A Self-Study of Aligning Pedagogy with Technology in Online Course Design

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Effective teacher professional development (TPD) is critical in improving the quality of education and assisting students in acquiring complex 21st-century skills. TPD can enhance teachers' motivation and confidence and improve their knowledge and practice. The research has identified a set of TPD characteristics: content focus, sustained duration, incorporation of active learning, collaboration, modeling practices with coaching, feedback, and reflection (Darling-Hammond et al., 2017; Desimone, 2009; Penuel et al., 2007). Through these practices situated, transformative, and theory-based TPD models challenge traditional transmissive models (Borko et al. 2010; Guskey, 2002).

In response to pressures for providing more flexible and cost-effective TPD, teacher educators have turned to innovative technology-mediated, online, and blended approaches that allow teachers to engage actively at their pace. Collaborative online technologies allow teachers to engage in participatory, not content-driven experiences, with pedagogically intriguing electronic apprenticeship where meanings and insights can be co-constructed (Dede et al., 2009; Harasim, 2017; Hrastinski, 2009). However, as the COVID-19 pandemic revealed, quality teaching mediated through technology is not easily orchestrated. Quality online and technology-mediated

teaching requires skillsets related to technology-mediated instruction, including development of materials, activities, and assessments, with skillful coordination of activities.

Technology integration is not "an isolated goal to be achieved separately from pedagogical goals" (Ertmer & Ottenbreit-Leftwich, 2013, p. 176). Instructional models based on how people learn with technology and attend to pedagogical principles are emerging (e.g., Anderson, 2008; Garrison & Vaughan, 2008; Harasim, 2017; Van Merriënboer & Kirschner, 2017; Picciano, 2017). However, the lack of attention to pedagogy during the design process may be a reason for many online designs not reaching their full potential (Graham et al., 2014). The linear orientation of identifying learning outcomes, connecting them with performance assessments, and developing learning activities using available technology tools, is not sufficient. It underestimates the need for strategic orchestration of instructional methods and technology, oriented toward a deeper understanding of the content and learning transfer. Such orchestration is defined here as a set of theoretical principles and related practices guiding teacher/instructional designer actions, judgments, and strategies to orchestrate the elements of learning activities that result in positive student learning.

Although pedagogy and principles of effective TPD are relevant, it is unclear how these translate into online technology-mediated settings. Our understanding of effective online TPD (oTPD), as well as our experiences with oTPD design, development, implementation, and evaluation, are minimal and sporadic. Research should focus not only on *what* works in oTPD but *why* it works (Borko et al., 2010; Dede et al., 2009). This self-study of practice closely examines the process of designing and developing a fully-online instructor-facilitated TPD course grounded in sociocultural practices. We explored our process of creating a course template and examined our decision-making patterns in designing the course. We sought to identify the design principles of practice that emerged in our work.

Methodology

The study was conducted during the design phase of a larger research project. Our project attended to principles of design-based research (McKenney & Reeves, 2018). Because of our orientation to developing assertions for action and understanding, we selected the S-STTEP (self-study of teaching and teacher education practices) methodology (LaBoskey, 2004; Pinnegar and Hamilton, 2009). Our self-initiated disciplined inquiry into our situated practice to improve practice allowed us to examine decision-making during template design. We attended to particulars of the design, considered the context of decisions, and retrospectively reviewed design processes identifying patterns. Our study was rooted in an ontological orientation grounded in our relationship to others, traced our rigorous and consistent dialogue and collaborative conversations with critical friends (Hamilton & Pinnegar, 2017).

Participants and Data Sources

Our team included a researcher/instructional designer, an instructional designer, and a teacher educator. The researcher/instructional designer, Bohdana, has a background in applied linguistics, experience in design, teaching, and research related to socio-culturally grounded TPD. The collaborating instructional designer brought experience in instructional design coupled with a K-12 teaching background. The teacher educator (Stefinee), an S-STTEP researcher, brought experience in designing curriculum and pedagogies representing sociocultural theory.

Data included nineteen recordings of collaborative conversations recordings, each lasting approximately one hour, including artifacts related to the developing template and course materials developed during the discussions. Bohdana analyzed the recorded collaborative meetings and related artifacts with Stefinee acting as a critical friend.

Procedures and Data Analysis

The analytic steps and processes, outlined sequentially, took place iteratively as data was continuously collected, analyzed, and interpreted and was part of the decision-making process. The analysis utilized two levels of continuous comparative techniques: (1) immediately after each meeting and (2) at the end of data collection. These recursive processes used from the onset of the study were practical and "enliven the research process and push toward the evolution of ideas to uncover possible insights and oversights... generat(ing) questions and point(ing) to new directions" (Pinnegar & Hamilton, 2009, p. 149), benefiting the process.

We met regularly for twelve months, collaboratively reviewing progressing course design. At the end of meetings, we explored solutions bringing them to the next conversation. Pivotal points were revisited during subsequent meetings. Collaborative conversations were recorded and transcribed shortly after meetings. Transcription accuracy was verified, and transcripts adjusted as needed. Raw data was organized into initial codes and conceptual categories through open coding (Corbin & Strauss, 2008). In reviewing the codes and categories, we recognized that initial coding was informed by both the data and our theoretical orientation, understanding, and values (Ryan & Bernard, 2003). We then decided to pursue two separate strands of inquiry: (1) understanding the elements and steps of the online TPD design process and (2) engage in S-STTEP to understand and improve practices revealed in the design process. Results of the first project are reported elsewhere (Allman & Leary, 2020). A discussion of the S-STTEP project is presented below.

Looking beyond initial codes and categories (Corbin & Strauss, 2008), the core phenomenon of aligning physical and pedagogical layers was identified, and additional themes, interrelationships, and patterns were explored. We employed critical reflection cycles focused on uncovering and making accessible our embodied knowledge, enabling

articulation of patterns. We explored similarity and contiguity-based relationships, which improved the quality of our data analysis (Maxwell & Miller, 2012).

Trustworthiness

Multiple investigators, member checks, and reflexivity supported our trustworthiness and increased credibility, dependability, and confirmability (Lincoln & Guba, 1985). We used audit trail, exemplar-based validation, and negative case analysis (LaBoskey, 2004). Attending to contiguity as well as similarity allowed us to guard against overgeneralizing and supported credibility of the findings (Maxwell & Miller, 2012).

Assertions for Understanding

The core phenomenon of aligning pedagogy and technology emerged from our analysis of the design process. We organized our ideas as interconnected tensions (Berry, 2007). We wove a fabric of understanding from strands of contradictions, turning the strain and pull into something strong and valuable. Because of the varied perspectives and different design roles, unique patterns became evident. These provided necessary *taut* while our intense collaboration and mutual respect kept a proper *balance*. Upon carefully exploring the tensions, we recognized emerging solutions to our problems, allowing us to identify useful processes and guiding principles.

Assertions for understanding from our self-study of design practice are presented as three strands of tensions: (1) delivery vs. pedagogy, (2) content-driven vs. participatory, and (3) theory vs. practice. The following excerpt from collaborative conversation 4 is an excellent example of all three tensions present, proposing a potential approach:

Stefinee: What I think you do is you articulate your understanding, like based in the research, on Vygotsky's notion of sociocultural teaching. Then you look at the constraints and affordances that are offered by online instruction... And then you talk about your design as the way in which you meet those affordances and the ways in which you enhance it.... You take those constraints, and you say, 'So these are constraints, and they're not tenable. What do we do to overcome those constraints in ways that mirror sociocultural theory rather than traditional direct instruction practice?' Although direct instruction can be a part of it...

Tonya: Something like here's a traditional discussion board or a traditional prompt (that) is used all the time... Post once, reply twice... But look at what's happening in that and then say, 'Is it applying to sociocultural theory? Or, is there a way that we can use the discussion boards and use those tools better in our online courses?'

Bohdana: Like, you're not creating deeper thinking and meaningful experiences...

Tonya: Yeah. And these are the things that we're missing. Is there a way we could still use this technology but enrich it?

Each tension present in this illustration is discussed in detail below.

Tension #1: Presentation vs. Pedagogy

Throughout our collaboration, we noticed the constant interaction between focusing on technology use or pedagogy. The focus between attention to technology or pedagogy shifted within an individual's

comments, depending on the role assumed from moment to moment. For example, Tonya's comment about using the discussion board better is an example of the linking of technology and pedagogy. Instructional design roles required our attention to the presentation and delivery of instruction through technology using technology tools and driven by issues of cost and access (Graham et al., 2014). On the other hand, the teacher educator roles required our attention to the underlying pedagogical structures and related methods and strategies as effective TPD entails modeling, experiencing, and practicing effective pedagogy (e.g., Darling-Hammond et al., 2017; Wiggins & McTighe, 2005).

Alignment of Pedagogy with Technology

In examining the tension between presentation and pedagogy, we recognized these seemingly disparate areas of focus exemplified two layers of design that need to be aligned. The physical layer with surface features of presentation and instructional delivery is related to access and cost issues – a priority for instructional designers. The underlying pedagogical layer, represented by structures and strategies and focused on supporting learning and reaching outcomes, is critical for teacher educators. To optimize instruction, the pedagogical layer, including careful attention to learners' needs, must be aligned with affordances of the technological layer (Antonenko et al., 2017; Bower, 2008; Graham et al., 2014).

Tension #2: Content-Focused vs. Participatory

The tension of favoring either content-focused or participatory models enabled our recognition of the issues we faced in moving toward reconciling these conflicts. Instructional design and teacher education reside within educational psychology, but each takes a different

orientation to learning which then influences the choice of instructional theories and differences in approaches to instructional design. In the discussion of our online TPD design, we indicated that instructional design experts tend to choose content-focused independent study online models with controlled interactions. Their model choices are likely to be aligned with a social learning theory framework (Bandura & Walters, 1977), acknowledging that learning is social and occurs in cycles of action, focusing on individual learning and the use of rewards, repetition, and modeling as the fundamental ways to promote learning. Some models are centered in social constructivism and recognize valuable principles of communities of practice (e.g., Anderson, 2008; Garrison & Vaughan, 2008; Harasim, 2017). However, instructional designers typically develop course activities that conceptualize the learner as working in isolation, moving toward pre-determined and discrete learning outcomes, and activities are set in place generally without space for adjustment. The learner produces, and the teacher evaluates.

Teacher educators ground their instruction within participatory frameworks, where knowledge emerges through collaborative interaction in learning activities supported by modeling and scaffolding and coaching from more experienced others. Learning activities begin by capitalizing on background knowledge and experiences before new content is brought in.

Learners make deep connections through interaction and extend learning through collaboration in producing artifacts that represent their learning, requiring frequent adjustment. In this case, there is an orchestration of content and activities, with a certain level of flexibility in order for the instructor to adjust and guide learners toward intended outcomes (Dalton & Tharp, 2002; Darling-Hammond et al., 2017; Vygotsky, 1978).

While multiple theories might be used to bring about creative and conceptually sound solutions sensitive to learning contexts, designers

must choose theories congruent with design specifications and requirements, carefully examine underlying theoretical assumptions and possible implications, and apply them in flexible yet coherent ways (Yanchar & Gabbitas, 2011). We identified two ways that helped us bring together the two theoretically contrasting models of instruction: identifying core attributes and specifying fixed and flexible element within the design.

Identifying Core Attributes

An essential step for aligning pedagogy and technology is identifying a set of core attributes in the pedagogical layer that would lead to desired outcomes (Graham et al., 2014). In our design, the choice of core attributes was guided by best TPD practices. Figure 1 shows the proposed alignment of the physical and pedagogical layers with their associated core attributes revealed in our conversations.

Figure 1

Identified Core Attributes of the Course Design Layers and their Proposed Alignment
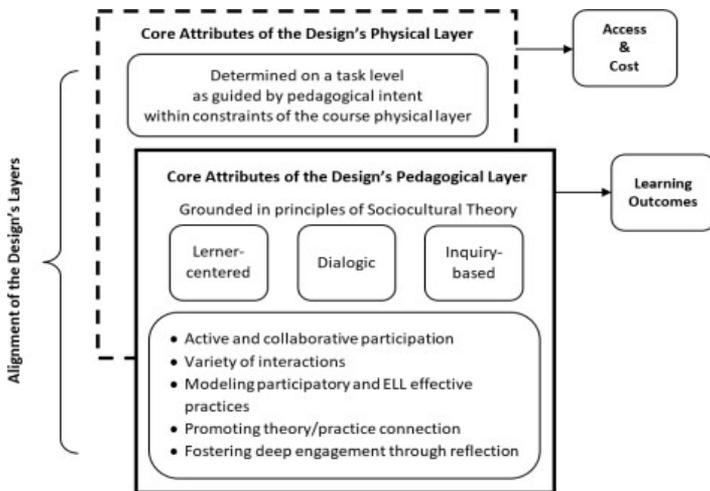
In order to reach our overall TPD aims of changing teachers' beliefs, attitudes, knowledge, and classroom practices, the courses need to be grounded in sociocultural theory with learner-centered, dialogic, and inquiry-based instruction and design encouraging active collaborative participation, supports a variety of quality interactions with content, peers, and instructor, models effective practices, promotes theory-to-practice connection, and fosters deep engagement through reflection. Notice, in Figure 1, the physical layer focused on presentation and delivery is without preset attributes, being determined on a task level during the alignment process explained below.

Fixed and Fluid Design Elements

Another way we were able to bring together the content-driven and participatory instructional models was to keep some elements of learning experiences fixed (design-based) and allow other elements to become fluid (instruction-based). Teachers cannot be continually present to each student. Therefore in the moment of interaction with a student, they must be completely present (Rodgers & Raider-Roth,

2006). Intentionally identifying fixed and fluid design elements ensures such presence. Providing fluid elements in strategic places enables facilitators to adjust instruction as necessary to attend to the needs of individual learners as well as group learning needs, adjust the trajectory of the interactions, push through to overcome barriers, move the negotiation of understanding to next levels, and ultimately enhance the learning experience.

Emergence of this understanding is evidenced in the following exchange from collaborative conversation 16:

> Stefinee: A liminal space is like a boundary and it's like you're not really one thing, and you're not another... and you've created this liminal space so you've done quite this straightforward school independent work, and then you've brought them and you've had them co-construct something, still very safe, and then right here you have this liminal space where you have opportunity for the more capable other to interject themselves... and so even though this is a small space, it's a large space, because what if I, as the facilitator, come in and this group has got it completely wrong... I'm gonna be really disruptive in that space, but if I come in and oh, these guys are really on track... in that space, we also want to teach our facilitators how to compliment the things that are right. Because how many times have you written a paper and it comes back red and you fix it and then you just get more red because the teacher didn't say to you, "I love this part, it's working exactly the way it should, and I'm having you redo this part."

> Bohdana: ...rather than just corrections.

Stefinee: And there also has to be this "this is what you're doing right" in that liminal space, so you're continuing to push them to do what you want, but you're disrupting if they're going off track. So, that's one of the things, and you represented it, that it was there, but I think we just need to be...

Bohdana: ...be more open about it.

Stefinee: Yes, because it could be a really big space, right, but it's not.

Tonya: But the nice thing is that the teacher can really prepare for that if she's following along on their individual and group work. She shouldn't be in shock. She shouldn't get in there and be like, "Wow, they're way off, now I'm going to redirect them!" She would know, "I'm probably going to redirect in these areas, and I really already like these things they've talked about." And she can know and play off of...

Bohdana: But it really has two functions, or possibly three. One is to gather information about the students, about their background knowledge and possibly connect it throughout the instruction; second, whether they're on track or not; and third, assessment purposes and push them.

Stefinee: Yes, also to push so their products are better. Right, so that space, you know, this is one of the unique things we're doing and it's not that people aren't doing it all the time online, they're just not talking about it in that way. Right, they're not talking about that as an instructional space, as a pedagogical space.

Tension #3: Theory vs. Practice

The ongoing tension between theory and practice surfaced in our discussions. It brought together all threads, helped us recognize commonalities in incommensurable views, and directed us toward particular solutions. An excerpt from collaborative conversation 21 illustrates this:

> Stefinee: This conception... that there's nothing more practical than a good theory, and there's nothing more theoretical than a good practice. But what happens is in the middle – the way in which these bump against each other, just like you said, is in an experience... So, the tension between theory and practice shows up...
>
> Bohdana: … in experience.
>
> Stefinee: In experience and creates a space, do you see what I mean?... So, as you're working to create this online course, then there's the theory of adult learning and the theory of online design.
>
> Bohdana: All these theories that you need to inspect... in different ways. But it's the experience that defines what the elements are going to be.
>
> Stefinee: It's the experience that makes that tension show up.

When tension between theory and practice emerges in experience, it creates a space for negotiating contextualized solutions. This understanding led us to bring theory and practice together in an

iterative process, moving from theory to practice and back, focusing on specific learning tasks with the purposeful alignment of technology and pedagogy.

Pedagogical Intent

Through our analysis, we uncovered a conceptual pattern fundamental to our work and a driving concept guiding the alignment of pedagogy and technology. We call it *pedagogical intent* and defined it as careful consideration of how intended learning experiences emerge in a specific learning task through making strategic choices to facilitate learning, which in turn guides an intentional selection of content, activities, and tools. In our work, we continually asked as we aligned pedagogy with available technology: (A) What is the pedagogical intent for the learning experience/event and associated tasks? (B) How could related pedagogical needs and technological resources be optimized? This process is made visible in Figure 2.

Figure 2

A Visual Representation of the Process of Alignment of Pedagogy with Technology
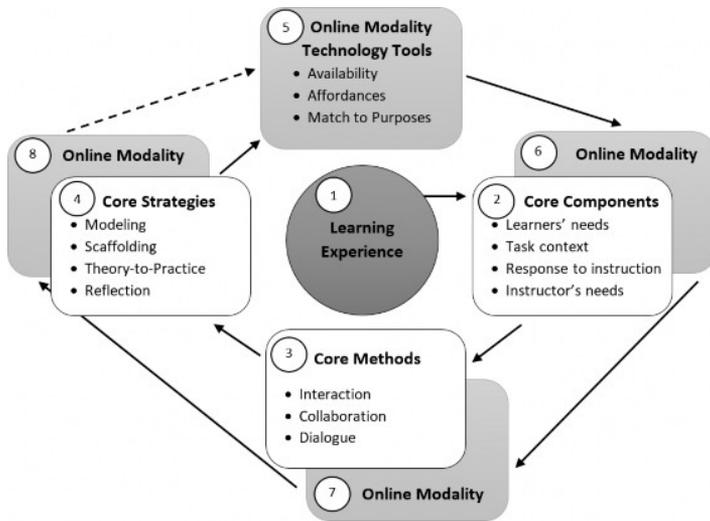
Steps 1 through 4 represent attending to pedagogical intent (question A), always centered around a learning experience/event (1). Initially, the core components of the task are examined: learner's needs, the context, anticipated response, and the needs of the teacher (2). Next, the core methods are considered, which, in our context, included a variety of interactions, active collaboration, and promotion of dialogue (3). Then the core strategies and ways they support learning are scrutinized (4). Notice the connection of the core methods and strategies with core attributes of the pedagogical layer identified earlier. Steps 5 through 8 represent the attention to optimizing technological resources as guided by pedagogical needs (question B). Technology tools utilized in instruction should enhance the pedagogical purposes of the event and should be intentionally selected based on availability, affordances, and pedagogical purposes (5). The process examines how tasks using the selected tool emerge as a learning experience for a learner in online modality through a reexamination of learners' and instructor's needs, context, and anticipated response (6). Then we reexamine whether the tool successfully supports the use of selected core methods (7) and core

strategies (8), which can be adjusted to meet the desired pedagogical purposes identified earlier. Additional cycles of steps 5 through 8 can occur until a satisfactory alignment of the technology with pedagogical intent is reached. In designing a series of learning activities or a specific one, strategic choices of content, activities, and tools can be made through careful attention to the pedagogical intent in the immediate task as well as consideration of the overall goals of the course.

Conclusion

Several assertions for understanding emerged from this self-study, allowing us to make sense of tensions present in our collaborative efforts, identify patterns in our practice, and propose principles and processes to improve our practice. First, recognizing the tension between a focus on presentation and a focus on pedagogy helped us conceptualize the design process as an alignment of key layers. According to Graham and colleagues (2014), attending to specific issues of presentation as well pedagogy is critical when we design and develop technology-mediated instruction. Our analysis suggests that the process of alignment of pedagogical and technological layers is possible, feasible, and possibly beneficial in increasing the quality and effectiveness of the online course instructional design. Indeed, it seems the attention to the underlying pedagogical principles and careful application of content and context-dependent practices (methods and strategies), not merely the use of innovative technological tools, make effective instruction and learning online possible. When used for and matched to clear pedagogical goals, various technology tools can be effectively employed to improve instruction in face-to-face, blended, or online modality.

Our analysis also implied that successful alignment of pedagogy and technology could be supported by identifying core attributes within the pedagogical design layer and by purposefully identifying certain

instructional elements as fixed or fluid. Identifying core attributes helps designers examine underlying theoretical principles that bring about particular learning experiences leading to desired learning outcomes, potentially resulting in original, contextually- sensitive, and conceptually sound designs. By purposefully recognizing certain instructional elements as fixed (design-based) and other elements as fluid (instruction-based), designers can take advantage of unique affordances provided by technology, strategically plan for instances where facilitators can attend to learners, adjust instruction as necessary, and enhance the overall learning experience.

Finally, our analysis led us to identify pedagogical intent as a potentially valuable guiding principle enabling instructional designers to align elements of the physical and pedagogical layers while attending to pedagogical purposes during design and development of online learning experiences. This increased attention to underlying pedagogy and alignment of pedagogy with affordances of available technological tools has the potential to increase the instructional quality and effectiveness of online course designs (Graham et al., 2014). It is also possible that designers who attend to the underlying pedagogy will engage in a more purposeful design of meaningful online collaborative and participatory learning experiences (Harasim, 2017; Hrastinski, 2009), which may be essential for development of effective online TPD. The notion of pedagogical intent, as well as the process of alignment of pedagogy with technology, contributes to our understanding of *why* specific oTPD designs may be more effective than others (Borko et al., 2010; Dede et al., 2009).

Using S-STEP methodology offered a powerful means of collaborative inquiry into our situated practice with the aim to improve that practice. The methodology of self-study allowed us

to not only engage as critical friends in a dialogue generating the data but also in a dialogue about the data, the analysis, and the interpretation attending systematically to the context of knowledge

construction and the effect our knowledge and embodied practices have on the research process itself. This study is limited in scope as the context of each course design is highly specific. Processes that are applicable in one context may not apply or transfer to another course design context. Future work may seek to analyze the process of aligning design layers during the design of other online courses and explore the efficacy of pedagogical intent in guiding the design process in other contexts.

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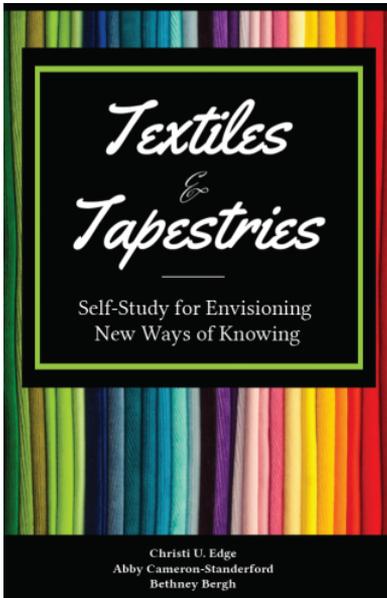
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