Technology-Supported Professional Development for Collaborative Design of COVID-19 Instructional Materials

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Issue-based learning is a pedagogical approach that features learning opportunities contextualized in compelling, societal issues that face students in their lives beyond school. COVID-19 is a global health emergency and represents the kind of societal challenge that can serve as the basis for issue-based learning. In this project, we facilitated teacher professional development in the midst of the COVID-19 pandemic with the aim of collaboratively designing instructional activities to teach about COVID-19. We used videoconferencing technologies to carry out the professional development in the wake of school and university closures. Breakout rooms within the videoconferencing platform and an online collaborative space were particularly important for the successful enactment of this program. The group was able to design four instructional

activities each of which incorporates different forms of technology. These technologies include a computational simulation, systems thinking tools, a mathematical model created through a spreadsheet, and media and information literacy tools. Project teachers are implementing these materials, and their feedback and results will be used to revise and improve the materials as we move toward design of a coherent unit that integrates the activities and aligns with the Next Generation Science Standards.

Theory/Literature Review

Issues-based learning is a form of Problem-Based Learning (PBL) that specifies compelling, societal issues as the anchor for curriculum and instruction (Marra, Jonassen, Palmer, & Luft, 2014; Sadler, Foulk, & Friedrichsen, 2017). Our team focuses on helping teachers develop and implement issues-based learning experiences with a particular emphasis on student learning of science ideas and engagement in scientific practices such as modeling (Peel, Zangori, Friedrichsen, Hayes, & Sadler, 2019). COVID-19 represents the kind of complex, societal challenge well-suited to serve as a basis for issue-based learning, but its recency means that available instructional materials are limited (Smith, Torsiglieri, Esch, & Pasley, 2017). In response to this challenge, we partnered with a group of teachers for professional development (PD) activities that would lead to collaborative curriculum design of instructional materials for teaching about COVID-19.

Process

We first recruited high school teachers (n=12) who were familiar with issues-based learning and interested in incorporating COVID-19 in their teaching. Next, we used videoconferencing software to bring the group together for two meetings. The first meeting consisted of introductions and the sharing of project goals. It also provided a forum for the teachers to share their priorities and concerns related to the project. The second meeting was a full-day workshop organized around collaborative curriculum design for COVID-related instructional materials. Collaborative curriculum design is a process through which teachers and researchers come together to lever-

age complementary areas of expertise to create materials well suited to the teachers' contexts (Voogt, Laferriere, Breuleux, Itow, Hickey & McKenney, 2015). To facilitate collaborative design, teachers formed small teams to work on topics that were of greatest interest to them. Table 1 presents a description of specific PD activities as well as the teachers' work after the PD sessions. Following the workshop, teachers worked independently to finalize instructional materials.

Table 1

Sequence of professional development (PD) activities

Phase of PD	Activity & Purpose
Initial meeting	Introductions of the project team and teachers.
	Share project goals (i.e., creation of COVID-19 materials for issue-based teaching).
	Teachers discuss motivations for participating and potential concerns associated with teaching about COVID-19.
Workshop	Introduce collaborative curriculum design as a process for developing instructional materials that meet the teachers' needs.
	Project team revisited concerns raised by teachers in the previous meeting. This included inviting a pediatric neuropsychologist to address concerns about student anxiety associated with learning in and about a traumatic event.
	Project team shared initial ideas for creation of instructional materials and individual teachers picked an idea on which they wanted to work.
	Teachers worked in focused design teams (2-4 teachers plus 1-2 project team members) to conceptualize a set of related instructional materials. The design teams worked in breakout rooms through the videoconferencing platform.
	Design teams shared their initial design ideas with the full group and received feedback.
	Design teams developed prototypes for their instructional materials.
	Design teams presented their prototypes to the full group and received feedback.
Follow-up to the workshop	Design teams worked asynchronously to finalize their instructional materials.
	The instructional materials were shared across the full group through Google Drive.

Results

Multiple forms of data were collected throughout the project to document the process, outcomes, and implications. These data included field notes, video recordings of PD sessions, and written reflections from the teachers. Based on these data, we present three early results of the project. The first relates to teacher concerns that surfaced during the first session and how we dealt with them. The second result focuses on the teachers' design products, and the third deals with implementation of those design products.

In the first session, some teachers expressed hesitation to address CO-VID-related content because their students were struggling (e.g., acquaintances infected by the virus; family members whose jobs were threatened). They questioned how learning about COVID-19 would interact with the trauma students experienced as they lived through its effects. In response, we invited a pediatric neuropsychologist to the PD. The neuropsychologist discussed how engaging in systematic inquiry and learning about facts associated with trauma-inducing circumstances can support students' mental health. Engaging in these activities helps students to focus on what they can do (e.g., steps they can take to protect themselves, sharing evidence-based information) while acknowledging some aspects of the situation that are beyond their control. Following this session, the teachers were much more at ease and committed to teaching about COVID-19 in the midst of the crisis.

Collaborative curriculum design can be a powerful approach for supporting teacher learning and the development of materials well-suited for classrooms (Velthuis, Fisser & Pieters, 2015). Our team has used this approach extensively with positive results but has always relied on face-to-face workshops (Hancock, Friedrichsen, Kinslow, & Sadler, 2017). We were concerned about using this approach when meeting remotely became the only option. However, conducting the work via videoconferencing technologies worked well, and the ability to form smaller design teams and flow between full group sessions and small group workspaces, seemed to facilitate productivity. All of the teachers made substantive contributions to the development of novel curriculum materials. Table 2 presents an overview of each of the four instructional activities designed by the teachers and the technologies embedded within each. These activities and associate materials are available online: https://epiclearning.web.unc.edu/covid/.

Some of the participating teachers have already incorporated the materials in their classes, and others have plans for implementing the materials later this school year. Another set of partner teachers works in a district that opted to discontinue new content in all classes, a development that drasti-

cally altered implementation plans for these teachers. We plan to continue collaborating with this group to explore implementation in the next school year.

Table 2

Description of the instructional activities created by the participating teachers

Title	Description	Technology used
Infection Curve Simulation	Students manipulate a computer-based simulation that shows how social distancing can impact viral spread.	Netlogo simulation
Considering Multiple Perspectives	Students use a graphic organizer and concept mapping tools to explore how COVID-19 and potential responses to the outbreak may be experienced differently by people with different perspectives	Concept mapping software
Model of Viral Spread	Students use a mathematical model to visualize exponential growth and to explore how reproduction number (R0) affects viral spread.	Spreadsheets
Media & Information Literacy	Multiple scaffolds help students develop strategies for evaluating the usefulness of information and the reliability of information sources.	Internet-based media

Implications

In this section, we highlight aspects of the projects and its design that contributed to its success and that should be considered to support similar forms of teacher education.

We chose to recruit teachers who were already familiar with issues-based teaching. This allowed us to move quickly to collaborative design work because we did not have to devote PD time to helping everyone understand the basics of issue-based teaching. We also recruited multiple teachers from the same schools or districts so that participants had colleagues at their home sites with whom they could collaborate (Luft & Hewson, 2014). These two recruitment strategies created immediate scaffolds and made it possible to arrive at intended outcomes quickly, which was important given the emerging nature of the COVID-19 crisis.

One of the biggest lessons for our team was the importance of being flexible. When we conceptualized the project, we had no way of knowing that stay-at-home orders would prevent meeting with teachers and that K-12 and university campuses would be closed. As the virus spread, we had to continually shift project plans. Without being flexible in response to the continually changing circumstances, the project would have stalled immediately. One of the biggest shifts was moving the PD from face-to-face meetings to fully online. This shift forced us to focus on the affordance of the technologies that made it possible to facilitate PD online. For example, the breakout rooms within the videoconferencing platform coupled with collaborative file sharing (e.g., Google Drive) made it possible for small groups of teachers to work together effectively. We encourage other PD providers using online formats to worry less about what they might otherwise have done in face-to-face settings and more about the affordances within available technology platforms of which they can take advantage.

The final implication relates to responding to teacher concerns. Our teachers shared concerns about potential impacts of teaching about COVID-19 on their students' mental health. It was a stressful time, and the teachers worried about how COVID-19 related instruction might exacerbate their students' anxieties. Had we not addressed this concern, it is likely that the collaborative design work would have failed. Instead, we invited a pediatric neuropsychologist to respond to the teachers' concerns, and they came to see how opportunities to learn about COVID-19 could support their students' abilities to cope with trauma. Our ability to take up the teachers' concerns was critical in moving toward productive outcomes.

Future Research

This work creates opportunities for advancing research in several different directions. We plan to conduct case studies of how participants enact these materials in their classrooms as well as explore how the collaborative design process impacts the teachers' approaches to creation and use of other coronavirus-related curriculum materials. We also plan to explore how other teachers, not initially involved in the creation of these materials, are able to modify them for their own use. Finally, we plan to further the design-based research process, which has led to the creation of COVID-19 materials, by integrating the individual activities into a coherent instructional module. The module will offer an issue-based learning platform that helps students make sense of COVID-19 and inform their own decisions and practices.

Acknowledgement

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