Board 284: First-Year Experience from Industries of the Future Research Experience for Preservice Teacher in STEM Settings

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First Year Experience from Industries of the Future Research Experience for Preservice Teacher in STEM Settings

Abstract

In 2023, University of Houston (UH) in Houston, Texas was awarded an NSF Research Experience for Preservice Teachers (RE-PST) site grant titled "Industries of the Future Research Experience for Preservice Teachers in STEM Settings." The goal of the project is to host 10 high school preservice teachers each summer to participate in Industries of the Future (IotF) research fields and then convert their experience into high school curriculum. In the 2020 report of the President's Council of Advisors on Science and Technology (PCAST) to the President of the USA, PCAST has recommended a set of bold actions to help ensure continued leadership in IotF, comprising artificial intelligence (AI), quantum information science (QIS), advanced manufacturing, advanced communications, and biotechnology. In summer 2023, the first cohort of 8 preservice teachers (PST) from the UH teachHOUSTON (*t***H**) PST program participated in the RE-PST program at UH Cullen College of Engineering (CCOE). This six-week program, open to high school STEM PSTs in the *t***H** program, sought to advance future educators' knowledge of concepts in IotF as a means of enriching high school curriculums defined in the Texas Essential Knowledge and Skills (TEKS) standard. Six UH CCOE professors each led workshops in a week. Five research mentors, assisted by student research assistants, mentored PSTs on various projects. The group also participated in field trips to local companies including Samson Controls, TechnipFMC, Beckhoff Automation, and SLB (Schlumberger). They worked with the professors in the teachHOUSTON on applying their knowledge learned to lesson plan design. Participants met weekly for Brown Bag teacher seminars to share their experiences and discuss curricula. On the final day of the program, the PSTs presented their curriculum prototype for their future field teaching to the group and received completion certificates. This summer is special in that this cohort of 8 PSTs participated in some activities together with 15 high school in-service teachers in the Research Experience for Teachers (RET) program at UH. The common activities include one day workshop in SolidWorks design, field trips, and some curriculum development sessions. Two research mentors mentored both PST and in-service teachers. PST participants found the research experience with their mentors beneficial not only to them, but also to their future students according to our findings from interviews. Selected course modules will be submitted to teachengineering.org for other K-12 educators to access.

1. Introduction

In the 2020 report of the President's Council of Advisors on Science and Technology (PCAST) to the President of the USA, PCAST has recommended a set of bold actions to help ensure continued leadership in Industries of the Future (IotF), comprising artificial intelligence (AI), quantum information science (QIS), advanced manufacturing, advanced communications, and biotechnology [1].. The three pillars underpinning these actions are (a) enhancing multi-sector engagement in research and innovation; (b) creating a new institutional structure that

integrates one or more of the IotF areas and spans discovery research to product development; and (c) creating new modalities for ensuring the availability of a qualified, diverse IotF workforce. This recommendation has guided multiple federal funding agencies, including NSF [2].

Texas House Bill 5 requires enhanced STEM content in high school curriculum as part of the graduation requirement [3]. Bill 5 lists four levels of high school advanced courses for graduation: Foundation, Endorsement, Distinguished, and Performance Acknowledgements. Each level has an increasing level of course content in advanced STEM topics [4,5,6]. However, many high school teachers have not received sufficient training to prepare more advanced learning modules. It is imperative to strengthen the STEM PST education and build long-term partnerships between high schools and UH to stimulate high school students' interest in STEM.

In 2023, University of Houston (UH) in Houston, Texas was awarded an NSF Research Experience for Preservice Teachers (RE-PST) site grant titled "Industries of the Future Research Experience for Preservice Teachers in STEM Settings." The goal of the Research Experience for Preservice Teachers (RE-PST) project is to provide summer research opportunities for high school preservice STEM teachers to engage in IotF research.

The project plans to host 10 high school preservice teachers each summer to participate in Industries of the Future (IotF) research fields and then convert their experience into high school curriculum. The objectives are to 1) Recruit 10 high school PSTs from the students in the teachHOUSTON (***t*H**) program with diverse backgrounds to engage in IotF research; 2) Provide interdisciplinary and hands-on research experiences to stimulate the interest of STEM PSTs; and 3) Develop course modules by translating cutting-edge research in IotF for high school classrooms, and meeting Texas Essential Knowledge and Skills (TEKS) standards. This RE-PST project will provide the IotF research experience to PSTs at the *teach*HOUSTON (***t*H**) program. ***t*H** is UH's secondary STEM teacher preparation program and addresses the critical need for highly qualified STEM teachers in Texas and across the country [7].

The rest of the paper is organized as follows. Section 2 discusses the preservice teacher recruitment. Section 3 discusses the RE-PST activities. Section 4 discusses the RE-PST program assessment for the first year. Section 5 has the conclusion for the paper.

2. Preservice Teacher Recruitment

The preservice teacher (PST) recruitment turns out to be a process that is more difficult than we expected, perhaps because this is the first year that the program is offered and potential participants are uncertain about what this program can bring to them. In fall 2022, we have prepared the RET 3-fold flyer and set up a dedicated website for RE-PST program. One of the main efforts was to talk to PSTs about the purpose of the RE-PST site program and why it was specifically designed to them. A presentation was prepared and distributed by ***t*H** faculty to their students. Ms. Matter, the main ***t*H** liaison for the project, made several presentations in the classrooms. Then, Dr. Zhu, the PI, visited several ***t*H** classes and talked to ***t*H** faculty and

prospect PSTs. Nevertheless, we did not receive many applicants although ***t*H** has a lot of qualified high school STEM teachers. The reasons are mainly:

1. They are not sure if they can do research even though we emphasize that this is designed for them. In the first summer, no one knows what to expect and they have no peers to ask about the past experience. We expect the situation will be better after the first cohort completes the summer program. This mindset is similar to the in-service teachers with whom we interacted in the RET program also funded by NSF program. Also, some PSTs did not realize the time and effort commitment needed. They kept thinking that RE-PST program was just a part-time job opportunity.
2. Students often have plans for the summer. Some of them are going to take summer courses. Some of them have commitment to other summer programs which may take a few days off. Each summer, ***t*H** offers several summer programs to K-12 students and teachers. ***t*H** students are often recruited to help out in these programs.

After a lot of efforts, we only received 11 applications and accepted 10 PSTs into the summer 2023 RE-PST program. However, one student dropped out due to family emergency in the last minute and the other student dropped out due to ineligibility. Eventually, only 8 of them participated in the first cohort. The cohort consists of 2 male and 6 female PSTs; 3 Asian and 5 Hispanic. Five of them are with biology background, two are from math background, and one in civil engineering. At the beginning of the summer program, one of these teachers was appointed as the lead PST. She was instrumental in hosting Brown Bag Seminars and course development meetings.

3. Teacher Activities

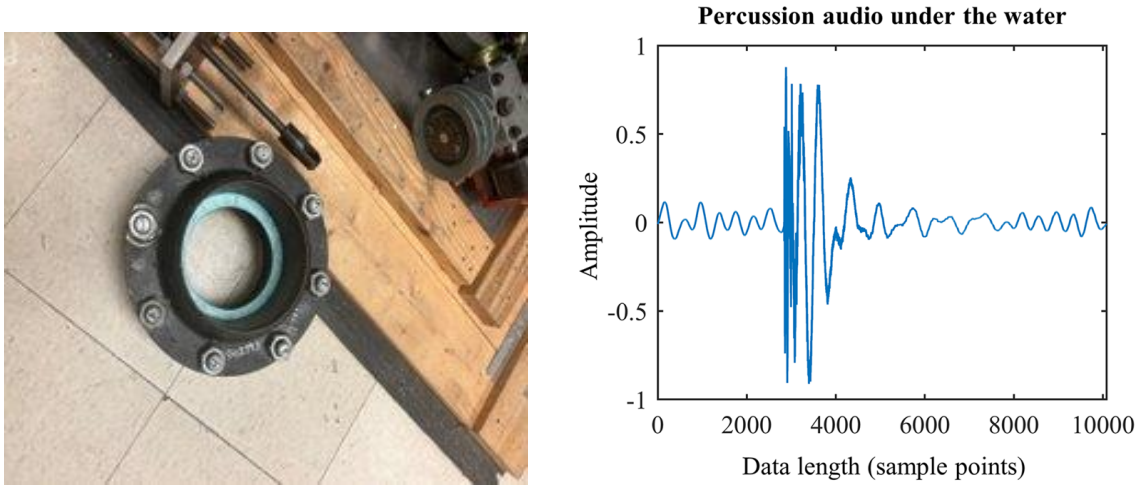
One week before the summer program started, Ms. Mateer offered two training sessions, each for 3 hours, to the research mentors and research assistants. The training prepares the mentors to learn how to better work with the PSTs.

In summer 2023, the first cohort of 8 PSTs participated in the summer research and education program from June 12 to July 21, 2023 at UH Cullen College of Engineering. The first one and a half days were the orientation in which teachers were given an introduction to the RET program, introduction to faculty research topics, lab safety, curriculum development expectation, and teachengineering.org website. The teachers signed an agreement for the payment and IRB review purpose. A special 3-hour lab safety session was given by UH Environment, Health and Safety Program Managers. At the end of the first day, each teacher spent about two to three hours assembling a 3D printer with assistance from Research Assistants.

Six UH professors each provided one week of workshops. The topics of these workshops include advanced manufacturing, biotechnology, SolidWorks geometric modeling, Artificial Intelligence (AI), Quantum Computing and Energy System Modeling, and Communication and IoT (Internet of Things). The 8 PSTs were assigned to five professors' research labs. Assisted by student research assistants, each professor mentored one or two PSTs on various projects. The

assignment of preservice teachers to mentors was based on the background and interest of teachers as evidenced by their resumes and essays from the application process. It is challenging to design the projects for the PSTs because the projects should be manageable in six weeks. If the tasks are too complicated, PSTs will lose confidence. If too simple, PSTs will lose interest and cannot concentrate on the work. The support from mentors and RAs are critical throughout the summer experience. Three project examples are provided as follows.

1. Two students were assigned to work on using machine learning (AI algorithms) in mechanical engineering applications. They first investigated percussion-based looseness detection algorithms on detecting the looseness of bolted connections that are widely used in structure assembly (**Figure 1**). During the experiments, audio signals are repeatedly recorded by tapping on a bolted connection. Spectral features are selected from the frequency domain signal. The K-nearest neighbors (KNN) algorithm, a shallow machine learning model, is built to assist the classification of looseness status. After that, they worked on detecting pipe blockage location using logistic regression, support vector machines, and neural networks. Based on this experience, they are developing a lesson plan in mathematics.
2. One student was assigned to work on protein extraction from microalgae and make media for microalgae and mushrooms. Different procedures were attempted to maximize the protein yield. Based on this experience, she is developing a photosynthesis lesson with an algae bead experiment.
3. Two students were assigned to improve a desktop mushroom incubator developed in senior design last year. They designed and 3D printed shells to protect controllers. They learned to wire the controllers and sensors for the mushroom growth monitoring. They then developed touchscreen user interface to show the CO2, temperature, and humidity.

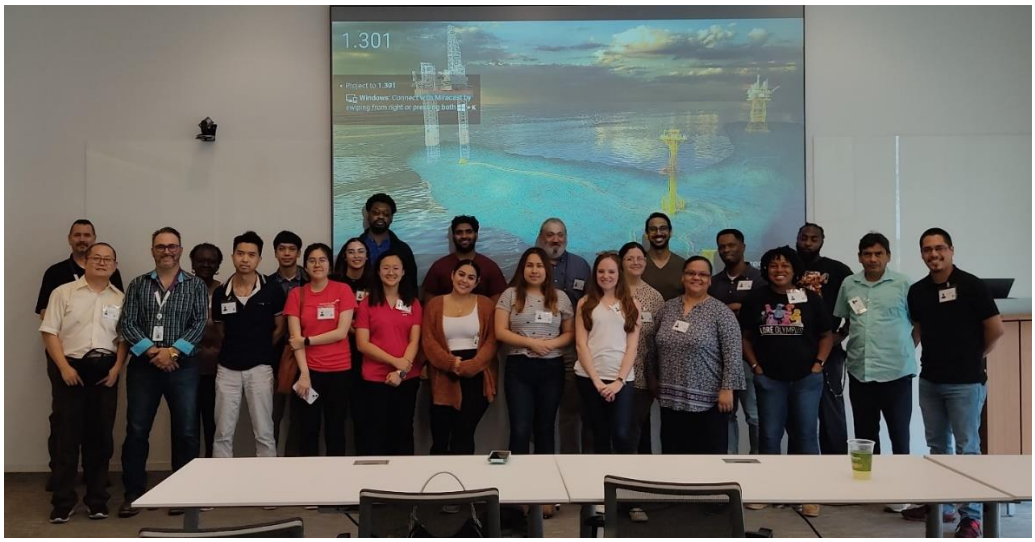


(a) Bolt assembly for looseness experiments (b) Signal for training AI models

Figure 1. Flange bolt looseness detection using sound percussion and trained with machine learning

The group also participated in industrial field trips to local companies including Samson Controls, TechnipFMC, Beckhoff Automation, and SLB (Schlumberger). In all the field trips, all the in-service teachers (from the RET program) and PSTs were together (**Figure 2**). According to feedback, these field trips were the favorite part for PSTs. Samson Controls at Baytown, Texas, is one of the leaders in pump design and manufacturing. It surprisingly uses a lot of Artificial Intelligence for pump maintenance. TechnipFMC, headquartered in Houston, Texas, is a leader in subsea engineering for deep sea drilling. Besides traditional mechanical engineering and electrical engineering, it uses automation, new materials, robotics, renewable energy, carbon sequestration, and virtual reality technology for subsea robot control.

(a) Field trip to Samson Controls, a pump manufacturing company in Baytown, Texas



(b) Field strip to TechnipFMC, subsea engineering in Houston, Texas

Figure 2. Industrial field trips to local companies in Houston

The teachers worked with the *t***H** lecturer, Ms. Mateer, in applying their learnings to lesson plans. Each week, they met with Ms. Mateer to discuss options for curriculum development. Course module templates downloaded from teachengineering.org were used to guide course module development. PSTs also met weekly for Brown Bag PST seminars to share their experiences and discuss curricula. The teachers shared their progress in research and knowledge learned. In addition, PSTs get together weekly to discuss their curriculum development ideas. On the final day of the program, the PSTs presented their curriculum prototype for the field teaching to the group and received completion certificates. The program assessment was led by a professor in human resource management at UH. In the following semester, the PSTs will present their course modules in *t***H** seminars at UH and submit their TEKS standards-aligned plans to teachengineering.org for other K-12 educators to access.

Besides the official RE-PST site website set up by the research team, a Facebook page and a LinkedIn page have been established for the RET site program to disseminate the activities information.

4. RE-PST Program Assessment

Each PST was given one pre-program survey at the beginning of the summer and one post-program survey after the summer program was over. Both the pre-program survey and the post-program survey measured the participants' perceptions of their knowledge of IotF technologies and their perceptions of self-efficacy and intentions towards high school STEM teaching. The pre-program and post-program data allowed for within-subjects comparisons to assess the changes in IotF knowledge and skills between orientation ("pre-program") and the end of the summer program ("post-program). Due to the small sample size, we can only report descriptive statistics to compare the survey results within a given year.

For the summer 2023 cohort, all eight participants complete the pre-program survey during the first week of the program. Five of the participants completed the post-program survey at the conclusion of the program. Therefore, we report pre-program and post-program data for those five RE-PST participants. Of the five participants included in this report, three identified themselves as women and two identified as men. Two participants self-identified as Asian/Asian American, one participant self-identified as Hispanic, and two participants self-identified as White.

At the conclusion of the summer 2023 program, a subset of the PSTs were also interviewed by the independent evaluator, Dr. Greer, a professor in human resource development. All participants were invited to an interview, four PSTs opted to participate in an interview. Additionally, Dr. Greer selected two faculty mentors to interview at the end of the summer.

a. Preservice Teachers Improving Technical Knowledge

All the PSTs came in with little knowledge about the background in the research topics and almost all the IotF fields, except for a little background in biotechnology. The RE-PST participants had STEM backgrounds mainly from various disciplines in math and biology. Only one student was pursuing dual degrees in math and civil engineering. Most students are in junior or senior standing. Overall, they lacked the background knowledge needed for conducting engineering research. In the interview, one PST admitted:

> "*I came in very unprepared. The whole point of this program was to do research and I did absolutely none of it because I didn't know the basics. I didn't know what a matrices was until they taught it to me. I didn't know the very basic principles of quantum physics until they taught it to me. I feel like I could have done some good research if I had known the basics beforehand. I know the RA was trying to send me materials before the program started. But, that really didn't happen so when I got there I had no idea what I was going to do.*"

However, through the RE-PST workshops, all participants obtained basic information in the IotF research areas. Then they obtained in-depth knowledge in certain fields with their mentors. All PSTs completed assembling a 3D printer and some used it in their summer research.

In the pre-program and post-program surveys, knowledge of the IotF research areas was assessed using a 5-point Likert scale [1=strongly disagree; 5=strongly agree] on the following survey item for each research area: "*I have knowledge of the latest advancements and trends in the technologies listed below*". As shown in Table 1, the five participants mostly reported increased knowledge of the IotF research areas at the end of the program. Participant B was the notable exception to this trend.

Table 1. Pre-Program and Post-Program Knowledge of IotF Research Areas

	Knowledge of Artificial Intelligence and Machine Learning		Knowledge of Quantum Information Science and Energy System Optimization		Knowledge of Advanced Manufacturing		Knowledge of Communications and IotF		Knowledge of Biotechnology and Sustainability	
	Pre-	Post-	Pre-	Post-	Pre-	Post-	Pre-	Post-	Pre-	Post-
Participant A	4	5	4	5	4	5	4	5	2	5
Participant B	4	2	3	3	2	2	3	2	3	3
Participant C	1	5	1	4	1	4	1	4	2	5
Participant D	1	4	1	3	3	4	2	5	4	5
Participant E	2	3	1	3	4	5	3	5	4	5

The interview data also supported the notion that the participants' knowledge of the technology areas grew as a result of participating in the RE-PST program. For example, one PST expressed:

> "*[The program] expanded what I had already been studying. Since I'm a biology major, I had always learned about certain lab techniques. And it wasn't until I was in the lab that I got to do some of those techniques for the first time.*"

In the pre-program survey and post-program survey, participants also reported their knowledge of how to translate research in the IotF areas into curriculum content for high school STEM courses. As shown in Table 2, all participants perceived that they had more knowledge in this area at the end of the program compared to the beginning of the program. This self-perception was assessed using a 5-point Likert scale [1=strongly disagree; 5=strongly agree] on the following survey item for each research area: "*I know how to translate research in the following areas to improve high school STEM curriculum*".

Table 2. Pre-Program and Post-Program Knowledge of Translating Research to High School Curriculum

	Knowledge of Artificial Intelligence and Machine Learning		Knowledge of Quantum Information Science and Energy System Optimization		Knowledge of Advanced Manufacturing		Knowledge of Communications and IotF		Knowledge of Biotechnology and Sustainability	
	Pre-	Post-	Pre-	Post-	Pre-	Post-	Pre-	Post-	Pre-	Post-
Participant A	4	5	2	5	4	5	4	5	2	5
Participant B	2	3	2	2	2	2	2	3	2	4
Participant C	2	5	1	3	2	5	1	5	2	5
Participant D	1	4	1	2	2	5	1	4	4	5
Participant E	2	5	1	3	1	5	1	4	2	5

b. Preservice Teachers Using New Knowledge to Improve Teaching

In the pre-program survey, PSTs were asked which technologies they wanted to add to their instruction when they become a teacher. As shown in Table 3, at the start of the program, the preservice teachers focused on a relatively narrow variety of technologies, with an emphasis on 3D printers. One participant even specified "none", indicating no intentions to integrate technology in the STEM classroom as a future teacher.

Notably, when asked the same question at the end of the program, the Preservice teachers demonstrated intentions to integrate a wider range of technologies in their future teaching.

Presumably, this is a result of the exposure to the IotF technologies and potential instructional applications during the RE-PST program.

Table 3. Pre-Program and Post-Program Plans to Integrate Technology in Future Teaching

	Pre-Program Instructional Technologies	Post-Program Instructional Technologies
Participant A	• Interactive websites for math application • Smartboard	• Internet of Things • Artificial Intelligence • Machine Learning • Biotech
Participant B	• 3D Printer	• Artificial Intelligence
Participant C	• 3D Printer • Robotics	• Artificial Intelligence
Participant D	• None	• Arduino • Microsoft Teams • Zoom
Participant E	• 3D Printer	• Technology projects to improve critical thinking and problem-solving skills • New lab techniques

These data suggest that the RE-PST program created new possibilities related to cutting edge technologies for these preservice teachers, which will ultimately impact the students that they teach in the future. Furthermore, at the end of the RE-PST program, the participants were asked about the most important things that they learned over the summer. The participants' responses mainly focused on technology application in teaching and learning. For example, one PST responded:

> "*[The most important things I learned from this summer research experience were] how impactful what you learn in math and science in High School can be in the real world and how to incorporate current technology into a lesson plan.*"

Another participant commented:

> "*We, as teachers, can bring relevancy though inquiry in our lessons. While as STEM teachers we will be able to directly promote STEM fields of study that doesn't mean it needs to be the same degrees and more so the same jobs.*"

A third participant noted:

"*I think the most important thing I learned is how to simplify a complex topic to spark students' interest in the industries of the future.*"

These responses provide some evidence that the participants were making connections and actively thinking about how the new technologies can be used to enhance their instruction in STEM classrooms, which is one of the primary objectives of the RE-PST program.

c. Preservice Teachers Learning Real-World Applications

The PSTs were positively impacted by the opportunities to see real-world applications of the new technologies that they were exposed to during the RE-PST. In the interviews, they commented on how the RE-PST program encouraged them to make connections between their previous knowledge and new knowledge of the IotF technologies. In particular, one PST said:

"*Learning is one thing but, to see it in action with your own eyes is a completely different experience. And it shows you that everything you're learning has an application. You're not learning it just to fill up your time as a student but, there is actual practical purpose.*"

Identification of real-world applications during the RE-PST program was especially driven by the field trips and the research projects. For example, one PST mentioned:

"*For me, I didn't have much trouble connecting my research to a topic in biology. But, I saw a lot of peers were having a lot more difficulty with that. But, they could do it…and they did. We would talk and help each other brainstorm and I think that productive struggle is what helped me realize that you can connect anything to your lesson.*"

Another PST added:

"*I really enjoyed the first field trip to Samson. I feel like I learned a lot, especially because I could apply what I learned in communications about deep learning and artificial intelligence to what they were talking about.*"

Importantly, by learning real-world applications, the PSTs are better equipped to share these applications with their own students. As one PST noted:

"*In the workshops, they did a really good job of connecting all the material we're learning in our research together, and connecting that with current issues in technology that I think would be very interesting and something we definitely have to take into account, and have our students become aware of. Because technology is such a big thing in our current society and it keeps improving and I believe it's important for students to*

be aware of what's out there, how it works, and how it can potentially impact us."

Another PST also viewed the real-world applications as an opportunity to share more information with future students:

"*For me, I really enjoyed the workshops and the field trips, since they correlated. You got to learn about the technologies in the workshops and then on the field trips, you got to see those technologies in action. I'm a first-generation student so, I didn't know a lot of professionals while growing up. And I didn't know a lot about those occupations so, it was really cool to see that and to have more things to talk to my students about. So, they won't be like me and not know those jobs exist. They will know from the beginning*."

d. Preservice Teachers Realizing New Professional Opportunities

The RE-PST program seemed to open new options in STEM education and was potentially career-altering for at least one of the PSTs, who stated:

"*I was completely set on teaching – high school teaching – and getting a Master's in Education. But I think my perspective has changed. Graduating with a biology degree, I really wanted to be a biology teacher, But, after this program, I can see myself being a science teacher, whether it be they want me to teach physics, chemistry…up to some mechanical engineering. I would definitely feel more comfortable going into any field rather than just staying focused on my degree*".

At least one participant is now considering the option of attending graduate school after participating in the RE-PST program:

"*I joined the program because I was very interested to see what it would be like to participant in research….it was challenging but, it was definitely a fun experience. And I feel like it just really opened my eyes to the entire research program, and definitely I want to go to graduate school. I still don't know what field I'll specialize in but, I definitely want to go to grad school.*"

These data indicate important aspects of growth and development for these future teachers. By widening their view of what is possible, they can do the same for their students.

e. Preservice Teachers' Satisfaction with the RE-PST Program

Overall, the participants reported positive experiences and highlighted the positive aspects of the program. One PST specifically noted that the program was more difficult than expected but, it turned out to be a better experience than originally anticipated:

"*As teachers, we always talk about how our students are supposed to struggle a bit. But, not like completely struggle. As a student, I felt like coming into this, I was a student who had to learn everything. And I had to feel that struggle and I eventually learned how to deal with that struggle and learn from it. So, I think that was a big addition to this – that we had to experience that.*"

Another PST also appreciated being stretched by the program:

"*I'm glad the program stretched me because it showed me that I don't need to stick to just biology. I can extend to other fields. And another thing I really appreciate was defining the interconnectivity of branches of science. And I did find one between quantum physics and biology!*"

The PSTs reported the best aspects of the program included the program faculty and industry partners. One student expressed:

"*We enjoyed the enthusiasm and the love that they had for the subjects – from the professors that gave our lectures and then the people where we went to our field trips. Anybody that was in the companies…you could tell that they loved what they were doing. It was really cool to see their enthusiasm, because of course we're enthusiastic about teaching. We don't really understand the other side – the business aspect. But, seeing how we could all find what we want to do and thrive in it was pretty cool for us.*"

The positive experiences, including learning and developing beyond their initial comfort zone, outweighed the concerns that the participants had about the program. In the interviews, they definitively stated that they were glad they participated in the program, it will positively impact their teaching in the future, and they would recommend the program to future preservice teachers. However, there is room for improvement for next year's cohort.

5. Lesson Learned

For some of the faculty mentors, this was their first experience of mentoring high school teachers through the RE-PST program. There are many lessons learned from the first cohort of the PSTs. The PSTs also provided their comments on improvement through an anonymous survey and interview. The lessons are classified into two categories as below.

A. For the Mentors

1) The recruitment for PSTs is not easy. In addition to a good marketing job, a good understanding of PSTs' mindset is important. Most PSTs are math and biology undergraduate students. They do not have exposure to engineering and technology which is much needed in high school teaching. Therefore, even though the RE-PST program was designed for PSTs, it is necessary to explain the program clearly on a one-on-one

basis. Compared to in-service teachers, PSTs need to improve their understanding of what are really needed in the teaching.

2) Prior to the RE-PST onset, faculty mentors have purchased lab materials and got ready for the teachers' activities. During the summer program, however, we realized that more materials were needed during the program, and it took time to get the things we needed. Therefore, for a seamless program running, a more careful purchasing planning is needed regarding necessary supply.
3) Communication between faculty mentors and teacher participants prior to the RE-PST program start is important to discuss research tasks and the expectation as well as obtaining necessary lab materials or equipment. This will help avoid surprise or frustration during the program.
4) Mentors should get familiar with the workflow of the RE-PST program, especially for the first year of the program in order to avoid unexpected surprises. The two mentor training sessions that was held one week before the program started was helpful in getting mentors ready for the research guidance. Compared to in-service teachers, PSTs need to have more guidance: they are PSTs but they themselves are still undergraduate students.
5) For the success of the program, there are a lot of things to be prepared. It should be noted that the preparation is not just limited to teaching and researching. For example, the PI had to make arrangements with stipend payment procedure and field trip arrangement.
6) It is important to design a tailored set of survey questions and more carefully design interview questions in order to gain more understanding of impact of RE-PST on the participants.

B. For PSTs:

1) Getting a good curriculum specialist can greatly help teachers in preparing their course modules. It is necessary to keep the communication channels between mentors and curriculum specialists to tune the research tasks. In the weekly PSTs' conferencing call, the PSTs were given a half day to meet together, share their research experience, and discuss how to convert their experience into curriculum.
2) The psychological changes of the teachers must be considered and watched during the progress of the RE-PST program. Research tasks may need to be tailored to be compatible with teachers' backgrounds to be more relevant and meaningful. It is also helpful to ask teachers to help each other.
3) Teachers enjoyed the field trips very much and considered them as the critical components of the summer research to get real world engineering experience.

6. Conclusion

The 3-year project started in 2023. It is currently in its second year of operation. The project ran smoothly in the summer 2023 program. The PSTs had the opportunities to mingle with in-service teachers in many meetings and field trips. There is a list of lessons learned from

this past summer. A few important changes we are going to implement for the second cohort will include:

1. Plan early and match teachers and faculty based on their mutual interest.
2. Define research tasks more clearly for teachers before the summer starts and make sure both teachers and faculty mentors understand the expectation.
3. Define a better set of survey questions and interview questions.

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