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Evolution of a STEAM Teacher Training Program

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ABSTRACT: K-12 teachers often suffer from high stress and early burnout, a state made even worse by the COVID-19 pandemic. Their need for summer rest and renewal can therefore be at odds with their needs and desires for summer-time teacher professional learning. To promote participation in the summer professional development component of a year-long program aimed at promoting STEAM education in K-12 classrooms, we redesigned the professional development to explicitly provide flexibility, accommodation, and empowerment for the teacher participants. In this new "Choose Your Own Adventure" model of professional development, teachers were given the autonomy to tailor their professional development experiences based on their personal needs, interests, and summer commitments by selecting a variety of workshops in their preferred modes of delivery. Findings suggest that this adaptation was effective in facilitating robust teacher participation in summer professional development while also satisfying the teacher professional learning needs of the overall program. This paper presents the design of professional development, its implementation strategies, available workshop offerings, and findings. Additionally, it offers insights into teacher participation within the model.

INTRODUCTION

Science, Technology, Engineering, Arts, and Mathematics (STEAM) instruction follows constructivist learning principles that support students' development of cognitive and technological skills, and promote essential real-world competencies, including problem-solving, critical thinking, communication, collaboration, creativity, and innovation (Allina, 2018; Land, 2013; Liao, 2016). These 21st-century competencies, promoted through STEAM education, are useful in the modern workplace and will be crucial for future workforce development (Hong, 2017; Taylor, 2016).

STEAM has grown in popularity in recent years, with discussion and research in the field centered on the efficacy of different pedagogies, curriculum initiatives, and instructional models. Commonly, STEAM literature highlights the use of constructivist methods, with a focus on active learning that is learner-centered and promotes real-world applications (Christensen and Knezek, 2015; Coffland and Xie, 2015; Zimmerman, 2014). Instructional strategies supporting STEAM include using visual representations and storytelling, as well as applying design-based, inquiry-based, model-centered, and community-based learning (Bertrand and Namukasa, 2020; Ge et al., 2015; Quigley et al., 2020).

Because of the increasing prominence of STEAM education in recent years, researchers have explored and highlighted several important characteristics of effective STEAM teacher professional development (PD). For example, given the interdisciplinary nature of STEAM, researchers have developed and described teacher PD that supports the exploration of real-world interdisciplinary connections (Houghton et al., 2022; Pant et al., 2020). Furthermore, emphasis has been placed on engaging teachers in cross-curricular collaboration to co-plan or co-teach STEAM lessons (Boice et al., 2021; Land, 2013). However, this cross-curricular collaboration among teachers often requires explicit school-level

administrative support (Boice et al., 2021; Land, 2013). Researchers have also noted that to reduce ambiguities around implementation and ensure teachers are comfortable (Kang, 2019), STEAM teacher PD should emphasize content-specific tools and the most effective instructional methods and practices (Henriksen et al., 2019; Mejias et al., 2021). Without proper access to instructional materials, teachers could face significant challenges implementing effective STEAM lessons (Herro et al., 2018; Park et al., 2016; Liao, 2016; Quigley and Herro, 2016).

Several research studies have examined STEAM-focused teacher PD programs designed to enhance teachers' understanding and recognition of STEAM and to increase interest in lesson implementation (Boice et al., 2021; Conradty and Bogner, 2020; DeJarnette, 2018; Yakman, 2017). These studies show that STEAM-focused teacher PD should not only offer opportunities for teachers to grasp specific STEAM instructional approaches and pedagogies but should also encourage interdisciplinary collaboration among teachers to exchange ideas. Equally important is the school-level administrative support that is critical for the implementation of STEAM lessons.

GoSTEAM@Tech ("GoSTEAM"), a five-year STEAM educational initiative to support engineering, computer science, and innovation-focused STEAM in K-12 classrooms, was established in 2019 and includes a summer teacher PD program ("Summer Institute") followed by year-round support for teachers to successfully integrate STEAM during the school year. The Summer Institute is designed to provide teachers with the time and space to explore diverse art, technology, and integrated STEAM content, relevant pedagogies, and various instructional strategies, while also enabling teachers to collaborate and co-plan for successful classroom implementation of STEAM. This paper describes 1) details of the design decisions and implementation changes made in Years 3-5 of the Summer Institute, 2) the resultant mix of sessions offered as the Summer Institute evolved, and 3) evaluation results of teachers' experiences in the Summer Institute. Lessons learned from the implementation of the program and potential next steps are also discussed.

DESIGN AND IMPLEMENTATION

GoSTEAM Program. GoSTEAM is a program developed by the Georgia Institute of Technology ("Georgia Tech"), with generous funding from a private foundation, to explore and support the integration of technology-focused fields (Engineering, Computer Science, and Innovation and Entrepreneurship) with the arts (Fine Arts, Music, Theater Arts, and Media Arts) and the implementation of STEAM-integrated lessons in K-12 classrooms. The program involves elementary-, middle-, and high-school classroom teachers, university faculty and staff, and community partners working together to create, implement, and disseminate K-12 STEAM-focused projects. At the start of each year, school principals sign a Memorandum of Understanding (MOU) pledging support and planning time for participating teachers. The school administrators, including principals, vice principals, and STEM/STEAM instructional coaches, work with the GoSTEAM program staff and teachers to facilitate and support implementation of STEAM instruction. Teachers also sign MOUs, showing their commitment to participate in PD, collaborate with other teachers on their team, implement their Action Plan, and communicate promptly with GoSTEAM program staff and evaluators. Since the program started in 2019, GoSTEAM has worked with a total of 13 schools across three metro-Atlanta school districts.

By providing teachers from all grade levels with a comprehensive understanding of STEAM and a collaborative environment, the program empowers teachers to weave STEAM into the learning objectives of their respective disciplines and to successfully implement STEAM in their classrooms. Teachers from each participating school collaborate as part of a "STEAM Innovation Team." Each school's STEAM Innovation Team consists of the teachers, an Innovator-in-Residence ("Innovator"), and an expert university-based Coach. Innovators are university students or local community members based in creative art or technology fields. Innovators are employed up to 20 hours per week to provide teachers and their classrooms with support and expertise in artistic and technical fields (further described in Kessler et al., 2024a). Coaches are former classroom teachers who are currently full-time Georgia Tech employees and provide ongoing pedagogical support and guidance to the teachers.

During the Summer Institute, each STEAM Innovation Team collaboratively designs an "Action Plan," which is a document that outlines the school's intended STEAM-integrated lesson plans and activities, assessment indicators, and proposed implementation timeline. During the school year, GoSTEAM teachers continue to work collaboratively with the STEAM Innovation Team to implement one or more STEAM-integrated activities. They also receive support from GoSTEAM, which provides essential materials and supplies for both the summer and the school year.

GoSTEAM Summer Institute: Foundational Design. Generally, the purpose of teacher PD is to facilitate teacher learning and encourage adaptations in their teaching practices (Desimone, 2008; Whitcomb et al., 2009). The Summer Institute was designed to promote STEAM implementation by engaging teachers in active learning, exposing them to various STEAM perspectives and ideas, and giving them the time to think, dream, and plan. To provide common language around STEAM perspectives and ideas within the program, the program team developed a working definition of STEAM within GoSTEAM. While acknowledging the

varied approaches to STEAM, program leadership defined STEAM as an approach employing "student-centered instructional pedagogies, such as project-based inquiry learning, group learning, and real-world application, to increase cross-disciplinary content knowledge through learning goals for students in both STEM and arts disciplines" (Boice et al., 2021, p. 5). The initial PD design, established in 2019, allowed teachers to learn STEAM foundational concepts and pedagogical content knowledge through workshops and discussions. The program offered field trips and presentations by expert guest speakers to broaden teachers' perspectives, and authentic hands-on activities in both the arts and technology to expand their content expertise. Time and space were also provided for teachers to collaboratively plan and work with other teachers, both within and across schools. During this planning time, teachers collaboratively created a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis of their schools, generated ideas for experiential lessons and activities, and developed and shared an Action Plan that outlined their plans for the school year.

The Summer Institute was first implemented in 2019. However, the COVID-19 pandemic necessitated significant changes in Year 2, as previously reported (Rao et al., 2021). Coming out of the depths of the pandemic in 2021, the PD landscape had changed. While online workshops were more familiar and effective, feedback from the teachers showed that many were tired of the screen and longed for personal, in-person contact. Teachers, like everyone else, had planned long-delayed summer vacations and needed flexibility, and some school systems addressed students' pandemic-related learning loss by implementing mandatory summer school and adding new school and classroom goals. The following sections outline the original design of the Summer Institute in Years 1 and 2. Subsequent sections describe the decisions made to accommodate the circumstances and conditions in Years 3-5 and include the evaluation data pertaining to the strengths and weaknesses of the model.

GoSTEAM Summer Institute: Implementation in Years 1 and 2.

GoSTEAM Summer Institute Year 1. The first Summer Institute was implemented in the summer of 2019 over the course of four weeks. Each of the nine schools was asked to send one STEM-focused teacher and one arts-focused teacher. These teachers were expected to participate in a total of 110 hours of PD and were paid a stipend of $2,500. Seventeen teachers successfully completed the PD. The Summer Institute included three categories of sessions: collaborative working sessions, face-to-face workshops and field trips. The collaborative working sessions provided space for teachers to complete school SWOT analyses and Action Plans with the Coaches and Innovators. The face-to-face workshops and field trips were designed to build STEAM literacy skills and teaching practices, foster teamwork, and experience various examples of real-world, authentic STEAM environments (Boice et al., 2021). In the workshops and field trips, guest speakers were also invited to offer insight into a variety of topics and perspectives. These sessions were conducted in parallel with a 10-hour asynchronous Project-Based Learning (PBL) course, hosted on an online learning platform. The PBL course was designed to assist teachers in making cross-curricular connections and expand their pedagogical perspectives in STEAM by diving into student-centered pedagogies such as project-based, problem-based, and inquiry-based learning (Rao et al., 2021).

GoSTEAM Summer Institute Year 2. Due to the COVID-19 pandemic, the Year 2 Summer Institute was converted into an entirely virtual format, taking place over three weeks using GoSTEAM's learning management system (LMS). The primary goals of the Year 2 Summer Institute were to provide a nurturing and collaborative virtual community for the teachers and to help teachers prepare for virtual instruction during the upcoming school year. Twenty-four teachers from eight schools attended the Year 2 Summer Institute, 11 of whom were returning as second-year program participants. Teachers were expected to participate in 20 hours of PD per week, for a total of 60 hours of PD, and received a stipend of $1,200. Training sessions centered on both building collaborative communities that supported and empowered teacher voices in STEAM, as well as presenting various technologies that can be used in virtual classrooms (Rao et al., 2021). To promote a sense of community during a very difficult summer, teachers collaborated within cross-disciplinary and cross-school teams on various activities, such as developing new musical instruments and producing creative videos that highlighted their instruments and talents. Teachers collaborated online to develop and refine their Action Plans, and returning teachers shared their prior experiences of the program on the LMS discussion board.

GoSTEAM Summer Institute Design Details for Years 3-5. Design decisions for Years 3-5 of the Summer Institute were informed by the results of the previous year's Summer Institute, as well as by teacher input collected through pre-surveys prior to each summer. Specifically, these surveys asked teachers about the focus areas of their schools and classrooms during the upcoming year and about their personal interests and needs in PD. In addition, the redesign considered the mix of new and returning teachers coming back to the Summer Institute, as well as the continued recovery from the pandemic, with particular attention to the ongoing stress experienced by teachers as they calibrated to new policies, expectations, and stressors (Kush et al., 2022; Marshall et al., 2020; Wilson et al., 2023). In Year 3, the program team also decided to focus on building capacity for

STEAM within schools and expanded recruitment to include teachers from any discipline, provided they design and implement STEAM integrated projects.

GoSTEAM Summer Institute Year 3. In preparation of the third Summer Institute in 2021, the program team sought to accommodate a cohort of new and returning teachers, representing varied grade levels, content expertise, and personal needs in response to the COVID-19 pandemic. In pre-Summer Institute summer surveys, teachers (*n*=20) reported that their schools were focusing on various STEAM topics and methods of instruction. Additionally, schools were considering different learning strategies to support students after the pandemic, including ways to improve test scores in core subject areas (e.g., English/Language Arts, math). In terms of PD, the teachers requested opportunities to learn about different methods of instruction and unique activities for classroom implementation. Suggestions also included field trips (e.g., art museums) that would enable them to better integrate the arts and build partnerships with local organizations. The teachers were also asked about their level of comfort attending the Summer Institute in face-to-face, hybrid, or virtual modes of delivery. Many teachers indicated a preference for face-to-face options, as long as necessary pandemic precautions were taken (e.g., the number of positive tests in the local area continued to decline, outdoor sessions, etc.). As a result, many workshops were offered in a hybrid format and teachers had the choice of participating face-to-face or connecting online through the program's LMS. The Summer Institute included some days that were hosted entirely online and others that only included in-person field trips. Teachers were able to choose both the content they were interested in and the modality of delivery. Details of the types of workshops provided are covered in later sections.

To accommodate the different needs of teachers and ongoing uncertainty or discomfort navigating return to in-person gatherings, the program team implemented changes to the format and content of the PD workshops by developing a "Choose Your Own Adventure" model of PD. By planning sessions which varied in program content and modality of delivery, this model provided teachers with more discretion over which workshops they attended and enabled them to participate in workshops based on their personal schedules. Not only was this model designed to accommodate the varying needs of new and returning teachers, but it was also used to counteract the burnout and mental health challenges teachers experienced after a year of virtual instruction during the pandemic. Moreover, this format ensured returning teachers were not required to attend the same workshops and sessions each year.

During Year 3, teachers self-selected the workshops and sessions based on their professional needs and personal schedules. Teachers were encouraged to complete a minimum of 40 hours of PD over a seven-week period in June and July. Participation was tracked by GoSTEAM program staff, and stipends of $20/hour were pro-rated by the number of PD hours that teachers participated in, up to a maximum of 83 hours. The only firm requirements were that the first-year teachers attend the 10-hour online PBL course and that all STEAM Innovation Teams develop an Action Plan for the upcoming year. Returning teachers were invited to participate in a new, 10-hour interactive online course on Rightful Presence in STEAM, which presented educational practices that foster equity and inclusion and promote student voice in STEAM classrooms.

GoSTEAM Summer Institute Year 4. Planning for the Year 4 Summer Institute followed the same "Choose Your Own Adventure" model, and teachers were asked about the types of sessions that interested them. Survey responses (n=20) indicated that teachers maintained an interest in engaging with university resources, guest speakers, and community partners to learn strategies for STEAM implementation. Teachers shared that these interactions could inspire creativity and new ideas through real-world experiences in STEAM. In terms of PD format, over 70% of the teachers preferred face-to-face, compared to virtual sessions. Schools were back face-to-face during the 2021-2022 school year, and these findings suggested that most teachers were enthusiastic to return in person. In the planning for Year 4, the program team decided that most sessions would be in-person, a decision that was communicated early to prepare teachers for the summer. Some teachers also recommended decreasing the number of weeks of the Summer Institute, indicating that seven weeks was too long.

Accordingly, the Summer Institute was offered across four weeks in June, instead of seven weeks, for a maximum of 90 hours. Teachers were encouraged to attend at least 40 hours of PD. This included either a 10-hour online PBL course for new teachers or a 10-hour Rightful Presence course for returning teachers, as well as an optional 10-hour teacher conference hosted by a local art museum. Some teachers were required by their schools to teach summer school; thus, the program team allowed teachers to earn PD participation credit by watching recorded workshop sessions and writing reflections on the program's online LMS. Even for teachers without summer school commitments, online participation in the LMS was encouraged for those who could not attend the face-to-face sessions. All participation was tracked, and teachers received a $20/hour stipend.

GoSTEAM Summer Institute Year 5. As in previous years, teachers (*n*=25) described their upcoming needs and school plans through pre-summer surveys. Teachers indicated a central focus on integrating the arts and technology into STEM instruction, on 21st-century learning (e.g., digital citizen-

ship, AI integration), mechatronics and engineering, and on different pedagogies to use in instruction. Teachers also expressed interest in learning more about integrating STEAM in subject areas through music, coding, robotics, 3D printing and technology, attending field trips, and collaborating with other teachers and local organizations. There was a national decline in COVID-19 cases prior to the start of the Year 5 Summer Institute, and teachers expressed a preference for in-person workshops with some back-up video streaming options available. Therefore, the Summer Institute was offered for three weeks on the Georgia Tech campus, with the first week dedicated to workshops and field trips, the middle week consisting of a hands-on STEAM Symposium (further described below), and the third week focused on collaborative planning. As in previous years, teachers teaching summer school were invited to watch recorded video sessions and write reflections online to earn participation credit. In total, out of the maximum 102 PD hours offered, teachers were encouraged to participate in at least 40 hours of in-person trainings, in addition to any virtual participation (such as the online 10-hour courses for new teachers (PBL) and returning teachers (Rightful Presence in STEAM)). Teachers received a $20/hour stipend pro-rated by their attendance record.

Because Year 5 was the final year of funding for GoSTEAM, the program team focused their planning on initiatives that might be sustained after the funding ceased. As part of this goal, the program team organized a week-long STEAM Symposium taking place as part of the Summer Institute and opened it to additional teachers from the participating school systems. The program team also invited returning GoSTEAM teachers to help plan and lead a session at the STEAM Symposium. The STEAM Symposium enabled the program team to provide integrated-STEAM professional learning to a wider audience and to explore possible strategies for sustaining the program after foundation funding concluded.

The STEAM Symposium consisted of workshops grouped into four tracks: 1) Beats and Bots; 2) Instructional Technology: STEAM Classroom Solutions; 3) Socio-Cultural STEAM; and 4) Drawing, Drama, and Design. The workshops in both the Beats and Bots and the Instructional Technology: STEAM Classroom Solutions tracks were PBL-focused, engaging teachers in the exploration of various technologies through hands-on activities. For instance, Beats and Bots workshops focused on using technology to explore music and sound. Instructional Technology: STEAM Classroom Solutions workshops included methods for increasing STEAM engagement using different technologies, such as micro:bits and different visualization tools. The workshops in Socio-Cultural STEAM and the Drawing, Drama, and Design tracks employed a reflective approach, fostering discussions on culturally responsive teaching practices and effective learning strategies through arts integration. In particular, Socio-Cultural STEAM workshops explored ways to implement STEAM in culturally relevant and inclusive ways. Drawing, Drama, and Design workshops focused on ways to integrate STEM into art classrooms. Workshops from all four tracks were offered throughout the week, with participants attending morning and afternoon sessions each day. GoSTEAM teachers received their normal $20/hr stipend for participating and non-GoSTEAM teachers attended the Symposium for free.

GoSTEAM Summer Institute Content Categories. To understand how the content of the Summer Institutes evolved over time, we developed categories to classify workshops and related activities, as first described in Rao and colleagues (2021). The categories include Pedagogical Instruction, Community Building, Collaborative Planning, Technical Content Enhancement, Arts Content Enhancement, and Integrated STEAM Experiences. Below we present the category descriptions and evidence of each in Years 3-5. While there is some overlap in sessions that may belong to multiple categories, this categorization has provided a useful tool for understanding the mix of sessions in the Summer Institute.

Pedagogical Instruction introduces STEAM best practices and pedagogies, including project-based learning, design thinking, and culturally responsive pedagogy. Workshops categorized as "pedagogical instruction" also include topics such as how to promote student voice and choice and how to implement culturally authentic practices. These activities represented the foundational approach of the PD and were highlighted consistently across all years of the Summer Institute. In response to the growing racial unrest in the region and the country in 2020, the program team increased the support for teachers to reflect on the impact of these events on themselves and their students, as well as introduce pedagogical approaches that promote equity and inclusion in the STEAM classroom. For example, the team developed the Rightful Presence in STEAM course in 2021 to explore the connection between STEAM-based pedagogical practices and a framework for promoting equity and inclusion in STEAM classrooms (Calabrese Barton and Tan, 2020; Jackson et al., 2023). In addition, teachers could attend a field trip to the Civil and Human Rights museum in Atlanta, Georgia, or sessions such as "Making Space for Black Girls: Embodied Learning in Transdisciplinary Community" emphasizing diverse experiences in STEAM.

Community Building provided opportunities for teachers to build rapport and share their experiences, ideas, and expertise with other teachers across schools, grade levels, and content focus. When teachers met face-to-face and participated in communal activities

and field trips, they organically built a community that encouraged comradery and informal brainstorming. The Summer Institute also included daily reflection time and collaborative STEAM activities to promote community. The challenge during COVID-19 was to build community in a virtual context, and in 2020 (Year 2), substantial attention was put towards developing specific collaborative online activities that brought teachers together, such as the musical instrument challenge described earlier (Rao et al., 2021). The return to face-to-face sessions and field trips in 2021 (Year 3) allowed for organic community building to naturally occur without the need for sessions specifically designed for it, which resulted in a decrease of community building sessions after Year 2.

Collaborative Planning consisted of work sessions for the STEAM Innovation Teams to collaborate, brainstorm, and develop Action Plans based on their specific school SWOT analyses. Some of these sessions took place on campus, but at other times, STEAM Innovation Teams were directed to meet at their school locations to minimize commute time and address pertinent needs and opportunities at their schools. Time for substantial collaborative planning was provided in Year 1, though there was a decrease in Year 2 amid uncertainties caused by COVID-19. Teachers were given ample collaborative planning time when they came back to in-person sessions starting in Year 3.

Technical Content sessions explored various technical tools that can be used in classrooms to support STEAM programming and problem-solving skills. Some examples of technical content included computer coding workshops using the online music mixing platform EarSketch (Georgia Institute of Technology, 2024a); robotics workshops using LEGO Mindstorm (The LEGO Group, 2024), micro:bit (Micro:bit Educational Foundation, 2024), and/or Hummingbird kits (BirdBrain Technologies, 2010); 3-D modeling sessions using TinkerCAD (Autodesk Inc., 2024); and Mobile App design using Thunkable (Thunkable Inc., 2024). These sessions also focused on the applications of innovation and included tours of campus facilities and laboratories to learn about invention and sustainability. Additionally, these workshops focused on embedding creativity and fostering engagement through gaming and drawing. As there were an increasing number of returning teachers in Years 3-5, sessions exploring different technical tools increased starting in Year 3 and continued throughout Years 4 and 5 to provide more technical tools and hands-on activities to use as part of lesson implementation.

Art Content sessions focused on increasing teachers' knowledge and familiarity with the arts through hands-on activities and field trips, providing them with concrete insights into how to integrate the arts with technology. Arts Content sessions included visits to local museums and art installations, attendance at theater productions, and attendance at teacher workshops hosted by local arts organizations. Visits to the local botanical garden, theaters, and art museum generally included discussions with the organizations' representatives, who conducted backstage tours and led discussions on effectively creating STEAM lessons. The sessions also provided opportunities for teachers to build relationships with community organizations, potentially providing a valuable future resource for the school. After the Summer Institute's return to being primarily in-person, starting in Year 3, the number of field trips increased significantly to compensate for the decrease of these sessions because of the COVID-19 pandemic.

Integrated STEAM Experiences explored the integration of technology (e.g., coding, 3D design, artificial intelligence, virtual reality) and the arts (e.g., drawing, designing, composing music), and how these fields can be integrated to develop innovative products. Teachers participated in hands-on activities designed to provide exemplars of innovative STEAM integration across different disciplines. Example activities include Prototyping Puppets, which combines visual art, engineering, and performance art (Georgia Institute of Technology, 2024b); Paper Mechatronics, which integrates robotics, micro:bit, and craft (PaperMech, 2024); Paper Piano, which combines music and coding using Arduino micro-controllers (Georgia Institute of Technology, 2024c); and the African Masks Project, integrating African art with 3-D visualization and 3-D printing (Georgia Institute of Technology, 2024d). Since it was feasible to deliver these sessions in both face-to-face and virtual formats, they were consistently offered throughout the first four years of the Summer Institute. In Year 5, the Symposium expanded its exploration of these activities, resulting in an increase of these sessions.

RESULTS

GoSTEAM Summer Institute. Previous publications about GoSTEAM discussed the impact of the Summer Institute on the teachers' experiences, including aspects that supported school-year STEAM implementation and the impact of PD on teacher practices during Years 1 and 2 (Boice et al., 2021, Rao et al., 2021). In Year 1, teachers shared positive experiences collaborating and learning about various pedagogies and methods for STEAM integration in their classroom (Boice et al., 2021). In Year 2, teachers valued the support the Summer Institute provided during the COVID-19 pandemic, especially the exposure to different technologies

used for virtual instruction (Rao et al., 2021). Teachers also reported that the virtual format of the Summer Institute was helpful in preparing for online instruction in the upcoming school year.

We expand on the previous findings in this paper by sharing results of the Summer Institute across Years 3-5, using the "Choose Your Own Adventure" model. These results include programmatic data (i.e., teacher retention rates across the years and hours of attendance) and select evaluation data (i.e., summer post-survey data and end-of-year interview and focus group data). Specifically, the program staff recorded details of teacher participation each year, including which teachers participated in the Summer Institute, which continued and/or joined the program during the school year, and the reasons for any teachers leaving the program.

To understand teacher experiences of the Summer Institute, all teachers who participated were invited to participate in an online survey at the end of each summer. The survey included five items assessing teachers' agreement with statements about the impacts of the Summer Institute, rated using a 5-point Likert-type scale ranging from "strongly disagree" (1) to "strongly agree" (5). Descriptive statistics (e.g., mean and standard deviation) were employed to capture teachers' perceptions of the Summer Institute impact across Years 3-5 (Moore and McCabe, 2005). Teachers were also asked to answer items assessing what factors influenced their decisions about which workshops to attend and the mode of delivery they mostly selected (e.g., face-to-face, virtual) in attending the workshops. Frequencies were calculated for select items (Moore and McCabe, 2005).

Qualitative data were collected at the end of each school year via one-hour focus groups with teachers from the same school, or when schedules did not align, interviews with those teachers. Semi-structured interview protocols were used (Creswell, 2014) to probe teachers' implementation of the Action Plans, experiences working in collaboration with others (e.g., teachers, Coaches, Innovators), and the impact of the program. Some questions specifically assessed teachers' perceptions of the impact of the Summer Institute experiences on their instructional practices during the school year. The focus groups were conducted virtually using video conferencing software (i.e., Zoom) and were audio-recorded and transcribed for data analysis. Thematic analysis was used to identify themes from the transcripts (Braun and Clarke, 2006), and a multiple-cycle descriptive coding strategy was used. In the first round of coding, four researchers individually coded the same transcript and discussed their findings to reach a consensus on the codes. These agreed-upon codes formed the basis for a codebook, which was used for a second round of coding. The researchers held consensus meetings to further refine the codes and interpret the data. As a result, themes from Years 3-4, and later in Year 5, emerged to represent the program's impact on the teachers' teaching practices. Participation rates in the summer post-survey and the end-of-year focus groups/interviews are provided in Table 1.

Table 1. *Teacher Evaluation Participation Rates.*

Data Collection Tool	Year 3 (2021-2022)	Year 4 (2022-2023)	Year 5 (2023-2024)
Summer post-survey	54%	69%	76%
End-of-year interviews/focus groups	81%	59%	48%

Teacher Retention in GoSTEAM. Teacher participation in the Summer Institute and during the school year changed from year to year. Although most teachers who took part in the Summer Institute continued into the school year, some teachers joined after the school year began and some left the program for various reasons (e.g., changing schools, retiring, stepping away from the program for personal reasons). This led to variations in the number of teachers starting and ending the program during each school year. Since the GoSTEAM program began in 2019, it has supported 70 teachers. To gain a deeper insight into the significance of teacher involvement, we present an overview the demographics of participating teachers each year, and the extent to which these teachers attended the workshops in the Summer Institute.

Table 2 presents the detail of the 70 teacher participants, including the number of new versus returning teachers each year, the number of teachers who joined or left the program throughout the school year, and the grade levels and subject areas the teachers taught. The GoSTEAM program started with 17 teachers, with new and returning teachers joining each year. While the number of new teachers decreased from Year 4 onwards, the number of returning teachers increased throughout the duration of the program. A small number of teachers joined the program after the Summer Institute at the beginning of the school year, including two in Year 2, one in Year 4, and one in Year 5. Among the teachers who joined, one in Year 4 joined during the middle of the school year.

To explore how teachers leveraged the "Choose Your Own Adventure" model of PD, we calculated the frequency distribution of their attendance at the workshops. To do this, we divided the total PD hours each year into three frequency-of-attendance categories of low, medium, and high. Low represents teachers who attended 0-32% of PD hours offered, medium is attendance at 33-65% of the hours offered, and high is attendance at 66-100% of the hours offered. Figure 1 provides an overview of these teacher participation rates for the Summer Institute during Years 3-5, illustrating the number of teachers and the duration of their attendance at the workshops. In Year 3, 51% of the teachers fell in the medium category (n=18), indicating that approximately 18 out of the 35 teachers attended between 33-65% of the 83 hours of PD that were offered. Nearly one third (n=10, or 29%) attended most of the hours that were offered (66-100%). In Years 4

Table 2. *Teacher Demographics Years 1-5 (n=70).*

Category	Year 1	Year 2	Year 3	Year 4	Year 5
Time in Program					
New	17	15	20	10	8
Returning	-	11	15	21	25
Participation Throughout Year					
Started Program During Summer Institute	17	24	35	30	32
Started During the School Year	17	26	35	31	33
Still in Program at the End of the School Year	17	24	33	30	32
Teacher Grade Levels [a]					
K-5	8	8	8	7	7
6-8	3	6	14	8	11
K-8	2	3	2	5	3
9-12	4	9	11	11	12
Teacher Subject Areas					
STEM	7	11	15	18	16
Arts	8	10	7	4	6
Other [b]	2	5	13	9	11

Note. *The numbers represent the frequencies of the data. [a]Grade level of teachers that started the program during the school year. [b]Other subjects include general K-5 education, social studies, gifted, special education, and STEM/STEAM instructional coaches or coordinators.*

and 5, a majority of the teachers fell in the high category and attended most of the hours, with 59% of the teachers in Year 4 (*n*=16) attending 66-100% of the 90 hours of PD, and 53% of the teachers in Year 5 (*n*=16) attending most of the 102 hours of PD. The data also highlight that the percent of teachers in the low category (0-32%) increased in Years 4 (22%) and 5 (30%), when many of the teachers from one school system were required to teach summer school during the Summer Institute.

Teacher Perceptions of Summer Institute Experience.

Teacher Perceptions of the "Choose Your Own Adventure" Model. Feedback provided on the summer post-survey illustrates that the "Choose Your Own Adventure" model allowed the program to deliver PD content in a way that accommodated teachers' interests and schedules. In Year 3, the first year the model was used, many teachers indicated "convenience in schedule" and "interest in session topics" were deciding factors for selecting the workshops they attended (Table 3). Mode of delivery (i.e., the ability to participate virtually or in person) was also a deciding factor for some teachers. However, this reasoning was reported less frequently than convenience or interest, suggesting that teachers valued the model for its flexibility over the varied session options rather than merely the opportunity to choose between in-person and virtual sessions.

The ability to participate virtually influenced more than half of the teachers' decisions about whether to attend a particular session in Year 3. In the following two years, teachers demonstrated an interest in moving back towards in-person

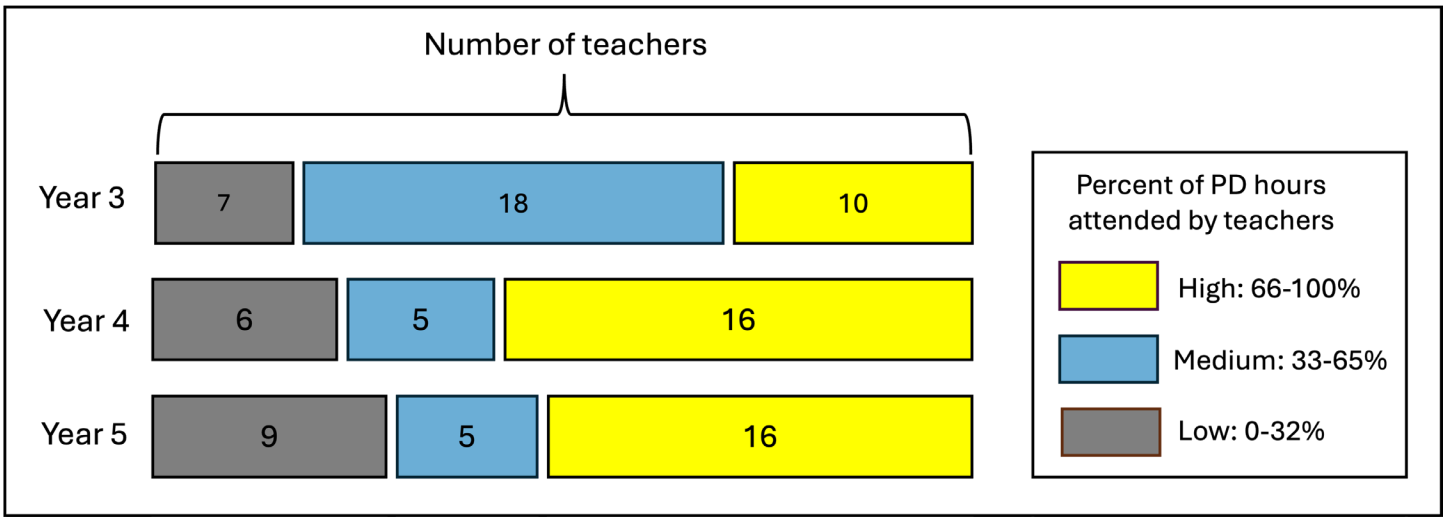

Figure 1. PD Hours Attended by Teachers. The different bars (Year 3, 4, 5) represent the percent of PD hours the teachers attended in the PD each year. The number indicated inside each bar is the number of teachers that fell in low, medium, or high.

Table 3. *Decisions Influencing in Attending the Workshops for Year 3.*

What influenced your decision about which sessions you attended? (Select all that apply)	Frequency (*n*=19)
Convenience in my schedule	16
Interest in session topic	15
The ability to participate virtually	9
The ability to participate in person	3
Other (please explain)	0

Table 4. *Mode of Attending the Workshops.*

Please choose the statement that most closely reflects your experience with the sessions you were able to attend this summer.	Year 4 Frequency (*n*=18)	Year 5 Frequency (*n*=18)
I attended all of the sessions in person.	6	8
I attended most of the sessions in person.	12	8
I attended all of the sessions virtually.	0	1
I attended most of the sessions virtually.	0	1

programming, with almost all summer post-survey participants indicating that they attended most or all their sessions in person (Table 4).

Participants were asked to respond to an open-ended item about their satisfaction with the format of the Summer Institute each year. In Year 4, teachers generally reported a positive experience and shared that they enjoyed the face-to-face sessions. For example, one teacher stated that the face-to-face experience "*exceeded the expectations*," as it increased the level of engagement. Many teachers also appreciated the flexibility of choosing the workshops based on their needs. Though most survey participants reported attending most of their sessions in-person, participants appreciated the hybrid mode of delivery, which worked well with their summer schedules. Similar feedback was given in Year 5, with teachers also sharing their satisfaction with the face-to-face format that included virtual options. In particular, the model may have facilitated community building. Most participants expressed satisfaction with the model, as it fostered interaction. Participants reported that they "*enjoyed getting together with everyone*," that the "*energy was great and everyone was comfortable with one another*," and that it was a place for "*exchange of fond memories and new ideas*."

Perceived Impact of PD and Connections to Practice. Teachers' perceptions of the impact of PD were explored using survey data and end-of-year focus group/interview data. Survey responses indicate that, across all years in which the "Choose Your Own Adventure" model was used, participants indicated positive perceptions of the Summer Institute (Table 5).

Implementation of Action Plans in the School Year. After the Summer Institute, teachers within each STEAM Innovation Team implement the Action Plans that they produced in the summer. The Action Plan details learning objectives, pedagogical approaches, and curriculum standards for both STEM and the arts. The Action Plan also outlines the scope of STEAM integration that is employed in implementing the STEAM lesson or unit project. Action Plans articulate intended outcomes, noting any final productions or products to be showcased as a result (e.g., a theatrical performance, diorama, presentations). This provides one authentic means of assessing the program, which is an essential component for successful STEAM professional development training (Herro and Quigley, 2017).

Each summer, returning Innovation Teams could decide to build on and expand an existing Action Plan implemented at their school in a previous year, or create new Action Plans to be implemented in the school year. For example, at one participating elementary school, a group of teachers iterated on the same Action Plan called the "Tiny House," a PBL project that was collaboratively designed and implemented by the Innovation Team during Year 1 of the program and iterated upon each year with 3rd-5th grade students. The project began with 4th and 5th grade students learning about mathematical concepts as they measured parameters (e.g., surface area) to build model homes based on collected data. The lesson integrated engineering and design concepts through hands-on learning as students constructed their homes during "build days." The constructed homes transitioned from using popsicle sticks in the beginning years to using micro:bit microcontrollers and sensors and integrating circuitry and audio-reactive sensors by Year 4. As part of the build days, 4th grade students created online listings on a real-estate listing website, which was integrated into English Language Arts standards. Third grade students engaged in a scenario-based activity which focused on purchasing a home, going through the loan application process to understand the income-debt ratios for home purchase. This activity incorporated mathematical concepts. The project provided an authentic learning experience by simulating the real-life process of home building and purchasing across 3rd through 5th grade students.

Teachers at one participating middle school implemented a similar Action Plan each year using PBL to teach basic coding and music concepts. This PBL, called "Conserving the 1%," was driven by the driving question, "97% of the Earth's water is salt water, 2% is frozen, leaving 1% for drinking water. What steps can we take to promote water conservation?" This driving question highlights a real-world need to conserve the Earth's natural resources and explore the proportion of water that is available for consumption. The PBL integrated earth science, music, and computer science standards for 6th grade students to learn about hydrology and create a 2-minute song that promotes the awareness of water conservation. Students collaborated in groups of 2-3 to write lyrics about water conservation and created music

Table 5. *Perceptions of Summer Institute Impact Years 3-5.*

The Summer Institute experience…	*M (SD)*		
	Year 3 (*n*=19)	**Year 4** (*n*=17)	**Year 5** (*n*=18)
stimulated me to think about ways I can improve my teaching.	4.74 (0.45)	4.88 (0.33)	4.89 (0.32)
increased my ability to network with teachers and other professionals.	4.84 (0.37)	4.76 (0.75)	4.72 (0.57)
was responsive to my professional development needs.	4.63 (0.60)	4.71 (0.59)	4.83 (0.38)
was appropriate for my knowledge, skills, and interests.	4.63 (0.60)	4.71 (0.59)	4.83 (0.38)
increased my knowledge about STEAM integration.	4.61 (0.61)	4.71 (0.59)	4.72 (0.57)

Note. *Participants rated their agreement on a 5-point scale from "strongly disagree" (1) to "strongly agree" (5).*

using the EarSketch platform, which allows users to compose melodies through block or text-based programming. As part of this PBL, teachers created various mini-lessons to promote water conservation. For example, teachers had students create interactive posters using paper circuits, battery packs, and micro:bits to share information about conserving water.

Findings in Years 3 and 4. At the end of each school year, teachers participated in focus group sessions and shared the ways in which they made connections between the Summer Institute experiences and their teaching practices.

In Years 3 and 4, the available focus group data reveals that most teachers made connections in their teaching through 1) *applying new and innovative ways of teaching* and 2) *building relationships with the students*.

New and Innovative Ways of Teaching. Teachers in both Years 3 and 4 revealed that the Summer Institute provided opportunities for teachers to consider creative and innovative ways of teaching, as it exposed them to ideas around integrating learner-centered (e.g., project-based learning) and experiential approaches (e.g., real-world) in instruction. Teachers described the extent to which they were able to incorporate those ideas into their teaching practices through experiences in the program. One teacher shared that the program enabled them to "*pick up something new, even if it is an idea or a thought, it's GoSTEAM that has given me a new way to approach it or the confidence to go ahead and try it*." Furthermore, the Summer Institute provided time and support to teachers as they developed Action Plans that made real-world connections. Teachers described selecting Action Plan topics and themes that addressed relevant issues, their interests, and/or their community's interests (e.g., homelessness and entrepreneurship). Moreover, the experiences gained in the Summer Institute enabled teachers to think differently about their approach to classroom lessons and projects in general, suggesting that the sessions categorized as supporting teachers' "pedagogical instruction" including PBL, design thinking, and culturally relevant pedagogy workshops, were effective. One teacher shared that being involved in the program helped them "*really understand a little bit more … project-based type of learning*." Another teacher revealed that the program "*stretched* [their] *mind to think outside of just teaching according to the standards*." Similarly, one teacher described how the components of the program became infused in their teaching practices, sharing, "*I have the opportunity to build it from the ground up and decide what the future is going to look like*."

Building Relationships with the Students. Teachers in Years 3 and 4 shared that the experiences in the Summer Institute enabled them to change how they approach and build relationships with their students. Specifically, the program team emphasized the ideas of social justice, equity, inclusion, and student voice in STEAM through workshops/courses (e.g., Rightful Presence, culturally responsive pedagogies, English Language Learners in the STEAM classroom, and STEAM for neurodiverse students). This helped teachers understand the importance of recognizing and acknowledging students' lived experiences and building relationships with students to create a safe and open learning environment. For example, one teacher shared a change in how they communicate with the students after the Summer Institute, from "*immediately shutting them* [students] *down if the questions wasn't pertaining to what they* [students] *were talking about*" to understanding the importance of building rapport and community in the classroom by "*being open to sharing thoughts, sharing feelings, inviting* [students] *to share their thoughts and inviting them to share their feelings*." Similarly, another teacher shared the importance of getting to know their students, and that it made a "*huge difference*" in accomplishing lesson activities, as students were more comfortable sharing and taking part in classwork. Another teacher explained how the sessions inspired them to shift how they view their students, moving beyond simply focusing on test scores to seeing who their students are as human beings and their holistic potential.

Findings in Years 5. Because GoSTEAM was established as a five-year initiative, Year 5 was the final year for the program to provide schools with financial, material, and personnel support for STEAM lessons. Additionally, in Year 5 there was a change to the program structure due to personnel changes in the program, with two of the three Coaches retiring, requiring remaining program staff and Innovators to

take on more active roles in communicating with the schools. Due to these changes and the emphasis on sustainability in the final year, teachers were asked more general questions to better understand the support teachers received from the program team, rather than on specific aspects of the program that affected implementation (e.g., Innovator roles, Coach roles). Many teachers expressed how the program impacted their teaching practices and described their ability to sustain what they learned in GoSTEAM by sharing how their understanding of integration was affected.

Impact on Integrative Teaching Practices. Teachers shared the ways in which their approaches to teaching have evolved as a result of participating in GoSTEAM. Teachers shared how, in the past, they were teaching from a "*standard set of paradigms*" and "*by the book*." As teachers learned more about and implemented STEAM into their teaching, their philosophies of teaching changed. One teacher shared that "*GoSTEAM has radically changed the trajectory of my pedagogy … I believe I am a better teacher because of what I've learned through GoSTEAM*." Another teacher described changes in their pedagogical practices by moving from "*how do I teach the knowledge, how do I teach not to the content and make them remember?*" to "*it's how do I teach them content and make them apply it?*" Moreover, teachers also developed more creativity and were "*more open and willing to try new things*." Teachers deepened their awareness of how the integration of different subject areas can be used to "*aid in their* [students] *learning*." For example, one teacher shared that now they understand that information and resources are "*not exclusive*" to each subject area but can be used for integration. Another teacher noted that through GoSTEAM, they learned that integration is more than just adding on another subject area, but that the skills and resources used in STEAM subjects can also be utilized in the lessons and make it easy to "*cross teach*." Teachers' changing understandings of STEAM over the full five years of the project are further described in Boice et al. (2024).

DISCUSSION AND CONCLUSION

Throughout the five-year implementation of the Summer Institute, program leadership made efforts to support teachers' establishment of a solid foundation of STEAM as part of their teaching practices. These efforts align with the research emphasizing the significance of enhancing teacher competence through PD training (Han et al. 2016; Yakman, 2017). In alignment with the categories of Summer Institute workshops in Years 1 and 2, Years 3 through 5 continued to emphasize pedagogical instruction, community building, collaborative planning, art and technical content, and integrated STEAM experiences. In Year 3, additional workshops were added to help teachers adjust to virtual STEAM instruction, uncertainties in the return to the classroom, and disparities and inequities exacerbated by the COVID-19 pandemic. These workshops aimed to support creative and interactive methods for online instruction and offered more opportunities for teachers to engage in conversation and learning around equity and inclusion in STEAM.

Over the course of the program, there were variations in the number of teachers joining in the summer, throughout the school year, and completing the school year. The program provided some flexibility for teachers to join either after the Summer Institute or in the middle of the school year, as well as the option to discontinue participation based on their needs (e.g., personal and/or school duties). The proportion of different subject areas of the teachers also varied, with a decline in art teachers in comparison to STEM and other subject area teachers starting in Year 3. This change was influenced by recruitment methods used by participating schools. Initially in Year 1, each participating school was required to nominate one STEM and one arts teacher for program participation. However, over the years, subsequent recruitment efforts focused on building capacity for STEAM within schools, leading many schools to nominate full grade level teams or to add additional STEM teachers. Moreover, several schools faced constraints in recruiting art or music teachers, as there is often only one of each per school. To address the reduced number of arts teachers, the program team recruited Innovators with strong arts expertise to support the STEAM Innovation Teams.

A major change that occurred in the Summer Institute was the introduction of the "Choose Your Own Adventure" model beginning in Year 3, which was the program's direct response to the pandemic. Attention was paid to the teachers' mental health and the exacerbated stress and burnout associated with the pandemic, which was witnessed in the program team's interactions with teachers and documented by scholars across the globe (e.g., Allen et al., 2020; Marshall et al., 2020; Sokal et al., 2020). In particular, the "Choose Your Own Adventure" model offered teachers flexibility with engaging in the Summer Institute as they self-selected the sessions to attend based on personal choice, needs, and schedules. The model also addressed problems associated with any conflicts that limited teachers from participating, such as summer school commitments.

The first iteration of this model in Year 3 of 2021 spanned seven weeks in June and July. However, attendance decreased towards the end of the summer (July). Based on this experience and teacher feedback, the Summer Institute was subsequently condensed to three to four weeks in June. In Years 4 and 5, a majority of teachers attended 66-100% of the workshops. This, and the high number of teachers who returned year after year, suggests that the teachers appreciated both the content and the flexibility of the Summer Institute.

The Summer Institute was complemented by support from Coaches and Innovators, who worked on-site to assist with STEAM implementation during the school year. GoSTEAM provided substantial support to K-12 teachers, guiding them in navigating their understanding of STEAM, implementing related practices, and developing interdisciplinary skills through collaboration with their fellow teachers. Teachers applied summer experiences to teaching by adopting new and innovative approaches and prioritizing relationships with their students.

In summary, the exploration of the Summer Institute's impact over Years 3-5 has revealed consistent positive perceptions among participating teachers. The program's innovative "Choose Your Own Adventure" model received commendation, particularly for accommodating teachers' interests and schedules. While much of the literature on supporting teacher wellbeing post-pandemic has focused on school-based supports (e.g., a positive school environment, the role of administrators in promoting teacher autonomy; Collie, 2021; Ortan et al., 2021), this paper provides important information on supporting teachers in out-of-school contexts, during PD and training opportunities. GoSTEAM demonstrates the successful translation of approaches for promoting teacher wellbeing post-pandemic to out-of-school professional learning contexts. Specifically, the Summer Institute supported teacher autonomy (Collie, 2021; Ortan et al., 2021) through the "Choose Your Own Adventure" model and emphasized relationship building (Fox et al., 2020; Soncini et al., 2023) amongst colleagues, through community building activities, and with students, using learner-centered and equity-focused pedagogies. Teachers demonstrated adaptability, transitioning between virtual and in-person sessions based on their preferences and availability. Moreover, survey data highlighted the Summer Institute's effectiveness in stimulating professional growth, fostering networking opportunities, and enhancing pedagogical skills, particularly in STEAM integration. After the summer, teachers implemented Action Plans in the school year, which demonstrated a direct link between program experiences and classroom practices. Notably, teachers reported integrating new and innovative teaching methods, such as learner-centered and experiential approaches, into their instruction. Additionally, emphasis on social justice, equity, and inclusion in the program encouraged teachers to prioritize building meaningful relationships with their students, fostering a supportive and inclusive learning environment. GoSTEAM bridged the gap between STEAM instructional approaches and theoretical underpinnings and pedagogies to offer a practical understanding of integration between the learning goals of PD and actual teacher practices (Jiang et al., 2024). It also responded to the mismatch that can occur between the teachers' pedagogical understanding and instructional practices, which can impact their actual teaching performance (Thompson et al., 2018).

Limitations. The paper reviewed the design and implementation of the Summer Institute for Years 3-5 of the five-year GoSTEAM program. We examined the trends/changes that occurred with the workshops based on the categories by Rao and colleagues (2021) for Years 1-2. This may have overlooked the distinct details of the workshops and failed to appropriately capture the focus of the workshops and types of activities that were offered across Years 3-5. Moreover, although the teacher retention rates show a consistent number of new and returning teachers in the program, we cannot definitively claim that resulted from the flexibility of selecting PD workshops and the modality that was offered through the "Choose Your Own Adventure" model. Likewise, we also cannot claim that the number of teachers and the extent of their PD attendance was a direct response to the workshop topics and Summer Institute format, as there were teachers who had minimal participation hours due to summer commitments, and stipend amounts varied year to year, which could have influenced their decision to participate. Although the program outcomes show that teachers indicated the Summer Institute was helpful in preparing them for integrating STEAM, it is not possible to assert that the Summer Institute was the only influence on their STEAM integration, as other factors likely influenced their performance, such as the sustained support during the school year.

Lessons Learned and Next Steps. Over the years, the program team worked to promote constructivist approaches that would support STEAM-based learning activities in classrooms, and sought to understand the economic, historical, social, and political implications to cultivating STEAM as a transformative educational model (Perales and Arostegui, 2021). These approaches seemed effective as we continuously explored and identified teacher and student needs based on real-world implications and modified the program components accordingly in the subsequent years. The changes made to the GoSTEAM PD as a result of the "Choose Your Own Adventure" model reinforce research findings on teacher wellbeing and suggest that similar approaches can be applied in an out-of-school professional learning context (Collie, 2021; Fox et al., 2020; Ortan et al., 2021; Soncini et al., 2023). Furthermore, we learned that our decision to include new workshop topics to support teachers amidst the difficulties caused by the pandemic may have slowed teacher turnover and potentially promoted a resilient teaching workforce during challenging times. The new topics focused on different technological tools for instructional use and on culturally relevant pedagogies that promote student engagement, particularly among demographic groups underrepresented in STEM. These changes were meant to address concerns, stress related to changing instructional modes, and possible job burnout, which are factors identified as contributing to increased teacher turnover (Bacher-Hicks et al., 2023; Diliberti et al., 2021; Zamarro et al., 2022).

The exploration of transformative approaches to sustain teacher training programs is necessary to ensure long-term STEAM implementation. GoSTEAM concentrated on enhancing the capacity of schools for STEAM integration and thereby sustaining STEAM integration by inviting teachers to return for multiple summers, while encouraging new teachers from existing school partnerships to join. Throughout the program, teachers continued to receive support from their school to build on their previous Action Plans over multiple years. Although it cannot be conclusively attributed to the program, teachers and school administrators have described the value of GoSTEAM participation in helping them prepare for STEM/STEAM certification, either through the state (i.e., the Georgia Department of Education) or a private organization (i.e., Cognia; Kessler et al., 2024b).

As we move forward, ongoing evaluation and reflection on teacher experiences will be crucial for refining and enhancing the Summer Institute's impact on PD and classroom practices. While GoSTEAM is flexible and easily adaptable, it is important to establish teacher development programs that can exist without the continuous need for additional resources, which is necessary for long-term success (Whitcomb et al., 2009). The program's dependence on financial and human resources to offer the Summer Institute, as well as to support Coaches and Innovators on-site throughout the year, raises concerns about its scalability and long-term sustainability. We continue to study possible components of GoSTEAM that can be scaled and sustained by understanding the outcomes from the perspectives of the program participants, community partners, and relevant stakeholders. Most importantly, as the data discussed in this paper are findings intended to holistically describe the GoSTEAM Summer Institute, we plan to supplement the data and further explore the larger program in future papers.

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ABBREVIATIONS

Georgia Tech: Georgia Institute of Technology; GoSTEAM: GoSTEAM@Tech; LMS: Learning Management System; MOU: Memorandum of Understanding; PBL: Project-Based Learning; PD: Professional Development; STEAM: Science, Technology, Engineering, Arts, and Mathematics; SWOT: Strengths, Weaknesses, Opportunities, and Threats

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