, we ask: how can instructional designers amplify agency via learner-learner and learner-instructor interactions within oTPD? To do so, we explore the design and pilot implementation of Zodiac, an oTPD platform specifically designed to engage teacher agency through the amplification of learner-learner and learner-instructor interaction at scale in ways commonly absent within MOOCs. For this initial implementation, we also created a professional development curriculum entitled PathsPD with the aim of helping teachers across all subject areas develop pedagogical knowledge and skills related to implementing project-based learning (PBL) in their classrooms. This paper then illustrates the interrelated design of both Zodiac and PathsPD and how these two creations in tandem speak to the concerns of teacher agency and interpersonal interaction within oTPD instructional design. We begin by describing how we aligned our design principles with Lim et al.'s (2020a) activity theory framework for oTPD to explicitly engage teacher agency. Lim et al.'s (2020a) interpretation of activity theory provided a particularly valuable conceptual framework for our

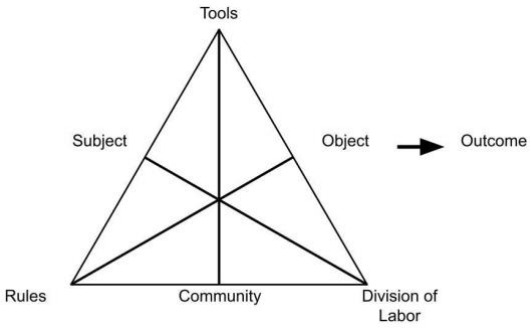
design process because of its emphasis on the mediated nature of professional development, one where teacher learning occurs through the interaction between learners, curricula, tools, contexts, and other actors. We then provide analysis of user feedback from our initial implementation. In doing so, we show how the complementary designs of Zodiac and PathsPD both attended to the community and division of labor aspects of the activity theory framework, amplifying teacher choice and interpersonal interactions within this oTPD context. We therefore provide a model for oTPD instructional design that attends to teacher agency through this theoretical lens.

Theoretical context

To more fully explore teacher voice and interpersonal interactions within our oTPD platform and curricula, we follow Lim et al. (2020a) in drawing on activity theory as a conceptual framework. Emerging from the work of Leont'ev (1978) and Vygotsky (1980), activity theory "suggests that human learning emerges from activities and emphasizes both the historical development of ideas and the active and constructive role of humans" (Lim et al., 2020a, p. 528). In this sense, activity theory situates human activity (both on the level of the individual and as a collective practice) within cultural and historical contexts and also mediates activity through the tools individuals use (hence its value within this particular study). Building on this theorization, Engeström (2014) proposes that activity theory provides the foundation for a system analysis of human activity (including learning) that includes the following components: tools, subject, rules, community, division of labor, and the object produced through human activity (see Figure 1). Through the interaction between these six elements in a given system, the outcome of human activity emerges. As Lim et al. (2020a) argue, activity theory provides a means for understanding how teachers learn through their engagement with oTPD systems: by situating teachers, their actions, and the surrounding context within the activity theory framework, researchers can better understand what and how educators learn within oTPD experiences (see Table 1 for more details).

Figure 1

Activity Theory Framework (Engeström, 2014)



In taking a broader sociocultural approach to examining activity, Stetsenko & Arievitch (2004) argue that activity theory also positions agency as distributed between the self and the surrounding social context. If agency represents "the phenomenon that individuals—including both single individuals and groups of individuals—are capable of making choices and acting on these choices in order to exert control over their lives and the environments they are living in" (Goller & Paloniemi, 2017, p. 1), then the directional relationship defined by an individual acting on a social context (i.e. the environment) in part defines agency. But other scholars also recognize the inverse of that relationship playing a key role as well, revealing how the immediate context of individuals both restrict and allow people to exercise their inherent agency within and beyond learning processes (Ahearn, 2001; Calabrese Barton & Tan, 2010). In considering teacher professional development, existing research has shown that teacher agency plays a crucial role in the ability of teachers to learn and institutions to change (Eteläpelto et al., 2013; Imants & Van der Wal, 2020; Priestly et al., 2012). Brevik et al. (2019) further suggest that all effective forms of teacher education require the development of transformative agency, or the ability to act outside of and subsequently affect a given frame of action. To this end, instructional designers of oTPD need to design learning environments that allow teachers to access their agency through learning processes. Applying activity theory in the design process, both in terms of designing professional development opportunities or tools *for* teachers and designing curriculum materials or technologies *with* teachers, provides a particularly potent lens for amplifying teachers' transformative agency (Severance et al., 2016).

By employing activity theory, a theorization of learning rooted within a contextualized understanding of human activity, we can more fully attend to learner agency through our design process and better situate learner-learner and learner-instructor interactions within the broader network of learning through oTPD contexts. More

specifically, a shift in these interactions implies an adjustment in how the subject (a teacher) agentically interacts with the community and potentially reimagines the division of labor between learners and instructors. The oTPD platform, the tool within this context, then mediates and facilitates that shift if properly designed and produces a different outcome in concert with the other changes. To explore how this theoretical plan for change emerges in practice, we turn towards the design process behind Zodiac and PathsPD.

Table 1
Elements of activity theory framework within TPD

Elements	Definitions (Lim et al., 2020a, p. 528)	Application in Zodiac/PathsPD
Tools	Any tool used to help teachers engage in oTPD (computers, programs, etc.)	Zodiac system and its embedded tools: discourse, miro, google docs (reflective journal)
Subject	"The teacher who engages in the professional learning activities"	Teacher interested in employing PBL in their classroom
Rules	Any norms, regulations, or conventions that shape the actions or interactions within the broader activity system	Explicit instruction on developing collaborative community
Community	"Different teachers engaged in the professional learning task within the TPD environment"	Teachers and instructional coaches work together to co-design PBL units
Division of Labor	"The mechanisms for teachers to complete the learning task to achieve the professional learning outcomes" as divided among community members	Teachers both develop curricula and provide feedback to other teachers, instructional coaches help teachers develop unit designs
Object	The learning task or assessment	New unit design as the PBL artifact
Outcome	The expected professional learning outcome	Develop a working understanding of PBL pedagogies and the skills needed for classroom implementation

Design process and technology description

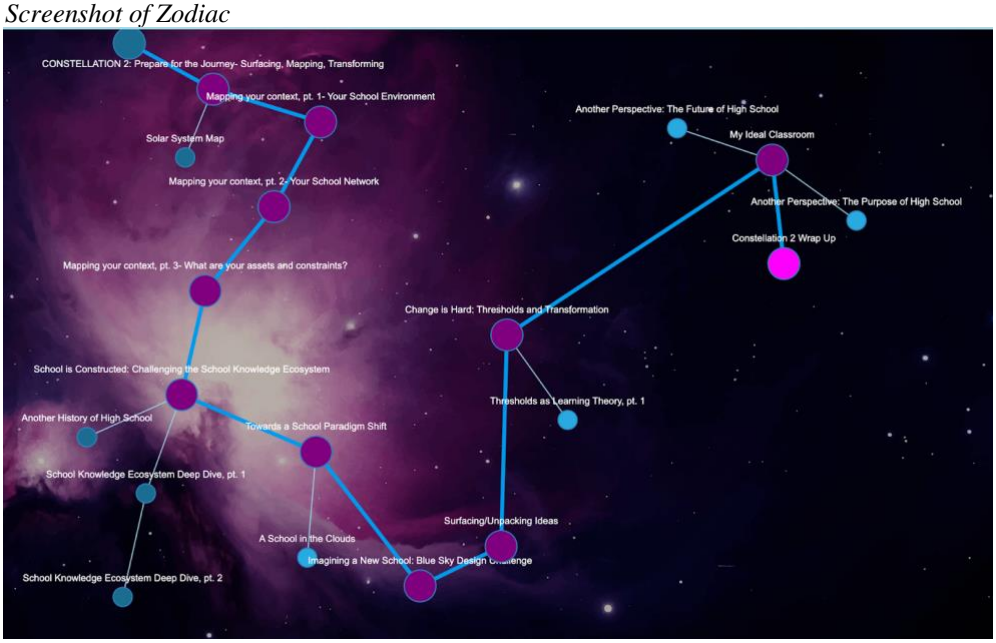
To help teachers develop skills and knowledge related to implementing PBL in their classrooms, we developed an oTPD module called PathsPD. To engage this process, we drew on our three years of experience designing and implementing both weeklong PBL-centric colloquia and on-site instructional coaching for teachers and administrators shifting to school-wide PBL implementations. In doing so, we drew on previous research into PBL-centric teacher professional development to effectively address the unique challenges associated with this process. For instance, our approach to professional development intentionally combined generalized PBL experiences with direct mentoring (Becker & Riel, 2000; Whitlock, 2020), extended over time with multiple opportunities for feedback and iteration on the part of the teacher (Chiu et al., 2021; McKendree, 2019; Shernoff et al, 2017), and centered contextual praxes and adaptability throughout the learning process (Miller et al., 2021; Potvin et al, 2021; Young, 2018). After multiple iterations of the colloquia and extensive time employing instructional coaching, the design team collected curricular artifacts and insight from the instructional coaches to develop an asynchronous and fully online (and, thus, scalable) curriculum. We used these materials to create a series of activities (discussions, readings, design challenges, reflective writings, etc.) that covered topics including PBL-based school reform, inquiry learning, constructivism/constructionism, and technical aspects of PBL unit design. The PathsPD curriculum then ended with teachers designing their own project curricula before receiving feedback from the instructional coaches and other teacher participants on their unit designs (providing one example of how the PathsPD curriculum embodied teacher agency and both learner-learner and learner-instructor interactions). Completing all of the activities in PathsPD took teachers roughly 40 hours.

However, the need to make PathsPD contextual pushed us to develop a new platform as well. While the curriculum materials we developed and curated could have been delivered in a MOOC style format, this approach would have limited the ability for teachers to focus on elements of the curriculum that applied to their specific school context while also limiting interactions between learners, their colleagues, and instructional coaches. In response, we created Zodiac, an oTPD platform that embeds teacher choice within the system while also amplifying learner-learner and learner-instructor interactions. Creating this new technology also challenged us to rethink our curriculum. The design of Zodiac therefore influenced the design of PathsPD and vice versa, with the platform creating opportunities for unexpected curriculum design choices and the evolution of the curriculum directing the development of the platform to meet its unfolding needs. Through this iterative process, we eventually decided on a non-linear model of learning (Rahayu et al., 2021) where teachers can make the choice

of how to move through the system and curricula while also embedding opportunities for interpersonal collaborations and interactions into the platform. Utilizing the visual metaphor of constellations, learners begin by clicking on a star set against a space themed backdrop. After clicking on the star, a pop-up window with text, embedded content (in the form of a pdf document, website, audio track, or video), and/or a browser-based collaboration tool (e.g. a Discourse forum discussion, a Miro board) shows up over the star. By incorporating both Discourse and Miro into the system, we explicitly engaged teachers in learner-learner interactions while responding to critiques of discussion forums in MOOCs: through the use of active engagement strategies that frame forum discussions as spaces for teachers to share their interpretations of materials and receive/provide feedback on learner created materials, we move beyond the approach taken by most MOOCS that merely ask participants to reiterate course content (Galikyan et al., 2021; Onah et al., 2014). Additionally, some stars included an embedded scheduling tool (Calendly) for teachers to set up one-on-one feedback sessions with our instructional coaches, thus creating opportunities for learner-instructor interactions. Participants also collected some individual reflections and curriculum design work in a reflective journal template created with Google Docs and stored outside of the system. When participants complete the task in a specific star, they close the popup window and a new series of stars appear. Learners can then choose how to proceed through the system: while the pink stars represent mandatory content, the blue stars present optional learning experiences for teachers interested in more deeply exploring a specific topic (see Figure 2). Through this design, we provide teachers with the ability to self-direct their learning experience via a non-linear learning path.

Figure 2

Screenshot of Zodiac



Through this process, we framed the intertwined design of the PathsPD curriculum and the Zodiac platform through Lim et al.'s (2020a) interpretation of activity theory within oTPD to accentuate learner-learner and learner-instructor interactions (and, by extension, teacher agency) within this oTPD experience (see Table 1). Beyond merely designing a tool for teachers to interact with (Zodiac), we also very intentionally chose and embedded tools within this broader system that created opportunities for agentic learner-learner and learner-teacher interactions (i.e. Discourse, Miro). We also foregrounded the rules of the activity theory framework by including activities related to collaborative community development within the curriculum. For example, we asked teachers to read Garmston & Wellman's (2016) seven norms of collaborative work and then collectively discuss what they valued about these norms and what other norms would benefit their experience in the system. In terms of the division of labor, we used the embedded tools to generate opportunities for instructors and learners to provide feedback to each other (again highlighting learner-learner and learner-instructor interactions). The scheduling tools and Discourse forums in particular created a space for instructional coaches and teachers to productively critique each other's work. Building on this feedback, teachers eventually achieve the outcome of developing a project for their classroom, a design choice building on previous research asserting that PBL itself provides a valuable model for PBL-centric PD where teachers learn through the creation and presentation of a

project artifact in the form of a unit design (Chookaew et al., 2017; Du et al., 2020; Ravitz et al., 2012; Reid-Griffin et al., 2019). Taken together, the outcome of this activity is the development of a working understanding of PBL pedagogies and skills on the part of the teacher.

Pilot implementation

Methodology

To better understand how teachers engaged with this tool, we now turn towards findings from a broader design-based research study (see Anderson & Shattuck, 2012; Barab & Squire, 2004) into Zodiac and PathsPD. While the design of our curriculum emerges from three separate iterations of designing and implementing in-person PBL colloquia, we present an analysis of data generated from the first (and only) implementation of Zodiac/PathsPD as the study remains ongoing. For this pilot implementation, we recruited six teachers from two schools (one middle school and one high school) located in the United States. Participating teachers had approximately one month to complete the 40-hour curriculum, allowing the study participants to engage the program on their own schedule and embody the asynchronous aspects of the module in their own way. Of the six participants, three completed the entirety of the program while three completed some of the curriculum.

To generate data, we first collected pre- and post-surveys focused on the participants' opinions about professional development and their sense of self-efficacy related to affecting change within their classrooms. The post-survey also included open-ended questions about their experience with PathsPD and Zodiac. Due to the small sample size in this study, we did not use these surveys as a data source. Instead, we conducted thirty-minute semi-structured interviews with all participants after the window for completing the module closed and used their survey responses to generate additional interview questions, often asking them to elaborate on their open-ended written responses or provide explanations for shifts in their survey answers. Interview questions centered on their experience with Zodiac and PathsPD, their shifting understanding of PBL, and how they conceptualized agency when partaking in the program. We rely on interview data for this particular study (as opposed to user data or learner artifacts like discussion posts) because of our interest in how participants experienced the program, as opposed to evaluating the efficacy of our design. Once completed, we fully transcribed each interview and employed an open and iterative approach to both descriptive and pattern coding techniques (Saldaña, 2016) to analyze the experiences of our study population. We first produced a series of codes through an emic, first round coding process and then categorized these codes within broader themes related to the kinds of interactions teachers encountered and their conceptualizations of agency (or a lack thereof) in the program. We then relied on Harry et al.'s (2005) consensus building process to ensure validity, with researchers reviewing each other's analyses and negotiating any differences in application until all researchers agreed on the final code book and its application.

Findings

Through our analysis, we found that participants strongly connected to elements of the program that allowed for learner-learner and learner-instructor interactions, thus responding directly to our research question. In terms of learner-learner interactions, the participants recognized the value of both Discourse forums and Miro boards as spaces for collaborating with their peers on their project designs. As one participant explained:

> I really liked the Discourse forum. I felt like you were able to get your thoughts down in a more coherent manner. I liked that the Miro board was kind of just scattershot, just kind of get any brainstorming thoughts out. Then the forum, I was able to go back and forth with some people… It helped me kind of jump from that brainstorming stage to putting my thoughts together more cohesively, and then finally building a product.

Another participant built on this understanding of learner-learner interactions when describing their experience as an audience for other participants' discussion posts:

> Just looking at the discussion that happened between other people or other people's responses was enough for me to go, "okay, that's a really good idea." Or I could see that's how they interpreted this question, which then made me think that maybe I wasn't expansive enough or maybe I took a very different route. It just allowed me to see a variety of perspectives.

In both cases, the tools embedded throughout the module and platform created an opportunity for learner-learner interactions (both in terms of sharing ideas and exploring others' work), producing a more intentional set of interactions with the community of learners and leading to the desired outcome (the creation of the "product"

or project curriculum and an expanded perspective in terms of what PBL looks like in schools). Additionally, this data indicates that participants recognized the collaborative engagement strategies we embedded within the Discourse discussions, creating opportunities for both the cognitive and social engagement that goes missing from most discussion forums in MOOCs (Galikyan et al., 2021; Onah et al., 2014).

Additionally, the study participants also recognized learner-instructor interactions as one of the most valuable aspects of the program. In particular, the participants appreciated the embedded opportunities to work with instructional coaches as they iterated on their unit designs. As one participant explains:

> having the coaching experience was also nice to be able to talk to other people and just get some more specific feedback for something I was working on. Especially because our school's big push right now with our accreditation is family engagement and trying to get parents more involved, and so I wanted some more specific help in that area too, of what can I do to try to get that engagement up. And [the coaches] gave me tons of ideas, so that was really helpful.

In this response, the participant explains the importance they found in incorporating learner-instructor interactions into the curriculum. Beyond merely having access to an experienced collaborator, the participant also recognized this kind of interaction as an opportunity for contextualizing the PD experience in a way that learner-system or learner-content interactions do not. By creating an opportunity to discuss their work with the instructors, our design created space for the participant to explore family engagement practices that were not part of the curriculum.

In connecting to the design of Zodiac and PathsPD in this way, the teachers identified an expanded sense of agency as learners in multiple areas. In terms of the Zodiac platform, teachers recognized the value in providing a non-linear curricular path. As one participant describes:

> You had the optional [stars], which I really liked. I got lost in a couple of those just because I was like, "Oh, that sounds really interesting. Here's a possible chance for you to explore something different." I like that aspect of it, because we all think in different ways or different things are appealing to us. So [I liked] just having that choice and checking some different things out.

Additionally, participants also recognized the increased sense of agency present in our project-based approach to the design of the PathsPD curriculum. In particular, by both allowing teachers to design projects they would implement in their classroom and providing open ended support in that process (rather than dictating how teachers should design those projects), the participants recognized an increased capacity to create meaningful materials. As one participant explains:

> A lot of times in our PD, we ended up doing it as a department and so I feel like I end up pushing some of my own thoughts to the side, just for the nature of a group dynamic. What I ended up with as far as a unit plan is a lot more authentic to what I do than necessarily teaching somebody else's material.

Taken together, these quotes speak to the role that intentionally centering teacher choice (and, by extension, agency) within elements of the activity theory framework can play in shifting the outcome of oTPD towards a personalized or situated outcome. While future research into this program will elaborate on the kinds of choice teachers found in exploring the system, this initial analysis reveals that teachers recognized their agency in deciding how to engage with the system (the tool) and also a sense of agency in designing their own projects while receiving support from the instructional coaches and other participants (community, division of labor).

Discussion

Through the process of designing Zodiac and PathsPD, we not only attend to Gamage et al.'s (2020) call to amplify learner-learner and learner-instructor interactions but provide a framework for engaging teacher agency within oTPD platforms (all of which remain absent from most MOOCs). The use of Discourse and Miro as embedded tools within the system, the use of active engagement and collaborative instructional strategies in framing those tools, and the facilitation of instructional coaching sessions provided a means for teachers to collaboratively develop their own projects with other learners and instructors. Additionally, the constellation metaphor at the heart of Zodiac provides an opportunity for users to customize the curriculum to suit their interests through customizable pathways, providing a learning context that foregrounds teacher agency. Yet merely attending to

these kinds of interactions cannot fully account for a shift in the outcome of an oTPD experience beyond what most MOOCs provide. To this end, we position these interactions within a broader activity theory framework, one that equally considers the tools, subject, rules, community, division of labor, and object in designing for a specific outcome. While the subject remains unchanged, our design and the analysis from our pilot implementation reveal that Zodiac (the main tool used in this activity) repositioned how the subject interacted with their community and shifted the division of labor between learners and instructors towards a more collaborative relationship. Additionally, we intentionally designed for the shaping of rules within this community of learners and framed the object within the context of PBL to highlight the learning outcome. To this end, Zodiac and PathsPD model Lim et al.'s (2020a) assertion that activity theory provides a framework for designing oTPD at scale while still attending to the lack of teacher agency and both learner-learner and learner-instructor interactions within most oTPD contexts.

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