Journal of Pre-College Engineering Education Research (J-PEER)

Volume 9 | Issue 2 Article 5

2019

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Recommended Citation

Porter, T., West, M. E., Kajfez, R. L., Malone, K. L., & Irving, K. E. (2019). The Effect of Teacher Professional Development on Implementing Engineering in Elementary Schools. *Journal of Pre-College Engineering Education Research (J-PEER), 9*(2), Article 5.
https://doi.org/10.7771/2157-9288.1246

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Abstract

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Keywords

elementary, professional development, EiE, focus groups

Document Type

Invited Contributions: Best Papers from ASEE Pre-College Engineering Education

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Available online at http://docs.lib.purdue.edu/jpeer

Journal of Pre-College Engineering Education Research 9:2 (2019) 64–71

The Effect of Teacher Professional Development on Implementing Engineering in Elementary Schools

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Abstract

Increased attention on the implementation of engineering education into elementary school classrooms aims to start preparing students early for potential engineering careers. In order to efficiently and effectively add engineering concepts to the curriculum, appropriate development and facilitation of engineering design challenges are required. Therefore, professional development programs are necessary to educate teachers about engineering and how to adequately teach it. This paper explores the effects of an engineering professional development program for practicing teachers. The program included training elementary teachers about how to implement units from Engineering is Elementary (EiE) by the Science Museum of Boston into their classes. Semi-structured focus group interviews were conducted, both prior to and following the implementation of the EiE units over an academic year. The interviews were transcribed and coded using open-coding, resulting in the development of a codebook. The codes were further analyzed until salient themes emerged that can be used to improve the training and better understand how teachers integrate engineering into their classrooms. The results show that many teachers need training to learn about engineering practices, as well as pedagogical guidance on how to incorporate engineering concepts into their lessons. However, not surprisingly, limited resources such as time, money, materials, and knowledge restrict efficient curricula implementation. We believe these findings reemphasize the need for science, technology, engineering, and mathematics professional development programs to educate K–12 teachers about engineering and will be useful to others interested in integrating engineering into K–12 curricula.

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Introduction

In 2002, the National Academy of Engineering began advocating to incorporate engineering and technology in K–12 education due to the significance of engineering and technology in today's society (Cunningham & Kelly, 2017b; Davis, Cunningham, & Lachapelle, 2017). In 2013, the Next Generation Science Standards (NGSS, 2018) integrated engineering into K–12 curriculum emphasizing that engineering establishes vital skills such as problem solving, critical thinking, creative design, and teamwork. Apart from the vital skills developed, engineering reiterates math and science concepts, while applying them to practical uses (Cunningham & Carlsen, 2014; Cunningham & Kelly, 2017b; Sedberry, 2014). Studies have also proven that students remember science concepts better through the incorporation of engineering (Aguirre-Muñoz & Pantoya, 2016; Cunningham & Carlsen, 2016; Lachapelle, Cunningham, & Davis, 2017). Due to the educational benefits of teaching science, technology, engineering, and mathematics (STEM), more STEM professionals are needed in the national workforce. Therefore, implementing engineering into elementary school classrooms exposes and educates students about potential STEM-related careers in order that students may someday fill the need for STEM professionals (Sedberry, 2014).

Background

Currently, several engineering outreach programs exist to teach young children about engineering. These outreach programs have a common goal of increasing the pool of potential future engineers by active learning through hands-on activities, inquiry-based learning, curriculum supplements, engaged role models, and K–12 teacher involvement (Jeffers, Safferman, & Safferman, 2004; Poole, Degrazia, & Sullivan, 2001). Even though multiple approaches to K–12 engineering outreach exist, including activities held on college campuses, activities held in K–12 schools, and sponsored engineering contests (Jeffers et al., 2004), not all students have the opportunity or time to participate in these programs. Therefore, in order to reach more students, the NGSS suggests the addition of engineering to the elementary curriculum. Effectively engaging in engineering activities requires the development of appropriate design challenges for each academic level (Cunningham & Kelly, 2017a). Different age groups are inclined to have different levels of interest in engineering as well as different levels of understanding (Lachapelle et al., 2017). For example, middle school students tend to engage in social problems pertinent to society, whereas elementary school students enjoy designing tangible items like hovercrafts or parachutes (Davis et al., 2017). The context in which students learn about engineering also varies with different age groups. For example, preschoolers tend to learn the engineering design process through music, whereas elementary students might use their five fingers to count the steps of the engineering design process (Davis et al., 2017). Even apart from the concepts, elementary school teachers find it difficult to teach engineering when they lack an understanding and education of engineering themselves (Cunningham & Carlsen, 2014; Cunningham & Kelly, 2017a, 2017b). The facilitation of learning about engineering requires more than just hands-on activities, as teachers shape engineering experiences by posing questions, reflecting on student responses and learning, and giving direction to students (Aguirre-Muñoz & Pantoya, 2016; Cunningham & Kelly, 2017b; Lachapelle et al., 2017). Other engineering fundamentals highlighted by teachers include allowing the students to develop their own approach, affirming that failure and revision are acceptable, and the idea that a technology is never final (Cunningham & Lachapelle, 2014; Lachapelle et al., 2017; Lachapelle, Oh, & Cunningham, 2017). Teachers are responsible for laying the foundation for the problem, including explaining any constraints or requirements, controlling variables, mediating teamwork, and introducing and guiding the use of the engineering design process (Cunningham & Carlsen, 2014; Cunningham & Kelly, 2017a, 2017b; Kelly, Cunningham, & Ricketts, 2017; Lachapelle et al., 2017). Therefore, engineering professional development programs for teachers are necessary to help lay the foundation for teaching engineering to elementary students.

Professional Development Programs

While many elementary school teachers believe engineering is important and should be integrated into the K–12 curriculum, many are relatively unfamiliar with engineering and not confident in their ability to teach it (Ming-Chien Hsu, Purzer, & Cardella, 2011). As such, teacher professional development programs focusing on engineering education have been created by multiple universities. Many professional development programs focus on increasing teachers' knowledge of engineering and teaching self-efficacy through available engineering curriculum. One such professional development program consisted of 32 teachers who spent three days in the summer learning about STEM. Through the use of PCS Edventure's Bricklab kits and a combination of presentations, instruction, and curriculum development, the program aimed to positively influence teacher STEM education self-efficacy (Nadelson et al., 2013). Nadelson et al. (2013) found a positive correlation between participants' knowledge of STEM and their efficacy for teaching STEM content which led to their suggestion that developing STEM content knowledge should be the focus of STEM teacher professional development.

While other engineering curricula are available, many professional development programs use the Museum of Science's Engineering is Elementary (EiE) curricula. For example, Yoon and Strobel (2013) held a week-long summer professional development program for 40 elementary teachers using EiE materials and additional activities to define technology and engineering. The teachers that attended the program showed a significant increase in their knowledge of engineering, design, and technology, which positively changed their perceptions of integrating engineering in the classroom (Yoon & Strobel, 2013). Another professional development program created by Duncan, Diefes-Dux, and Gentry (2011) used design activities and model-eliciting activities designed to be solved by teams of students. The outcome was a change in teachers' ability to recognize and understand engineering. During the second iteration, EiE curriculum was implemented and a greater change in teachers' abilities and understanding was found. Duncan et al. (2011) believe this greater change was due to the fact that the first iteration curriculum was "created in-house with limited piloting while EiE is research-based, standards-driven, and classroom-tested curriculum." Another university used EiE curriculum in a yearlong professional development program with five workshop days for 198 elementary teachers (Guzey, Tank, Wang, Roehrig, & Moore, 2014). In addition to using the EiE curriculum, the program created professional learning communities

(PLCs) for the teachers between the workshop days in order to reinforce what was learned on those days. Through a study conducted during the program, Guzey et al. (2014) concluded that professional development is needed to explicitly assist teachers with recognizing and implementing quality engineering integration.

Sedberry (2014) studied the effects of engineering professional development programs and concluded, on average, an increase in skills throughout each program. More specifically, 63% of teachers gained knowledge by participating in the professional development programs. Sedberry's (2014) program and the EiE curriculum focused more on teaching teachers to incorporate design challenges into the classroom and less on teaching how to design their own design challenges. This remains a concern for teachers, along with lack of time, supplies, and administrative support. In addition, teachers call for a need of more substitute teachers so they can attend professional development programs, prepare for engineering design challenges, and observe other teachers who use the available engineering design challenges online or through EiE (Sedberry, 2014).

Epistemic Practices of Engineering

Currently, EiE is the premier curriculum for professional development programs and classroom design challenges at the elementary level, due to its research-based approach. Christine Cunningham, the founder and director of EiE, crafted four broad categories that incorporate various epistemic practices of engineering. These epistemic practices overlap with the eight epistemic practices of science presented by Jiménez-Aleixandre and Crujeiras (2017). The scientific epistemic practices include (1) asking questions and defining problems, (2) obtaining, evaluating, and communicating information, (3) planning and carrying out investigations, (4) analyzing and interpreting data, (5) engaging in argument from evidence, (6) developing and using models, (7) using mathematics and computational thinking, and (8) constructing explanations and designing solutions.

The first engineering epistemic practice is that engineering is a social field and requires real-world context (Cunningham & Kelly, 2017a; Cunningham & Lachapelle, 2014). Engineers work directly with clients to develop a set of criteria and constraints (time, money, resources, etc.) and to define the problem (Cunningham & Kelly, 2017a; Lachapelle et al., 2017). Before any project can begin, engineers must see the problem in context (Cunningham & Kelly, 2017a). Therefore, every EiE lesson begins with a narrative which allows students to gain interest in the topic, understand the need for engineering, develop a sense of criteria and constraints, and make connections to the real world (Aguirre-Muñoz & Pantoya, 2016). Connecting problems to the real world also engages students, specifically girls and minorities, who are concerned with helping others or value cultural interaction (Cunningham & Lachapelle, 2014). Apart from working with clients, engineers work in teams to solve problems. The collaboration of ideas is a key aspect of the engineering process, but requires that teammates communicate efficiently, which might include communicating in different languages (Cunningham & Kelly, 2017a; Lachapelle et al., 2017). Therefore, teachers should mimic this collaborative atmosphere in their classroom.

The second epistemic practice of engineering is the use of data and knowledge to solve problems and make evidence-based decisions (Cunningham & Kelly, 2017a). Engineering problems require students to practice skills gained through math and science lessons, reemphasizing the concepts. This also eliminates students' perspective that school knowledge is irrelevant (Cunningham & Carlsen, 2014; Cunningham & Lachapelle, 2014; Lachapelle et al., 2017). Therefore, when designing engineering curriculum, teachers should evaluate what their students know and understand, in order to create an open-ended engineering scenario that is both age-appropriate and challenging, with qualitative and quantitative results.

Third, problem solving uses certain tools and strategies, including exploring material properties and building models and prototypes (Cunningham & Carlsen, 2014; Cunningham & Kelly, 2017a; Cunningham & Lachapelle, 2014; Lachapelle et al., 2017). Another tool that engineers often use is engineering notebooks. Notebooks allow students to organize their thoughts, communicate their rationale for using certain materials or designs, keep track of their data, and record potential improvements to the design (Hertel, Cunningham, & Kelly, 2017). Elementary teachers should also explore materials with their students and create models to help immerse the students to have a greater understanding of the problem and surrounding resources.

The fourth epistemic practice in engineering is using creativity and innovation to solve problems (Cunningham & Kelly, 2017a). Good engineering design challenges are open-ended and result in multiple different solutions, but also lead to constructive failure (Lachapelle et al., 2017). Persistence from failure and mastery of engineering is demonstrated by the engineering design process, an iterative process that views failure not as a negative outcome, but an opportunity to gain more knowledge. Teachers should design engineering curriculum that is challenging to students, while emphasizing that revision from failure is acceptable and that innovation is suggested.

The focus of this paper is a study that used the EiE curriculum to run an engineering professional development program with three elementary schools. Our overarching research question is "What do K–12 teachers perceive to be factors that affect how they effectively teach STEM in their classrooms?" More specifically we aim to answer the following sub-research questions:

- What do K–12 teachers perceive to be the program-specific elements that affect their STEM teaching?

- What do K–12 teachers perceive to be general challenges associated with STEM teaching after implementing it in their classrooms?

Through the analysis of focus-group interviews, potential themes about engineering professional development programs were constructed. These themes suggest ways to further advance engineering professional development to better equip elementary teachers to teach engineering.

Methods

The Ohio State University (OSU) held an engineering education professional development program for a cohort of approximately 30 teachers from an urban, low-income school district that teach grades K–8. The program consisted of a week and a half of training in June, a half-week curriculum planning session in August, and Saturday workshops during the school year. By participating in the professional development program, teachers earned a stipend and supplies. During the summer, teachers were introduced to the EiE curriculum, including "What is Technology" and "What is Engineering" activities. Additionally, there was a section of the program that focused on dramatic inquiry, or the use of theater techniques, such as role playing, to aid learning and understanding. The participating schools were given a set amount of funds to purchase EiE kits, which the teachers would use during the school year.

Throughout the summer portion of the program, semi-structured focus-group interviews were conducted. The first set of focus groups each consisted of about six elementary teachers each and a moderator. Questions such as "How do you currently teach STEM in the classroom?" and "What challenges do you have when teaching STEM?" were asked. At the end of the following school year, semi-structured focus groups were again formed, and different questions were asked concerning how the teachers incorporated engineering into their classroom and what further support they needed to teach engineering. These groups ranged in size from one to five teachers. Focus group interviews were recorded and transcribed under an approved IRB protocol.

Following the transcription, two researchers open-coded by sentence one of the pre- and one of the post-transcripts using Microsoft Word®. Once the transcripts were coded (one pre-transcript and one post-transcript), a macro developed by Fredborg (2013) was used to extract the comments. By extracting the codes, the two researchers could compare their codes and find similarities. The open-codes led to the development of a codebook, consisting of sixteen codes with corresponding definitions. All four transcripts were then coded using the codebook. Although all of these codes are distinct from one another, they are interwoven in nature. Therefore, several of the passages were co-coded with multiple codes to fully capture the ideas within each excerpt. After coding, the passages were reviewed and salient themes emerged. The themes encompass both program-specific themes and general themes of practice. These themes are discussed in the follow section with supportive quotes. These quotes are directly taken from the transcripts and were not cleaned. In keeping with qualitative methodology, we are solely presenting themes and responses without quantitative analysis. Future work will include a more quantitative perspective.

Results

The final codebook, shown in Table 1, includes codes and definitions. These codes reflect both the positive and negative aspects of the topics discussed. For example, if teachers discussed how they did not collaborate with one another, this was still captured by the code collaboration. Note that all code names are in italics throughout this paper.

The first code, *challenges of teaching STEM*, was used when teachers described their lack of knowledge about STEM, teaching the students to persevere through failure, working with open-ended challenges, and encouraging the students to think for themselves. One example of this response is:

> "They tend to shut down when they're wrong. That to me is the hardest part of STEM period. I [...] work with a group of kids that, they don't bounce back very well. So I don't know how much I have to encourage that and to keep it going, and maybe that requires something else before a STEM project."

The *challenges of teaching STEM* code is directly related to the code *limited resources*. Teachers described not having the proper materials, having a limited support system, and lacking the time in their schedule to meet the curriculum requirements and testing, while incorporating STEM. This relates to curriculum requirements, testing, school-wide activities, and grading that are all examples of the code *teaching standards*. For example, one teacher said, "Creative thinking is one of those things that we don't get enough of most of the time. During the day it's old, [because] it's testing, testing, testing."

Another limiting factor when it comes to incorporating STEM is *planning within STEM*, specifically the time it takes to plan. This code captures the passages where teachers discuss planning, adjusting, or using design challenges or STEM projects for the students. *Planning within STEM* is exemplified in the following excerpt:

> "There's a lot of components into that one lesson. So I picked and chose which ones I wanted because time constraints. That's where I was, I can't do the whole book, I had to pick and choose what I felt my kids would do best."

Table 1
Codebook with code names and definitions.

Code name	Definition
Challenges of teaching STEM	Participant discusses the challenges or difficulties of teaching engineering or STEM. This includes teachers' lack of STEM knowledge, creating an atmosphere appropriate for STEM, and sticking to open-ended projects.
Collaboration	Participant discusses student collaboration or teacher collaboration. This includes teachers working together to teach STEM activities or students working as a team to complete a design challenge.
Cross-curriculum	Participant discusses the ability of teachers and students to relate their design challenge to other things they have learned in the classroom or in other classrooms.
Dramatic inquiry	Participant discusses how they used dramatic inquiry as a supplemental tool to the engineering design process.
Engaging the students	Participant discusses certain teaching methods or processes that teachers use to help excite the students about engineering. This also includes how the teacher tries to get the students to think with an engineering cognition (e.g., asking the students questions)
Engineering design process (EDP)	Participant discusses how they used the EDP. This includes talking about the process as a whole or just one specific step of the EDP.
Implementing STEM takes time	Participant discusses that teaching STEM is a process. This includes teachers discussing changes they will make in the future.
Interest	Participant discusses what the students or teachers are interested in.
Limited resources	Participant discusses anything that inhibits the teachers from carrying out design challenges (time, money, materials, hands, space, etc.)
New faculty	Participant discusses how new teachers will affect teaching STEM.
Planning within STEM	Participant discusses planning design challenges for the students to complete. This includes planning time and challenges with planning.
Pre-existing STEM	Participant discusses existing STEM activities/clubs prior to professional development programs.
Student response	Participant discusses how they anticipate students to respond to engineering design challenges or how they did respond (i.e., closed-mindedness, perception of failure, lack of perseverance, participation).
Teacher learning	Participant discusses how they (teachers) are learning about engineering and how they are better equipping themselves to teach engineering lessons.
Teacher observation	Participant discusses observing themselves or others to reflect on how they could better implement STEM in the classroom.
Teaching standards	Participant discusses the different requirements teachers are obligated to fulfill. This includes curriculum requirements, testing, and school-wide activities.

Planning within STEM is also closely linked to *collaboration*. *Collaboration* was the most prominent code that describes when teachers would work together to plan or perform a design challenge. One example of teacher collaboration is captured by the following excerpt: "I feel like [teacher name] and I really collaborated a lot, three or four lessons there in the end of the school year, where we're all arts and second grade science." *Collaboration* also incorporated student collaboration or instances where the students would work together as a team to complete a design challenge or project. Often, teachers would assign team roles to the students to encourage them to work together.

Although students were willing to collaborate and excelled when they did, another *challenge of teaching STEM* involves dealing with *student response*. *Student response* was a broad code that described students' positive and negative reactions to STEM. One positive example of student response was "the kids really loved getting into what is technology, and how they can use it." A negative example is below:

> "And then the real issue I think though is when our kids failed, like they tried to use cardboard, like cardboard to secure everything, haha. But they tried to use cardboard, it didn't work, so then they're like, well I don't know what else do. Well, think of something. [...] I don't wanna give it to them, [because] that defeats the purpose of STEM."

Teachers described that students live in a black-and-white world with only one solution. Along with that, students struggle with brainstorming and coming up with ideas and opportunities to improve their work. *Engaging the students* required the teachers to constantly ask the students questions, provide the students with necessary background information, and even give the students time to play before starting a challenge.

Another way to engage the students is to link the design challenge to the *interest* of the students. Our *interest* code covered both student interest and teacher interest. One teacher said, "Well, I take surveys to see what they're interested in to start with." Several teachers mentioned gathering ideas for design challenges based on what the students liked. However, this also made planning difficult.

Teachers found that building on what the students already know also helped to engage the students. The code *cross-curriculum* deals with any passage where the teacher relates the STEM design challenge to other concepts learned in the classroom. One way we saw this in the transcripts is below:

> "I am a dance teacher. So I integrate what they've already started in the classroom…they were learning about energy. One thing I had them do is, without bending their knees, try to jump…and we have to have that potential energy stored up in order to do it. So we would…get them to explore energy with their own bodies. And then I always take it into, how do we define energy in dance? So taking what they're learning in their classroom and then applying it either through dance or with exploring their own bodies, and then creating something, and creating becomes the design process."

Engineering itself uses a process, the engineering design process. The code *engineering design process (EDP)* is given to passages where teachers use the whole process or just a specific step within the process, such as the step "Improve." For example, one teacher said "We follow the engineering design process. We always are asking questions. How can you refine that?" While engineering is a process, teachers realized that teaching STEM is also a process that takes time. This idea lies within the code *implementing STEM takes time* and involves passages where teachers talk about changes or improvements they would make to their STEM projects in the future.

To aid future STEM improvements, teachers discussed reflecting on their own use of STEM and how others use STEM. Therefore, the code *teacher observation* was made to capture these ideas. As part of the program, teachers were asked to videotape themselves while teaching STEM one day. Then these videos were available to the other teachers who participated in the engineering professional development. An example of *teacher observation* is:

> "And if I wanna see, let's say I'm looking for an idea I don't know about plants whatever it is and I'd go through, I'd end up watching maybe five videos to find what I'm looking for […]."

Along with teacher observation came the idea of *teacher learning*, or excerpts where teachers discussed learning about engineering and STEM. The following quote is one way this came up in the interviews:

> "When we made those cards, I wouldn't have ever thought that's paper engineering, but it certainly was, [because] I got on and did a lot of research and I thought wow. I never thought paper making a card is paper engineering. But it's just kinda opens up a new realm for you."

Teachers anticipated their confidence to teach STEM to increase over time, but several teachers were worried about *new faculty* or faculty that did not participate in the engineering professional development program. Finally, the codes *dramatic inquiry* and *pre-existing STEM* were program-specific codes. The professional development program put on by OSU saw art as a supplemental tool for teaching STEM. Thus, dramatic inquiry was used and a direct question about dramatic inquiry was asked in the focus group interviews. In addition, a question about how STEM was taught in elementary schools prior to the professional development program was asked.

Discussion

After open-coding, several salient themes arose across the four transcripts through research discussion of the coding. The themes fall into two categories: OSU-specific professional development themes and general themes of practice.

OSU-Specific Professional Development Themes

The OSU-specific themes were recognized in our analysis, but for other studies involving different schools or put on by different institutions, these themes might not be as evident. First, teachers are interested in the idea of PLCs, where they can share their ideas and learn from other teachers. The idea of PLCs is similar to the work of Guzey et al. (2014) who used PLCs as a way to reinforce what was learned during the professional development program. Several teachers talked about an online forum where they could share videos, pictures, ideas, challenges, etc. regarding engineering at the elementary level. This would allow the teachers to brainstorm together, improve their design challenges, and create a space for collaboration.

The second theme is that the teachers who went through EiE professional development are worried about what new teachers, who have not been involved with the engineering professional development program, will do within STEM. One teacher said, "We've also had a significant turnover in the middle school staff over the last several years."

Finally, the teachers request an allocation for a STEM-focused position that would help them implement STEM in their classrooms. This position would be an "expert" in STEM, but will also allow other teachers more time to plan their own lessons. Another benefit of this position would be to observe classrooms and help inform the teachers what the students are learning in other subjects. Thus, teachers could collaborate more and build on knowledge learned in a different part of the school. "But if you had an allocation for a teacher for a year who could cover classes or coordinate integrating. If we had an extra body in the building dedicated to this stuff." This teacher could also help videotape lessons for teachers or provide more feedback, improving STEM education school-wide.

General Themes of Practice

The non-OSU-specific themes could be seen among different engineering professional development programs. First, teachers are more willing to incorporate STEM into their classroom if they are able to collaborate with other teachers. One teacher said, "It was fun, because I didn't feel alone in it." Collaboration allowed the teachers to team up, co-teach, share ideas, and provide feedback for one another. Collaboration also leads to implementing STEM across curricula such that STEM can be related to other subjects.

Additionally, teachers struggle with the differences between a STEM project and a design challenge. Although projects and design challenges can overlap in nature, a project usually is not open-ended like a design challenge. Planning open-ended design challenges pertinent to the curriculum is difficult for teachers, especially those who have never taught STEM before. For example, one teacher said, "I just think that trying to make, trying to make project-based learning fit in STEM is very difficult if not impossible."

Teachers must tailor their STEM activities towards the students they currently have. Teachers find it important to first survey the class and find out what students are interested in. This could be as simple as using certain materials over others or as complex as planning design challenges around what the students are interested in. Teachers also found that asking students questions during the design challenge allows the students to think for themselves and to engage more in the activity. However, they also realize that implementing STEM is a process and it will take several iterations or years to master. This includes incorporating the feedback from both teachers and students.

Finally, the paramount struggle teachers have in implementing STEM curriculum is the limited amount of resources such as time, funds, people, etc. This includes the time it takes to plan design challenges as well as implement them. For teachers, planning in advance all the materials, extra hands, etc. that they need to perform the design challenges is especially difficult. Along with that, testing and other obligations complicate teaching STEM. When asked "How could we help support you more throughout the school year?" most teachers commented "time for teachers to get together and talk about it, it would help."

Conclusions

This study looked at the effects of professional development on implementing engineering in K–12 classrooms. The resulting codes and themes allow for improvement within the engineering programs, while trying to mitigate some of the factors that hinder teaching engineering in elementary schools. The codebook led to the development of themes related specifically to the OSU professional development program and general practices. However, two key themes took precedence over the others. First, collaboration between teachers allows for efficient and effective teaching. Some examples of collaboration are brainstorming design challenge ideas, co-teaching lessons, and incorporating different subjects into an engineering challenge. Second, while collaboration helps engineering education, limited resources such as time, money, materials, and support all hinder engineering education at the elementary level. Further investigations are needed to increase supported collaboration and resources available to K–12 teachers to ensure effective and efficient engineering lessons that help prepare the next generation of engineers.

Acknowledgments

This work was funded by a grant under the federally funded Improving Teacher Quality (ITQ) State Grants Program, administered by the Ohio Board of Regents. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the funding organizations. Additionally, this paper was previously published in the Proceedings of the 2018 American Society for Engineering Education Annual Conference & Exposition.

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