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Development of K-12 STEM Teacher Self-Efficacy through Participation in Goldberg Gator Engineering Explorers Summer Programs (RTP)

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Abstract
The Goldberg Gator Engineering Explorers (GGEE) Summer and Afterschool Programs are informal learning programs hosted at schools in communities across Florida with the support of the Engaged Quality Instruction through Professional Development (EQuIPD) program at the University of Florida. These programs are designed to provide programming, computational thinking, and engineering design opportunities for middle school students and their teachers. Teachers selected by their respective schools or youth organizations to facilitate programs came from various backgrounds, subject areas, and prior experience with programming. Training and support were provided to ensure that these teachers were equipped with both the content knowledge and the confidence to facilitate the program. An IRB study explores the development of teacher self-efficacy in science, technology, engineering, and mathematics (STEM) after participating in the preparation and facilitation of the GGEE summer programs. This paper discusses relationships between teacher self-efficacy and participation in the GGEE summer program and other relevant factors that may impact teacher self-efficacy, such as prior experience, coding skills, and subject area focus. There were significant increases in teachers' coding skills and overall self-efficacy in STEM after participation in the summer program training and facilitation. Teachers shared how participating in the program impacted the way they think about their teaching and how they intend to implement STEM concepts from the program into their classrooms.

Keywords: teacher self-efficacy, K-12 teachers, informal learning, STEM, summer camps

1. Introduction

1.1 Background

Within research literature, a plethora of studies look at the impact of informal learning on identity, achievement, and academic persistence in science, technology, engineering, and math (STEM). However, there is less research into the impact of informal learning on teachers or even teachers who participate in informal learning with their students [1], [2], [3], [4]. Teachers generally develop pedagogical practices based on their educational pre-service programs and then refine them over time based on their own experiences, intuition, or professional development opportunities [4]. In many schools today, however, many teachers do not have pedagogical training because they are entering education with alternative degrees or certification routes. Additionally, most professional development programs available to teachers fall under formal learning as they are often direct instruction and occur as part of a teacher's normal work.

Informal learning engages participants in engaging scientific experiences that harness curiosity, motivation, and excitement outside of the traditional classroom environment [4]. Understanding teachers' professional identity development through their participation in informal learning opportunities for students provides insights into developing more refined professional development opportunities for teachers to build efficacy for teaching STEM concepts. Self-efficacy is defined as a person's belief in their ability to succeed in a particular task in a particular situation; in this case, teachers teaching STEM concepts [5]. Teachers' self-efficacy can be tied to their pedagogical beliefs, choices, and practice [6]. Teachers' experiences with informal STEM learning opportunities could also inform factors and attributes of practices that work for STEM learning through knowledge transfer into other learning environments [7], [8]. Teacher self-efficacy in STEM has been found to improve students' academic performance in STEM [9], [10], [11].

1.2 Summer Program Overview

The Goldberg Gator Engineering Explorers (GGEE) Summer and Afterschool Programs were created to engage middle-school-aged learners and facilitators in programming and working with hardware through a series of scaffolded projects structured using the Engaged Quality Instruction through Professional Development (EQuIPD) model to develop conceptual understanding through Elicit, Develop, Deploy, and Refine inquiry model development stages. These activities are designed to incorporate all areas of STEM while being anchored in engineering design and computational thinking [12], [13], [14]. The summer program introduces programming through block coding in Microsoft's Makecode platform to program micro:bit microcontrollers [15], [16]. Summer programs are composed of three main activities hosted using two timelines: four full-day or eight half-day sessions based on district preference. The first camp activity comprises a series of introductory programming lessons to introduce the platform and hardware and build fundamental skills such as process mapping their code, using strings, logic, and various inputs. The second camp activity introduces the Stanford Design Thinking Process, where learners are posed to design, iterate, and build a unique micro:bit pet for a partner student [17]. The final activity of the summer program has learners working in teams to design a solution for a technical design challenge from the following choices: a greenhouse monitoring system, a traffic light system for emergency service vehicles, or a safe driving monitor. Teams program the micro:bit to incorporate sensors and servo motors into their designs. Once the designs are complete, learners present their proposed solutions and share their design process.

During the 2024 GGEE programs, 23 K-12 teacher facilitators led the 26 summer program sessions across 13 different counties in Florida, reaching a total of 322 middle-school-aged students. Teacher facilitators for the programs comprised various elementary, middle, and high school teachers, youth program leaders, and counselors, referred to as *teachers* for the remainder of the paper. These teachers were chosen by their organization to facilitate the summer programs at their chosen site: schools or youth organization spaces. The hosting groups underwent the process outlined in Figure 1 to identify their summer program locations: schools or facilities, teachers, volunteers, or recruited to lead programs. The GGEE program held a 10 to 12-hour virtual training series of two hours a session, that was live and recorded over the Zoom conferencing platform to prepare and support teachers in the program concepts and structure through constructing some of the activities themselves. During the training, the teachers were introduced to the engineering undergraduate student mentors with whom they facilitate the programs and were familiarized with the curriculum delivered as assignments through Microsoft Teams. During the two-hour sessions, the GGEE team led the teachers and undergraduates through completing all of the activities in the program, modeled facilitation strategies, and programmed all activities. Teachers unable to attend a live session or complete an activity were required to complete the session outside the sessions. To ensure facilitators participated and completed the training, they submitted activity assignments and artifacts to document their ability to conduct the activities.

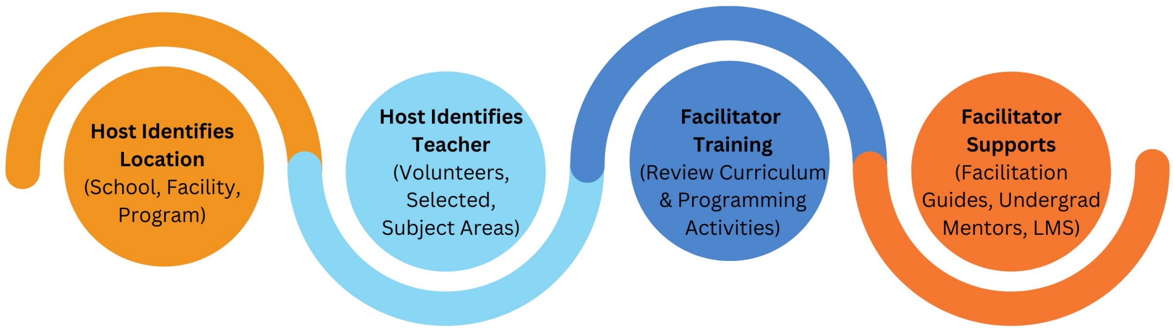

Figure 1: Process of working with program locations that select their summer program locations and teachers and the support from the GGEE program in the form of training, curriculum materials and guides, and trained engineering undergraduate student co-facilitators.

2. Study Purpose

The summer programs provide authentic STEM experiences in programming, computational thinking, and engineering design for middle-school-aged students. By hosting these informal programs with schools and other youth organizations, the GGEE program supports teachers in learning these concepts, upskilling them in programming, and empowering them to continue or expand their STEM teaching in their classrooms during the traditional school year, reaching more students outside of the summer programs [13]. As teachers develop more self-efficacy in the topics they teach, student learning increases [9], [10], [11].

This study aims to investigate the following research aims:

1. *How does participating in an informal STEM summer program impact teachers' perception of their coding and programming skills?*
2. *How does teacher STEM self-efficacy develop after participating in STEM summer programs?*

3. Methodology

3.1 Research Tools and Rationale

Coding Skills

Programming is a large technical aspect of the summer program. Teachers were asked to rate their prior experiences with coding and programming and the level of their coding skills before and after the summer program. A pre-survey was distributed to teachers in early May 2024, at the start of the summer program training, and a post-survey was distributed after they completed all the summer programs they facilitated.

In the pre-survey, teachers were asked about their prior experiences with coding or programming to provide the research team with context to their experience and if they had enjoyed the experience they had. A teacher's emotional engagement in STEM influences their engagement in the practice of STEM education and is a part of their self-efficacy in the area [18]. Teachers were asked, "How much experience do you have with coding or programming?" using the following 4-point scale: No experience, A little experience, Some experience, or A lot of experience. Teachers who provided they had prior coding experience were asked to rate "How much you enjoyed your experience in coding or programming?" using the given 4-point scale: I disliked it a great deal, I disliked it a little, I liked it a little, and I liked it a great deal. These questions were chosen to gain context on their level of experience in coding and programming and how much they enjoyed that experience.

During the pre-and post-surveys, teachers were asked to rate their skill level using the following 4-point scale: None, Basic, Medium, and High. This question was asked to survey the change in teachers' perceived coding ability after participating in training where they were introduced to and learned the programming concepts of the camp and the facilitation of the summer camp, teaching students programming through engineering design activities.

Teacher Self-Efficacy

The Teacher Efficacy and Attitudes Toward STEM (T-STEM) survey tool was delivered in both pre- and post-surveys to measure the change in STEM self-efficacy among the participating teachers [19], [20]. This tool was designed to gather information about a teacher's personal teaching efficacy and beliefs in engineering. It was adapted to survey STEM efficacy and to better align with the experiences in the summer program. Teachers were asked to use the following 4-point scale: Strongly Disagree, Disagree, Agree, and Strongly Agree to rate how much they agree with the following questions about teaching efficacy and beliefs:

A. I am continually improving my STEM teaching practice.
B. I am confident that I can teach STEM effectively.
C. I understand STEM concepts well enough to be effective in teaching STEM.
D. I am confident that I can answer students' questions about STEM.
E. When a student has difficulty understanding a STEM concept, I am confident that I know how to help the student understand it better.
F. I know what to do to increase student interest in STEM.

Interviews

Teachers were interviewed after the last of their summer program sessions to gain more context into how participating in the summer programs impacted their teaching practice with respect to the concepts developed during the summer camp. Teachers were asked the following two questions:

- How has your participation impacted the way you think about teaching?
- How do you plan to incorporate computational thinking, engineering design, use of technology and system thinking in your future classrooms?

The research team chose these questions as they captured how teachers' perspectives on teaching in STEM may have changed after participating in an informal learning setting. The second question is geared toward understanding what major concepts from the summer program teachers are bringing back to their classrooms and how they envision applying those concepts.

3.2 Data Collection

Data collection was approved by the University of Florida's Institutional Review Board (IRB202102451). All teachers who facilitated summer programs were provided the opportunity to opt into the study and complete research consent documents acknowledging their participation in the study and their ability to leave the study at any time.

Teachers participated in a pre-survey, post-survey, and interview before and after participating in the summer programs. The pre-and post-surveys were developed and distributed electronically using the cloud-based survey tool Qualtrics [21]. The pre-survey was delivered at the start of the training for the summer camp programs in May 2024. In this survey, teachers provided demographic data, coding, and programming experience, rating their coding skills and their initial self-efficacy in STEM. The post-survey was delivered after a teacher completed all their summer program sessions to capture changes in coding skills and self-efficacy in STEM. Survey data was exported from Qualtrics and stored in a secure Dropbox managed by the research team.

Teachers were scheduled for 1-on-1 virtual interviews over the conferencing platform Zoom with a member of the study team they did not engage with during the summer program. Interviewers followed a script to introduce the interview procedures and questions. The interviewer manually transcribed the teachers' responses in real-time in a Microsoft Word document stored securely in Dropbox. Audio or video recording of the interviews was not permitted.

3.3 Data Analysis
Demographic and prior coding experience data collected in the pre-survey were tabulated and averaged in Microsoft Excel to calculate the percentage of participant responses. The resulting Excel file was imported into the RStudio integrated development environment (IDE) [22] and visualized using the open-source programming language R [23].

For the coding skills and STEM self-efficacy questions that collected pre- and post-summer program responses, population matching was completed to ensure responses from the same pool of teachers were analyzed and compared. There were 20 participants in the pre-survey and 17 participants in the post-survey. The three participants from the pre-survey who did not complete the post-survey were not included in the analysis. Both the coding skills and STEM self-efficacy survey questions were structured as 4-point Likert-style questions. Likert scales were converted from text to numeric scales from 1 to 4 in Microsoft Excel in order to compare the pre-and post-survey results. The data was then imported into RStudio, where the mean and standard deviation were calculated, and a paired t-test was completed to identify significant changes.

4. Results and Discussion
4.1 Teacher Demographics
During the pre-survey, extensive demographic data was collected from teachers. Teachers provided information detailing elements such as gender, race and ethnicity, and regional location. They also provided insight into their teaching backgrounds, including grade levels, subject areas, teaching experience, and prior participation in GGEE programs.

Gender

Teachers were prompted to select the gender they most closely identified with from the options provided: Female, Male, Gender not listed here (please specify), or Prefer Not to Say. Of the 20 teachers who completed the pre-survey, 30% (6) reported Female, 65% (13) reported Male and 5% (1) preferred not to say, as shown in Table 1 below. There was a larger percentage of male teachers leading summer programs, which aligns with the gender distribution in science and engineering occupations in the workforce, with 26.7% Female and 65.4% Male.

Table 1. Teacher gender, racial, and ethnic demographics compared to the U.S. population.

Category	Participants	Total Population [24]
Gender (n=20)		
Female	30%	49.5%
Male	65%	50.5%
Prefer Not To Say/Not Listed	5%	-
Race (n=20)		
American Indian or Alaska Native	0%	1.3%
Asian	0%	6.4%
Black or African American	10%	13.7%
White	85%	75.2%
Other Race Alone or in Combination	0%	3.3%
No Race Selected	5%	-
Ethnicity (n=20)		
Hispanic or Latin(x)	20%	19.8%

Race and Ethnicity

Teachers were asked to select their race and ethnicity, Table 1, by selecting all the options that applied to them: American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or other Pacific Islander, White, or Hispanic or Latin(x). It is important to note that Hispanic or Latin(x) was not offered as a separate ethnicity in this survey; as a result, participants may not have identified a race along with their ethnicity.

Of the 20 participating teachers, 85% (17) identified as White, 10% (2) were Black or African American, and 5% (1) did not identify a race. 20% (4) of teachers indicated they were of Hispanic or Latin(x) ethnicity. According to the National Science Board's "Elementary and Secondary STEM Education" science and engineering indicators, the racial minority breakdown for science educators aligns with the teacher population selected by the program hosts [25]. Nationally, the racial demographics for minorities are as reported: 80% White, 6% Black, and 7% Hispanic.

Grade Level, Subject Area, Years of Teaching Experience

To provide more insight into the teachers' backgrounds participating in the study, they were asked to provide information regarding the grade levels and subject areas they teach in addition to the number of years they have been teaching while completing the pre-survey. This information is detailed in Table 2.

Teachers indicated the grade level band they taught during the previous school year from the following options: K-5, 6-8, and 9-12. If the teacher selected both 6-8 and 9-12, those responses were pooled under 6-12. Of the 20 teacher responses, 45% reported 9-12, 15% reported 6-12, 30% reported 6-8, 5% reported K-5, and 5% did not reply to this question as they are not a classroom teacher. 90% of the teachers taught 6th grade or higher. This is likely due to the summer programs being targeted toward middle school students, and most camp locations were middle or high schools by districts to encourage the development of STEM pipelines.

Table 2. Teacher grade level, subject area, and teaching experience demographics.	
Category	**Participants**
Grade Level (n=20)	
9-12	45%
6-12	15%
6-8	30%
K-5	5%
None Listed	5%
Subject Area (n=20)	
STEM Elective	50%
STEM Subject Area and STEM Elective	25%
STEM Subject Area	5%
STEM Subject Area, STEM Elective, and Other	5%
STEM Subject Area and Other	5%
Social Science	5%
Other (Non-Teacher)	5%
Teaching Experience (n=20)	
30+ years	10%
20 – 29 years	20%
15 – 19 years	15%
10 – 14 years	10%
4 – 9 years	30%
0 –3 years	15%

Teachers selected the subject area(s) they taught during the 2023-2024 school year, given the following options: Science, Math, STEM/Engineering, ELA, Social Science, or Other. Teachers were given space to write additional details about the subject(s) they taught for each option listed above. Subject areas were categorized into STEM Subject areas, STEM electives, and Other. A STEM Subject Area includes science, technology, engineering, or math classes such as AP Biology, 4th-grade math, Chemistry and Biology, or 6th grade Science. STEM Elective groups include all STEM-related curricula that would not be taught as a core class. For this category, teachers put Artificial Intelligence 1-4, Applied Engineering Technology, Robotics, Cybersecurity, etc. The Other category refers to non-STEM electives such as Leadership and Business classes. One camp teacher is not a traditional classroom teacher but works with students in informal learning settings at a Boys and Girls Club location and is identified as "other." 90% of teachers reported they taught either a STEM Subject Area or Elective, 5% reported Social Science, and 5% reported Other (Non-Teacher).

Teachers selected the range of years they have been teaching or working in their youth programs from the following options: 0-3 years, 4-9 years, 10-14 years, 15-19 years, 20-29 years, or 30+ years. Of the 20 teachers, 15% reported 0-3 years, 30% reported 4-9 years, 10% reported 10-14 years, 15% reported 15-19 years, 20% reported 20-29 years, and 10% reported 30+ years. The vast distribution of teaching experience, from 0 to 30+ years, indicates that teacher participation in the programs is unrelated to the number of years one has been teaching.

Previous GGEE experience

Teachers were asked to indicate if they have participated in previous GGEE summer or afterschool programs or if they are new to them, Figure 2. Of the 20 teacher responses, 35% (7) of teachers are returning from previous GGEE summer or afterschool programs, and 65% (13) reported that this summer camp was their first GGEE program. This suggests that the GGEE summer camp program grew to reach new teachers while retaining returning teachers from previous summer or afterschool programs.

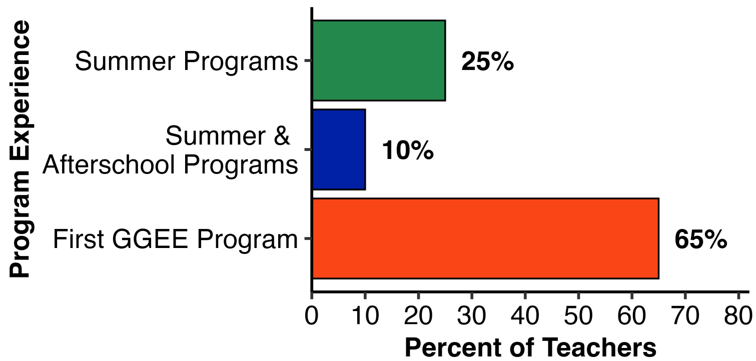

Figure 2: Teacher's previous GGEE summer or afterschool program experience prior to facilitating a 2024 summer camp (n = 20).

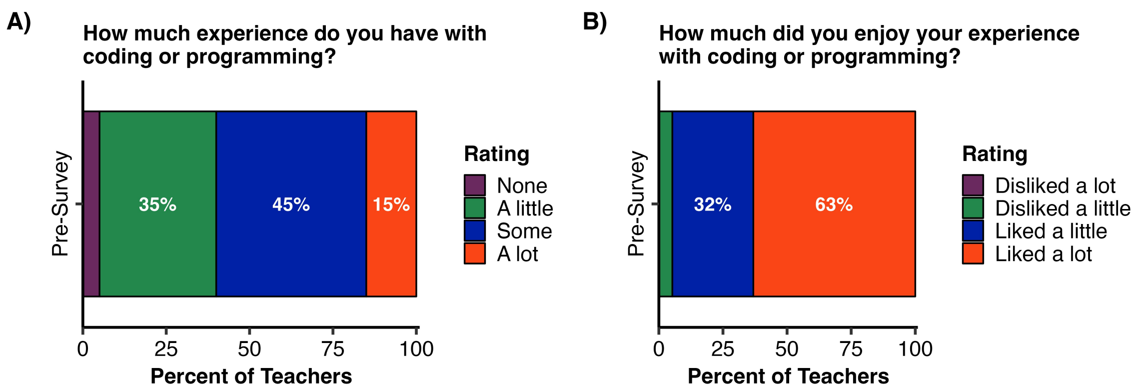

Figure 3: A) Teacher participants' prior coding or programming experience before the summer program (n=20). B) How much teachers enjoyed their prior experiences (n=19).

4.2 Surveys

Prior Coding Experience and Enjoyment

During the pre-survey, teachers selected how much experience they have with coding or programming, Figure 3A, and how much they enjoy their experience, Figure 3B. In response to how much experience the teachers have, out of the 20 responses, 5% chose No experience (None), 35% chose A little experience (A little), 45% chose Some experience (Some), and 15% chose A lot of experience (A lot). The 19 teachers who indicated they have prior experience were then asked how much they enjoyed that experience: 0% chose I disliked it a great deal (Disliked a lot), 5% chose I disliked it a little (Disliked a little), 32% chose I liked it a little (Like a little), and 63% choose I liked it a great deal (Liked a lot). Most teachers had limited programming experience (A little or Some), suggesting that many teachers were approaching the camp with low familiarity with programming. The teachers who indicated they had some experience in coding or programming generally enjoyed their previous experiences. Enjoyment is an element of self-efficacy and can influence their engagement in STEM education [18].

Coding Skills

Teachers were asked to rate what they believe is their coding skill level before summer program training and again at the end of their respective GGEE program session, Figure 4. Of the 17 responses, 18% of teachers rated their skills as None, 35% rated their skills as Basic, 41% rated their skills as Medium, and 6% rated their skills as High. After the summer programs, teachers rated their coding skills the following: 0% None, 18% Basic, 47% Medium, and 35% High. When the ratings were converted to a 1 (None) to 4 (High) scale and averaged, the pre-survey had an average rating of 2.35 ± 0.86, and the post-survey had an average rating of 3.18 ± 0.73. A paired t-test showed a significant ($p = 2.01 \times 10^{-7}$) change in the average coding skill rating.

At the start, 47% of the teachers rated their skills as Medium or High, and by the end of the program, 82% rated their skills as Medium or High. Participation in the summer program training and facilitation allowed teachers to develop their coding skills by gaining experience through practicing and then teaching students how to program micro:bits using a block coding language. This experience allowed teachers with coding experience to teach it in an informal setting where they could build upon prior programming and coding experiences.

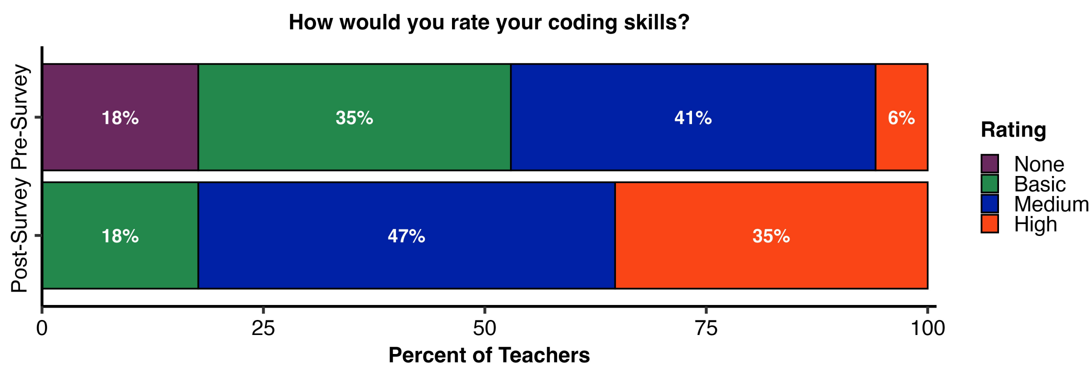

Figure 4: A comparison of teachers' coding skills ratings before and after the summer camps (n=17).

Teacher Self-Efficacy

To measure the change in self-efficacy in STEM, teachers rated how much they agreed using a 4-point scale to answer six questions modified from the T-STEM survey tool before and after participating in the summer programs. Pre- and post-survey responses were matched to ensure the same 17 participants were in each data set to allow for comparison. The ratings were converted to numeric values of 1 (strongly disagree) to 4 (strongly agree) and averaged. An overall rating was calculated by averaging all ratings for the entire question STEM teaching efficacy and beliefs block as suggested by the guidelines from the tool developers at the Friday Institute at NC State University [19].

The results of the T-STEM surveys are displayed in Table 3. There was a significant increase (+0.14, $p<0.05$) in the average overall ratings from pre-survey, 3.42 ± 0.59, to post-survey, 3.56 ± 0.57 scores. This indicates that, overall, teachers experience an increase in self-efficacy in STEM after receiving training and facilitating a GGEE summer program. There were significant increases in the average ratings for questions C. I understand STEM concepts well enough to be effective in teaching STEM (+0.24, $p<0.05$) and E. When a student has difficulty understanding a STEM concept, I am confident that I know how to help the student understand it better (+0.29, $p<0.05$).

These significant increases could be attributed to the learner-centered training experience teachers participate in to prepare for the programs. The hands-on training and the experience of facilitating and troubleshooting with students during the summer program build confidence in teachers to understand and support students in learning STEM concepts.

Table 3. Pre- and Post-survey STEM teaching efficacy and beliefs. (n=17)

Question	Mean (SD) Pre	Mean (SD) Post	p (<0.05)
A. I am continually improving my STEM teaching practice.	3.71 (0.47)	3.65 (0.49)	0.332
B. I am confident that I can teach STEM effectively.	3.65 (0.49)	3.65 (0.49)	-
C. I understand STEM concepts well enough to be effective in teaching STEM.	3.41 (0.62)	3.65 (0.61)	*0.0413
D. I am confident that I can answer students' questions about STEM.	3.29 (0.59)	3.47 (0.62)	0.0826
E. When a student has difficulty understanding a STEM concept, I am confident that I know how to help the student understand it better.	3.24 (0.56)	3.53 (0.62)	*0.0201
F. I know what to do to increase student interest in STEM.	3.24 (0.66)	3.41 (0.62)	0.0826
Overall Scores	3.42 (0.59)	3.56 (0.57)	*** 0.0003

4.3 Implications for Practice

This paper shows evidence that participation as a facilitator in the GGEE summer camp program improved teachers' programming skills and created more efficacy in teaching and supporting students in difficult STEM concepts, particularly for computational thinking and engineering design. This has implications for teacher practice at the classroom level for improved student conceptual understanding of computational thinking and engineering design. Additionally, students with teachers who have confidence in STEM topics are more likely to be successful in STEM domain knowledge [26]. Furthermore, teachers who improved their own coding skills were shown to have improved student performance and satisfaction in the same domain area [27], [28]. Based on these findings, we posit that teacher participation in this informal learning program shows the ability of the programs to provide passive professional development to teachers to improve domain knowledge and efficacy.

When prompted to share how their participation in the program has impacted their thoughts about teaching and their current teaching practice, one teacher shared how participating allowed them and other teachers to become more comfortable with teaching open-ended engineering design lessons.

> *"It helped me at learning how to teach open-ended project assignments in the computer science field. It kind of just helped me with teaching open-ended projects with the micro:bit in computer science, and that is what I like to do."*

Anecdotally, teachers have reported bringing in system and computational thinking pedagogical practices in their current teaching practice by using process mapping skills learned from the camp. Teachers shared the following on system thinking and how it applies to one of their STEM courses,

> *"...If I write a common story for the course I am teaching, system thinking is going to help me narrate that course better. I am teaching Environmental Science. It is all about relationships. From the beginning, I am teaching kids to make maps and that is making a common map we will use throughout the course. Computational thinking is the logic and step-by-step. The activities we did in the camp were common. They were part of my teaching before and will continue to be. Engineering design and technology the same thing as computational thinking. The one that is most impacted is system thinking.'*

4.4 Limitations
While 23 teachers worked in the summer program, 20 opted into the research study and participated in the pre-survey, and 17 participated in the post-survey. Of the 17 teachers, 15 participated in one summer program in 2024. The remaining two teachers participated in multiple sessions, leading two or three sessions over the summer. Both teachers were returning facilitators from previous years of summer programs. The study was not designed to measure if participating in multiple sessions directly impacted self-efficacy but rather as the impact of the overall summer experience.

The teacher efficacy was self-reported by teachers using a modified T-STEM test. The survey was matched but anonymized, so the individuals were not known. Teachers were surveyed in previous years of the program but will be studied for the additional years of the program moving forward. While some teachers return to the program to teach each year, there are also many new districts and teachers each year of the summer camp programs, and teachers who have participated in the program should have data separable from new teachers to the program.

5. Conclusions
The Goldberg Gator Engineering Explorers summer programs partnered with schools and youth organizations to host 26 STEM summer camp sessions across Florida for middle school students. Teachers from the organizations served as lead facilitators for the camp sessions, with the support of an engineering undergraduate student. These facilitators received around 10 hours of training to ensure they were confident in the concepts and could complete the programming and engineering design activities.

This study aimed to investigate the impacts of teachers' participation in a summer program on coding skills and self-efficacy in STEM using surveys delivered before training and upon the conclusion of facilitating summer programs. There was a significant 35% increase in teachers who rated their coding skills as Medium or High from pre- to post-survey. STEM self-efficacy was measured using an adapted T-STEM survey tool to align with the features of the summer program. Overall, teachers experienced a significant increase in STEM self-efficacy after training and facilitating a GGEE summer program. The survey data showed two questions with significant areas of improvement: increased understanding of STEM concepts well enough to be effective in teaching STEM and confidence in helping students with a difficult STEM concept. These increases show a gain in perceived efficacy for teaching the engineering, computational, and STEM core concepts embedded in the camp activities. Additionally, teachers felt more confident about being able to support their students in the acquisition of STEM concepts. This is especially important for helping teachers ensure their efficacy in teaching STEM concepts is correlated with improved student performance in STEM.

To expand the scope of understanding the impacts of the summer programs on teaching self-efficacy in STEM, interview questions will be revised to focus on areas of self-efficacy. This will allow the research team to gather more directed narratives around exactly how participating in the program impacted teachers.

The Goldberg Gator Engineering Explorers Summer Programs were designed to build student STEM identity, skills, and confidence through informal learning in an engaging summer camp program. This program is being studied to see if there is an additional ad-value for the teacher. Findings from the summer of 2024 indicate that the informal learning extended to the students results in gains for the teachers participating in the program.

6. Acknowledgements

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