When a Pandemic Requires a Pivot in the Modality of Teacher Professional Development (Work in Progress)

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Abstract

The impacts of COVID-19 have led to a rapid pivot in the delivery of professional development (PD) for new teachers to Engineering for US All (*e4usa*). *e4usa* previously provided a week-long, in-person, intensive PD in the summer for teachers but PD was shifted online to a mixture of synchronous and asynchronous sessions during the summer of 2020. The goal of this work in progress is to present how the *e4usa* team adapted teacher PD to establish community among our teachers and between teachers and staff, use this connection to enhance our responsiveness in PD, and deliver the engaging content of the *e4usa* curriculum. Teachers engaging remotely in *e4usa* activities have led to productive adaptations based on their challenges. The lessons learned reflecting back upon the PD will inform the design, delivery, and content of future *e4usa* teacher PDs. It is expected that future PD and professional learning offerings will continue to utilize flexible modalities and novel online tools, while also working to better align to PD standards.

Introduction

The COVID-19 pandemic has impacted the lives of people in communities around the world and has precipitated considerable disruption to the field of education. Though school systems and educators initially anticipated relatively brief closures, the impact remains extensive [1]. "The global COVID-19 pandemic has created the urgent need for quality online instruction throughout all levels of education" [2]. This includes the delivery of professional development (PD) to practicing teachers.

Effective PD is necessary for educators to continue to grow in knowledge [3] and is known to lead to improved student outcomes [4]. COVID-19 has had a catalyzing impact on teacher PD, which frequently utilizes onsite and in-person delivery, and has traditionally been inaccessible to a wide audience of teachers due to required funding and availability of travel [2]. The pandemic continues to offer unique opportunities for PD to evolve in its delivery, design, and content, which may otherwise be missed [1]. However, questions remain about the outcomes of the sudden move to the online modality and about how to respond appropriately to the needs of the greater educational community.

Simply shifting the modality of PD delivery is not necessarily a sufficient response. The content of PD must aim to address challenges related to delivery of online instruction and efforts to remain connected with students [1, 5]. Therefore, teachers must be provided with opportunities to participate in and develop online learning content and activities in socially-connected and collaborative community spaces with other colleagues, and to reflect on issues and share resources [1, 6]. Resources shared through videos and individualized guidance and coaching are also necessary components to effectively support educators [1,2].

The limited literature on the delivery of PD during the pandemic presents the use of videoconferencing platforms, breakout rooms, and online collaborative spaces as essential [7]. Other digital tools include screencasts of content, gamification, and digital escape rooms [1]. However, addressing equity issues and the digital divide amongst teachers and students exacerbated by the COVID-19 pandemic has also emerged as another pressing issue [8]. Access to computers and broadband wireless internet impacts communities of color, rural

communities, and students and teachers in lower socio-economic groups, and must be consciously addressed within PD offerings and in all facets of the education system [9].

Aim

This work in progress will recount how the *e4usa* [10] responded to the onset of the COVID-19 pandemic by rapidly transitioning and redeveloping our summer PD to be delivered remotely. The aim is to fill the gap in literature regarding the shifts in design, delivery, and content of remote teacher PD, especially focusing on how we responded to teachers by supporting them as they prepared to teach engineering content in online and hybrid modalities.

e4usa Teacher Professional Development

In summer 2019, *e4usa* staff delivered a week-long, in-person, intensive PD for 9 teachers. Starting from this framework, we initially planned to replicate this in 3 geographic locations across the country for 30 new teachers in 2020. Due to COVID-19, the PD shifted to a virtual modality, with two available versions, "Marathon" and "Sprint." This adjustment, along with many others, was a timely opportunity to model flexibility in our online instruction and share emerging best practices amidst the pandemic. We had three goals with the PD, establish community among our teachers and between teachers and staff, use this connection to enhance our responsiveness in PD, and deliver the engaging content of the *e4usa* curriculum.

Community. The in-person, hands-on PD of summer 2019 created a vibrant atmosphere. Hoping to capture their enthusiasm to support and encourage new teachers to adopt the *e4usa* curriculum in the midst of a pandemic, we added a new role of 'mentor teacher' to assist with developing and delivering summer 2020 PD. Seven of the nine returning teachers assumed this role and worked to share effective strategies for transforming the curriculum for virtual instruction. In addition to being paired with a mentor teacher, new teachers were also paired with a 'university partner'. This university partner was asked to provide resources - project ideas, practical experience, advice, etc. - to the teacher and serve as a local connection to *e4usa* and their network of practicing engineers.

To combat the loss of face-to-face down time for building trust and deeper connection, *e4usa* staff and teachers completed a LifeMap (see readwritethink.org) video about themselves. Completing a 'bingo' game ensured we viewed videos as a means of getting to know each other better. Social activities continued just after mandatory training with *e4usa* 30-minute donut sessions, akin to eating a donut around the water cooler, getting to know each other better. On five occasions during the PD, all teachers and *e4usa* team members were invited to participate in an evening activity such as a 'meet the engineer' happy hours, baking a dessert, and *e4usa* Co-worker Family Feud.

Flexibility. Two versions of the *e4usa* summer PD were developed, which allowed educators the flexibility to complete the PD within one week or over several weeks (Table 1). The perceived benefit of the Marathon was to spread out the content into two meetings a week for a total of four weeks. Within the Marathon version, there were greater expectations to engage asynchronously through discussion board and homework submissions to maximize flexibility. An anticipated benefit of the Sprint was to minimize the 'spill over' into the rest of the teacher's summer schedule by limiting the PD to just one week. The Sprint version included two hours each day as a 'group study hall' for teachers to work together with staff support to complete the same work. Both versions were offered over Zoom, with asynchronous content hosted and assignments collected via the Canvas LMS platform similar to 2019.

Table 1 *Duration and Frequency of Meeting for Marathon and Sprint Versions*

Marathon - June 29th to July 24th

20 hrs	8 synchronous meetings, 1:30-4pm EST
3 hrs	Video content to watch - posted to Canvas
8 hrs	Asynchronous homework / Canvas discussion
5 hrs	Mandatory + optional social (camaraderie and team bonding)

Sprint - July 19th to July 24th

20.5 hrs	9 synchronous meetings 10am-12pm(except Friday), 1:30pm-4pm
4.5 hrs	Mandatory 7/19 + optional socials, 9:30-10am or 4-4:30pm
8 hrs	Teamwork (scheduled via Zoom) 6-8pm MTW, Friday 10am-12pm

Asynchronous video content. The content to be covered asynchronously primarily included a video overview of the curriculum and learning objectives focused on the first half of the curriculum, as Units 5-8 would be covered in January. Videos introduced each of the four *e4usa* curriculum learning 'threads': Discover Engineering, Engineering in Society, Engineering Professional Skills, and Engineering Design and where and how they appear in each unit.

Asynchronous hands-on engagement of teachers. From the onset, a conscious effort was made to ensure that teachers would have hands-on opportunities to engage in the curriculum and lessons, just as their students would experience it. Translating experiences from the in-person PD to the online modality required teachers to be mailed a kit of materials to be used for at-home design activities. Teachers completed five hands-on projects from Units 1 and 2 of the *e4usa* curriculum using the provided kit and a few supplemental items: a 'robot' arm design, a water filter design, a rain shelter design, a shoe sole sketch, and a take-apart project. Importantly, these kits did not contain 'assembly instructions.' For example, for the robot arm in Unit 1 of the curriculum, teachers used common, inexpensive household items (e.g., popsicle sticks, rubber bands, wire hangers) to design and construct a proof-of-concept 'robotic' arm to lift a bottle and move it to a designated safe space. After tackling asynchronous projects, teachers were asked to post reflections. *e4usa* staff selected and shared design submissions during the live PD sessions, which let teachers notice a variety of designs (like they might encounter in class) and to prompt deeper discussion. This allowed teachers to reflect on the experience of *e4usa* projects in a distance learning format to better appreciate any challenges that their students would face.

Synchronous sessions. To begin introducing engineering design as a process, teachers were challenged to build the tallest tower they could out of limited supplies to design a lookout station for a new national park. They photographed their solutions and then gave five verbs that described the steps that they took. Finally, they read the first three chapters of *Whistling Vivaldi* [11] to prepare for a discussion on topics including stereotype threat and imposter syndrome.

Teachers practiced using the Engineering Design Process Portfolio Scoring Rubric (EDPPSR) and its related online tool, MyDesign [12-13]. Using the EDPPSR helped to standardize assessment of engineering design process work. The 12-element rubric spans the design process, including the student's reflection and after-action recommendations. We left more in-depth training for fall of 2020 when teachers approach the point in the curriculum that

they would use the rubric. Teachers also explored using MyDesign, an online individual and team portfolio tracker with built in rubrics from the EDPPSR.

Ultimately meaningful engineering problems that students will solve must come from a local context, not a textbook or prescribed activity. Units 3 and 4 rely on school-based problems, while Units 5-7 can utilize problems with authentic clients. We spent time sharing examples of these projects from our COVID-truncated pilot year and brainstorming possible ideas for these projects. Teachers received feedback on their lesson plans of Unit 3 and 4 activities from *e4usa* staff and mentor teachers. Teachers also met with university to share priorities and ideas with each other.

Supporting teachers during the transition in instructional modalities. As previously mentioned, both social and economic disparities continue to be highlighted by the COVID-19 pandemic. The PD attempted to address this digital divide by having teachers experience ways to take the *e4usa* curriculum online or to a hybrid model and then creating Remote Learning Tips for each activity and Related to online teacher training, the *e4usa* staff and mentor teachers used Zoom breakout rooms, Google Jamboards, and Google Docs - many of the same tools and techniques the teachers would be using in the coming year with their students. Typical sessions required small group participation among the teachers, with many opportunities for think-pair-share, and for them to experience online versions of traditional active learning strategies- like working synchronously on shared Google docs and then returning from a breakout room to share their work. These tools and suggestions became a permanent part of the *e4usa* curriculum as archived on *TeachEngineering*.

Preliminary Feedback Gathered from Participating Teachers

We conducted two focus group sessions before and after the PD. Each session was further broken down into multiple breakout rooms to ensure five to eight teacher participants in each group. Focus group data is being analyzed using an inductive approach outlined by Miles, Huberman, & Saldaña [14]. Pre-focus group data suggest that teachers were not only looking to gain a better understanding of the *e4usa* curriculum but were also expecting to learn more about remote teaching. Specifically, they wanted to learn how to convert in-class lessons to an online modality. Some teachers also indicated a desire for project ideas that students could work on from home using readily available household materials. Post-focus group data indicate that the online PD served a dual benefit for the teachers. The PD provided them with the curriculum knowledge and resources to teach online as well as with a glimpse into the kind of experiences and challenges their students would go through in the remote learning environment. Some teachers struggled to build relationships and community with the *e4usa* staff and peer group in the online environment. A number of teachers in the sprint version of the PD also found the pace too quick to allow for the information to be absorbed. Overall, teachers indicated feeling confident to teach the *e4usa* curriculum.

Discussion

The COVID-19 pandemic required a rapid evolution of the *e4usa* summer PD delivery, design, and content. In doing so, we remained alert to the urgent needs of teachers undergoing multiple unexpected shifts between online, hybrid, and in-person instruction. Upon reflection there are many aspects of the newly revised PD that we intend to retain for future summer PD sessions. Engagement of mentor teachers in planning and leading the PD was fruitful, and provided an important perspective in the design, delivery, and content of the PD. These more

experienced teachers shared examples of prior classwork to guide the teachers and their experiences with transitioning the curriculum to an online modality. This was a judicious opportunity to respond to teachers' anxieties with regard to the online and hybrid instruction of a heavily hands-on engineering curriculum. Furthermore, their relationships with one another and the *e4usa* team showcased how new teachers can establish collaborative relationships with their fellow teachers and the *e4usa* staff. In 2021, we will continue to collaborate with mentor teachers and a day-long mentor teacher PD training. Time during the training will be dedicated to planning for clarified mentor teacher expectations throughout the academic year.

We found the use of asynchronous time to be efficient and beneficial. The expectation that all asynchronous activities must be completed was enforced through the use of a simple grading system in Canvas. The expectation that the activities would be hands-on and engaging was accomplished as well. For example, in one of the opening asynchronous activities where the participants built the tallest tower possible numerous teachers involved their families and reported spending quality family time while 'doing' the assignment. However, we learned that kits must include other items (e.g., newspaper, water bottles) that were assumed to be readily available in all households. We employed a flipped classroom model for any simple descriptions, speaker videos that could then be followed up by rich synchronous discussion.

Prior to the start of the PD, teacher-created Life Map videos and a game format to view others' videos further helped to form an engaging community of teachers and they began to get to know one another. Future implementation of this activity will require that additional expectations for the videos be clarified to ensure some standardization. The 'Donut Calls' and other social events also let people get to know each other as teachers *and* as humans.

This academic year was the first year that we utilized university partners outside of the *e4usa* team. While we did an hour-long training for these individuals separately, we plan to increase that time in the summer of 2021 and provide additional specificity to our expectations. We also allocated time for university partners and teachers to collaborate in a 2.5-hour session of the PD. While that time allowed for important conversations to begin, ultimately, we plan to lengthen and strengthen that time this summer.

Conclusion

The global pandemic will have a lasting impact on the field of education, including delivery, design, and content of teacher professional development. COVID-19 spurred providers of PD to not simply shift the modality, but to do more to be responsive to the needs of teachers and model practices that can add to teachers' advancing instructional practices and translate in their online or hybrid classrooms [1, 3, 6]. The effective changes to the *e4usa* summer PD are expected to remain well after we return to normalcy, and with continued reflection, the PD and professional learning offerings will be iterated upon. Because *e4usa* is working with an eye towards ultimate project sustainability, this experience of developing online PD has been tremendously valuable. Ultimately, we aim to have asynchronous online PD available through a *TeachEngineering e4usa* hub. To this end, we will also include not only teachers but also counselors and university partners in the online PD.

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