JSO JOURNAL of STEM OUTREACH

Vol. 7, Issue 2, February 2024

DesignYOU! Code Camp: Lessons Learned for Engaging Underserved Youth

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Keywords: Coding, Middle School Students, STEM Interest, STEM Education

Publication Date: February 1, 2024

DOI: https://doi.org/10.15695/jstem/v7i2.04

ABSTRACT: DesignYOU! Code Camp is a grant-funded summer outreach camp designed to increase interest in coding and STEM careers among middle school students (6th – 8th graders) through an innovative, immersive summer camp experience. To make the concepts of coding more palpable, researchers incorporated fashion and retail allowing students to learn through practical applications of the concepts taught. This paper outlines the planning, logistics, and lessons learned from the second iteration of the DesignYOU! Code Camp. Overall, both parents and students expressed satisfaction with the camp while student interest in coding increased. Successes and challenges from implementing the DesignYOU! Code Camp are discussed.

INTRODUCTION

For over two decades, there has been a conjoint effort to increase interest in STEM (science, technology, engineering, and math) education and careers particularly for underrepresented (e.g., women, minorities, first generation, etc.) students. Much of the research has focused on early academic interventions which seek to increase student's self-efficacy, perceptions and attitudes toward STEM and STEM careers (e.g., Brown et al., 2016; Newton et al., 2020). More recently, interdisciplinary approaches such as including art, music or the social sciences are common due to the pervasive nature of technology. For example, the integration of art in STEM education has been proven as an effective tool for increasing interest in STEM related careers (York et al., 2022). This can enhance the capability to learn, collaborate, and solve problems using STEM principles, a critical factor for today's students. "Scientific and technological innovations have become increasingly important as we face the benefits and challenges of both globalization and a knowledge-based economy" (National Science Board, 2007, para 4). Moreover, Generation Alpha, which began in 2010, are the most technologically savvy generation to date (McCrindle, n.d.), never having experienced life without items such as tablets and smartphones, disrupting how students traditionally learn, grow, and think. As such, developing STEM capabilities should be a primary concern as current levels do not meet the existing needs of this technologically centered global society (Ogle et al., 2017).

With the increase in technological advancements and the call from government officials for earlier computing education (Chen et al., 2019), summer code camps have increased in popularity. Interventions such as summer coding camps, industry-funded STEM camps, and free STEM learning resources for classroom teachers offer broadened opportunities via technology-enhanced learning experiences for students of all ages (United States Environmental Protection Agency, 2020). However, within the computer science discipline there remains underrepresentation of women (Stewart et al., 2020), domestic students of color, and students with lower socioeconomic status (Bryant et al., 2019). Experts suggest the addition of Art to STEM as an effective tool to engage minority and female STEM students (Kant et al., 2018) as the activities enhance creativity and thinking skills. To meet the increased demand of STEM job opportunities, guides and programs to integrate STEM programming in diverse school curricula have been developed. For example, during Computer Science Education Week, students commit to doing one hour of coding, which has been coined the 'Hour of Code'. Dynamic growth of STEM related jobs spans all industries and creates demand for job ready workers (Battelle for Kids, n.d.). Job readiness skills include STEM knowledge as well as communication, critical thinking, and collaboration skills (Naizer et al., 2014; United States Department of Commerce, 2012). Applications of artificial intelligence and data science in support of decision-making processes escalate needs for STEM workers, especially in areas related to computer and information sciences and coding.

Early investment in students' curiosity and wonder is imperative to nurture creativity and to stimulate future innovative ideas that will change and improve their world. Career aspirations begin to surface during the middle school years, yet unfortunately, many students begin to lose interest in academics during these years (Lynch, 2016). Middle school years are turbulent and challenging years; subject to confusion, prejudice, peer and social pressures, drug and alcohol temptations, and bullying that often lead to falling grades, withdrawal from others, a lack of self-confidence and self-worth, depression, and anxiety (Afterschool Alliance, 2021). Research (e.g., Cappelli et al., 2019; Stewart et al., 2021) has shown code camps as an effective tool for increasing interest in STEM education and careers; however, there are often barriers to enrolling in these types of programs. Only twenty-seven percent of parents in the lowest income bracket reported their child has technology and engineering activities available to them, compared to 44% of families in the highest income bracket, according to a 2021 report from the Afterschool Alliance, a nonprofit focused on increasing access to affordable after-school programs (Afterschool Alliance, 2021). Also, there is a 15% gap between the lowest- and highest-income families being able to access computer science learning activities and a 14% gap between the groups in access to after-school STEM programs (Afterschool Alliance, 2021). Although the research is vast on STEM camps' effectiveness particularly as it relates to underserved populations, scant literature has evaluated interdisciplinary STEM camps aimed at underserved student populations.

Fields (2009) recommended camps utilizing an informal science education approach to increase enthusiasm and interest towards science education which is echoed by the National Science Teachers Association who suggest promoting STEM to youth through camps as they emphasize creativity and enrichment and develop intellectual curiosity. Foster and Shiel-Rolle (2011) found, in a pilot study, that low cost science camps are appropriate to bring relevant science focused information to students and that STEM camps had positive impacts on science literacy and career goals. Other research reported the role of camps in producing attitudinal changes in student participants. Ouyang and Hayden (2010) found positive outcomes in attitudes of Hispanic middle school students toward science and technology following a STEM camp for 7th and 8th graders (Nadelson and Callahan, 2011). Similarly, Bathgate et al. (2014) demonstrated improvement in attitude factors among fifth and sixth graders such as understanding the value of science (appreciation), excitement in learning about science (curiosity), recognition of the role they themselves can play in 'doing' science (identity), confidence in their own ability to do science (self-efficacy), developing sufficient interest in science to motivate learning it (motivation), and the ability to remain focused even when facing obstacles (persistence). Although there is significant evidence of STEM camps' effectiveness, no research outlines an interdisciplinary approach to implementing code camps that are inclusive of design and retailing principles—connecting the theoretical with the practical applications. Thus, this paper details how a team of faculty, students, and practitioners collaborated to implement an interdisciplinary weekly summer Code camp for 6th, 7th, and 8th graders which emphasized fashion and retailing concepts. The approach was selected based on needs to expand STEM preparation especially in underserved populations, evidence of the success of informal learning experiences, and the capabilities and interests of middle-school youth.

Traditionally, STEM careers, specifically those in computer science, have engaged fewer underserved populations such as women and minorities. In an effort strengthen the pipeline, untraditional models have been found to be effective in the recruiting and retention of these populations. Moreover, the literature suggests (e.g., DeWitt et al., 2017) that interventions addressing these disparities should begin at an age where students are still open to changing their viewpoints. A vast amount of literature exists on STEM and computer science camps that take an informal approach to learning. Particularly, previous literature has focused on campers' interest (Essig et al., 2020), self-efficacy (Brown et al., 2016) and parental support (Clarke-Midura et al., 2019) as contributing factors toward broadening participation in STEM and computer science activities. Informal STEM learning experiences increase interest in STEM activities by providing a more engaging, hands-on learning environment (Roberts et al., 2018). As noted by Clarke-Midura et al. (2019) coding camps and other informal programs typically offer either block programming languages such as Scratch or Alice or scripting languages such as Python and HTML. Combining these programming languages along with non-traditional exercises may prove beneficial in sparking students' interest in STEM.

Other STEM camp studies focused on outcomes related to whether participants learned STEM concepts and whether camp content is viable for learning by younger students. For example, Clark et al. (2013) developed small group activities using the block-based Scratch programming 'language,' and affirmed the use of Scratch for teaching elementary children. Similarly, after attending a summer STEM camp, Essig et al. (2020) found an increased interest and high self-efficacy concepts related to engineering in girls aged 8 to 10.

An additional aspect of investigation focused on elements and practices that were proven effective for camp success. Fields (2009) found that peer relations and interactions contributed to a positive camp environment. Additionally, Fields (2009) reported that students felt empowered when they autonomously used the equipment and technology. Further, learning from peers and experiencing use of learned concepts in other contexts emerged as important factors for camp success. Collaboration between engineers and K12 teachers in building and delivering camp content was identified as an important success factor for science camps. This finding endorsed the importance of partnerships between teachers and engineers or other practitioners in designing and delivering camp content (Hammack et al., 2015). Ouyang and Hayden (2010) argued that camp teachers contributed to success, noting that "with proper support, science teachers can become advocates for both computing concepts and technology related careers" (p. 233). Finally, a study by Yildirim and Türk (2018) captured specific teacher perspectives about STEM camp success. They observed that camp assignments should have real life orientation; content must be age appropriate; time and classroom management skills were critical; and camp teachers should not only be competent in STEM content but also in pedagogical principles and establish positive relationships with students.

PROGRAM DESCRIPTION

The process for planning and preparing for the DesignYOU! Code Camp is highlighted below. Creation and execution of the DesignYOU! Code Camps were generally sequential; however, some phases were ongoing and spanned multiple stages. Similar to Essig et al. (2020) these stages included: identification of need, strategy, and partners; funding; curriculum development; staffing; logistics; and recruiting. Previous literature guided the authors' decision making with each step outlined in the following subsections.

Identification of Need, Strategy, and Partners. Faculty members at a large southwestern university evaluated multiple intervention methods and selected summer camps as the tool to encourage both STEM career orientation and early skill development. Selection of camps as the means was predicated not only on positive reviews in the literature, but also on the capacities of the University of Houston, student interest in summer programs, and awareness of resources including campus facilities and personnel, and external funding. Gaps in self-confidence related to STEM topics begin to widen during middle school (Pajares, 2005), therefore, the camps described herein focused on students in 6th, 7th and 8th grade.

Partnerships were desired and obtained to enable high quality camp experiences. First, alliances were built with area schools and the community. These included local public, private, and charter schools in the underserved neighborhood area. The neighborhood, located in Houston, is a historically Black area which predominately contains underserved students of color. Five schools serving 6th through 8th graders were selected to partner with the DesignYOU! Code Camp. Additionally, two social services agencies were included. Expansion beyond the local neighborhoods prompted inclusion of the city's school district as a partner. These school and community partners assisted with student recruitment, liaison with parents, and general consultation. The partnerships were formed by contacting school principals and superintendents as well as directors of social service agencies by email, phone, and individual visits. Those contacted then disseminated the camp opportunity to their faculty, staff, campuses, and parents. Written partnership agreements nor MOUs were not required since the primary role of the partner schools and social agencies was restricted to assistance in recruiting students. Next, strategic campus partnerships were also created. These included the faculty and staff within the College, the Advisory Board for the retailing program, and the Office of Neighborhood and Strategic Initiatives. The College faculty provided curriculum support, while the staff facilitated camp logistics and procurement. The Advisory Board not only offered curriculum advice, but also donated funds and merchandise to be used as camper success incentives. The Advisory Board was a pre-existing board comprised of retailers and educators that support the retailing degrees and programs at the University. The Office of Neighborhood and Strategic Initiatives was a liaison to the local community and aided in recruiting potential students.

Funding. Funds to support the DesignYOU! Code Camps were obtained from a state workforce commission. Research faculty had to provide monthly status reports for the commission as well as detailed accounting of the camp budget. While the camp team desired to offer the camps in 2020 and 2021, COVID-19 thwarted that desire. Targeted youth for the grants were those from low-income families, minorities underrepresented in STEM fields, youth in foster care, and students with disabilities.

Curriculum Development. The curriculum was created by a team of faculty with experience in STEM and coding education. Three one-week camps were created; each week focused on one grade level to create grade-specific camper cohorts. Week one was sixth graders; week two was seventh graders; and week three was eighth graders. Individual components of the curriculum included videos highlighting student award-winning projects, field trips, weekly STEM themes, interaction with STEM professionals, teambuilding activities, campus engagement tours, creative projects, group presentations, and individual work. Technical instruction utilized independent and group work in a computer lab using CS First - Fashion and Design Curriculum, Hour of Code, and computer language tutorials and applications that created age appropriate, real-life problems for students to analyze. Scratch and Python with applications to drones, robots, and Alexa Dots played valuable roles in student engagement and application. Goals for the coding experiences and applications were for each camper to: a) identify the role of coding in retail and everyday life, b) create simple codes, and c) experience real world applications of coding. Care was taken to accommodate the variety of student coding experiences and capabilities. Supplemental activities were available for more advanced campers including more advanced coding languages and coding learning tools such as Codecademy (https://www.codecademy.com) and CodePen (https://codepen.io). Additionally, the researchers included peer learning and other group activities to facilitate informal learning which has been proven successful in increasing interest in STEM careers.

A number of planned informal learning activities took the campers outside of the computer lab to other areas of campus to experience college life. On-campus activities included in each week-long camp were a campus tour and scavenger hunt, time spent with technology professionals on campus, and demonstrations to highlight the use of campus food delivery robots and 3D printers. The goal of these on-campus activities was to encourage campers to visualize their future selves as individuals pursuing higher education by attending college. Group activities were planned to build teamwork and collaboration skills among campers and between campers and camp counselors and teachers. Activities included roller coaster and card building challenges, drone target practice, lunches with STEM professionals, and robot races with students working in teams (see Table 1). Based on the previous literature, researchers created a schedule to maximize informal learning, peer interactions, creativity, and engagement.

Staffing and Logistics. In addition to volunteers who shared their professional experience and expertise, DesignYOU! Code Camps functioned with a staff of eleven. These included three grant principal investigators, one camp director, two senior instructors, and five camp mentors or counselors. Additional university staff members assisted with camp logistics, purchasing, and safety. Researchers were intentional in their hiring, recruiting staff that were reflective of the camp population which included students of color, low socioeconomic background, and disabilities. In addition to camp orientation, camping staff were required by law to participate in training that outlined the proper protocols for working with minors. Each member of the camp staff was required to score 100% on the final quiz of the mandated Child Protection Training.

Logistics and planning were key elements in hosting the successful DesignYOU! Code Camps. Considerations spanned the concern areas of safety and health (including COVID-19 protocols), meals and snacks, safe and within-budget bus transportation to and from campus to field trip locations each week, faculty and staff hiring, assignments and training, campus physical arrangements such as computer labs with software needed for the activities, logins for the computers for the student guests, computer security with respect to online vulnerabilities for youth, and the processes for reaching out to the community to recruit camp attendees, certify their eligibility, and enroll them in camp. Parent pick-up processes and protocols were developed.

Camp dates were determined by the academic calendars of both the University and the local schools to ensure fit with campus space, and camper and staff availability. The home base for the camps was an academic building with classrooms, computer labs, and administrative, research, and faculty offices. Lighter building usage during the summer made it possible to hold the camps there.

Recruiting. Camper recruitment meetings were held with the principals or counselors at each of the partner schools and social service agencies. These meetings introduced the DesignYOU! Code Camps and outlined the process of recruitment. Printed materials were provided for each school and agency to post and distribute. They, in turn, publicized the camp opportunity and directed the students and their parents to register. In a few cases, schools arranged information and registration meetings with parents. The registration process was online and included both an English and Spanish version of the application. This allowed parents who were non-native English speakers to register their students for the camp. The online application included all required registration information as well as parental releases in a single format. To manage questions and concerns from parents and camp partners, an email alias was created. This sent an email to all camp administrators and allowed for rapid response to queries.

Day 1 – Merchandise Monday. The first day of DesignYOU! Code Camp was dedicated to introducing concepts associated with retailing and technology. After a series of icebreaker activities including conversation cubes and bingo, the faculty gave a presentation explaining the fundamental aspects of retail and how retail technology impacts their daily lives. Following a short discussion, campers were then instructed on how to use the programming software Scratch

Table 1. *Summary of activities and interactions in each day of the camp.*

	Monday	Tuesday	Wednesday	Thursday	Friday
Theme:	Merch(andise) Monday	Designers at Work	Retailers at Work	Technology in the Tropics	Forward Friday
8:30 am - 9:00 am	Students arrive and are directed to Shasta's Café for the 'Conversation Cubes' and breakfast snacks	Students arrive and are directed to Shasta's Café breakfast snacks	Students arrive and are directed to Shasta's Café breakfast snacks	Students arrive and are directed to Shasta's Café breakfast snacks	Students arrive and are directed to Shasta's Café breakfast snacks
	Administrative tasks & Introductions	Field trip #1 -Buckle, Baybrook mall	Field trip #2 – UH Bookstore	Making the Sale	Finalizing coding projects
9:00 am - 9:20 am	'Conversation Cubes', Welcome, Introductions to Camp staff, Dean's welcome	Get ready for bus trip (restroom, water); Go out to bus at 9:10 and leave by 9:20	Team-building Challenge - Towers of spaghetti & marshmallows	Team-building Challenge - Roller coaster challenge	Team-building Challenge - Card tower
9:20 am - 9:30 am	Get to know each other activity - Bingo and assignments to groups	Travel (9:20 a.m. - 9:45 a.m.)	Travel to bookstore @ 9:40 a.m.	Introduction to Python	Post-camp Assessment
9:30 am - 10:00 am	Presentation - What is Retail and how does technology play a role?				
10:00 am - 10:30 am	Pre-camp Assessment, Create Scratch accounts, distribute water bottles & label w/names, distribute & change into camp t-shirts	Field trip #1 - Buckle, Baybrook mall (10am - 11am)	Field trip #2 - UH Bookstore (10 am - 11 am) Students are divided into 4 rotational groups: visual merchandising activity, accounting tools in merchandising, technology used for inventory, technology used in sales	Python programming projects	Python programming projects
10:30 am - 11:15 am	Begin Scratch programming projects			Meet campus field delivery robots	
12:30 pm - 2:00 pm	Programming in Scratch (Retail curriculum, "Fashion & Design" from csfirst.withgoogle.com)	Scratch programming project	Blacklight Bowling in Student Center (1 -3 p.m.)	Programming robots Programming drones	Toilet Paper Fashion Show
3:00 pm - 3:45 pm	Scratch programming project	Tech Talk	Team sales pitch activity	Programming drones Programming robots	Celebration with families, school representatives
3:45 pm - 4:00 pm	Student pickup	Student pickup	Student pickup	Student pickup	Student pickup
4:00 pm - 5:00 pm	Camp staff daily debrief	Camp staff daily debrief	Camp staff daily debrief	Camp staff daily debrief	Camp staff daily debrief

and began work on individual projects. Scratch, a coding language with a simple visual interface that allows youth to create games, animations, and stories was selected because of its age-appropriateness as an initial coding language. The primary learning objective was to engage individual campers with a simple coding process. In the afternoon, students were introduced to the CS First – Fashion and Retailing program and were given the opportunity to continue exploring this software or continue working on their Scratch projects. Students also worked with the fashion and design camp staff to craft a series of apparel items, including a tote bag made from a t-shirt.

Day 2 – Designers at Work. On the second day of camp, researchers partnered with the retail store Buckle located in a nearby mall. Campers were exposed to various functions of the retail store, including merchandising and displays, customer service, and using the store's POS (point of sale) technology. Buckle employees worked closely with campers in four designated stations around the store to ensure that all students received personalized instruction and had ample time to ask questions. Employees also shared their own experiences working in retail and offered guidance to students with great interest in fashion and retailing. Following the field trip, students had the opportunity to continue working on their individual projects on Scratch. During this time, students were guided by camp staff but were encouraged to work creatively and without extensive instruction.

Day 3 – Retailers at Work. The third day of DesignYOU! Code Camp focused on visiting other retail settings and expanding the camper's knowledge of design technology outside of the retail industry. Researchers partnered with the university bookstore to explore how a retail store on a campus operates. Campers were divided into four rotational groups that examined visual merchandising, accounting, and sales and inventory technology. During the afternoon, campers engaged in Blacklight Bowling. Students were educated on the digital technology that powers the lighting displays in the bowling alley then had the opportunity to bowl. Campers then returned to the technology lab and were able to complete work on their individual Scratch projects. The activities of day three were aimed to provide continued education on retailing and coding technology, but also expose them to the various aspects of a college campus and hopefully instill a desire to pursue higher education in the future.

Day 4 – Technology in the Tropics. On the fourth day of camp, new technology programs were introduced to campers. Students received an introductory lesson on the Python programming software and were given instructions to follow to complete an independent project. Once that project was completed, camp staff designed additional curriculum, including interfacing with Alexa Dots, robots, and drones to further challenge the students. Campers then visited with campus food delivery service to learn about the food delivery robots which delivered food autonomously across campus. Following this presentation, students eagerly observed the robots picking up and delivering food across campus. In the afternoon, based on completion of Scratch-based activities and readiness for greater challenges, campers were divided into groups and given the opportunity to both program Lego robots and program and fly drones on campus. At the end of the day, students were able to decide whether they wanted to work in the technology lab on Python or work with the fashion staff on an independent design project. Python was selected as a more advanced programming language to provide students with exposure beyond Scratch. While with Scratch, campers created on-screen coding projects, their experience with Python allowed them to program and manipulate simple robots and drones.

Day 5 – Forward Friday. On the final day of camp, students were encouraged to wrap up all projects that were started throughout the week. Those with an affinity towards coding and programming were able to complete their projects using the Python software. Campers who were more inclined towards the fashion and design curriculum were tasked with leading the toilet paper fashion show that occurred later in the afternoon. Applying design concepts used in both code development and fashion, these students designed and created a toilet paper outfit concept along with their group and a designated model. The toilet paper fashion show took place just prior to the arrival of parents/families to celebrate the accomplishments of the students throughout the week. During the celebration, parents and families of campers were able to walk around the technology lab to observe the work of their student and participate in a camp-wide assembly displaying the incredible projects that campers completed during the week. All were then invited to leave comments on a public display board regarding their experience at the DesignYOU! Code Camp.

Camp Implementation. This camp description spans two years of implementation of DesignYOU! Code Camps. The first iteration of the June coding camps specifically catered to female students who were from underserved communities. However, with the second iteration, the funding agency, the Texas Workforce Commission, and the researchers decided to open the camp to male middle school students to be more inclusive. This change to co-ed camps did not alter camp recruitment nor curriculum. Approximately 45-50 students attended each week with about 140 students served each year. The novelty of the DesignYOU! Code Camp was the intersection of fashion, retailing, and coding. Students were exposed to coding activities using Scratch and Python in addition to activities that sparked creativity through handmade bags and bracelets from sustainable materials. Camp staff, most of which worked in the fashion/retail and coding fields, served as mentors for students sharing knowledge of the industry and real-life work problems.

METHODS

This study used a survey as the research strategy to assess the effectiveness of the camp. Parents filled out an application for acceptance to the camp and provided consent for their child to participate in the research study. Prior to administering the survey, a member of the research team explained the process to campers and those who did not provide assent were moved to another room for an alternate activity. Questions on the survey were adapted from the Middle School Student Attitudes toward STEM Survey created by the Friday Institute for Educational Innovation (2012) reported on a 5-point scale (1 = strongly disagree, 5 = strongly agree). This scale assessed students' attitudes toward science, engineering and technology, math, coding, and learning (decision making, working with others and leadership skills). The survey was administered on the first day of the camp and again on the last day of the camp. An Independent-Samples t test was run to determine if differences existed after students completed the camp. ANOVA was used to ascertain if differences existed among 6th, 7th, and 8th graders after attending the camp. Parental surveys were also distributed after the camp concluded and were used to assess satisfaction with the camp.

RESULTS

The primary goals of the DesignYOU! Code Camp were to influence the interest of middle school youth in coding and provide hands-on experiences in a summer camp that includes challenging and innovative concepts and experiences in computational thinking, problem solving, and analytical skills, while fostering an interest in STEM related careers. To assess the influence of the DesignYOU! Code Camp, pre

Table 2. *Characteristics of Camp Participants.*

Measures (Across all Camps)	TOTAL	Survey Participants
Total Number of Enrollments	139	90
Total Number of Completions	139	90
Number of Female Participants	68	41
Number of Male Participants	71	46
Number of Foster Youth Participants	1	--
Number of Participants with Disabilities	7	--
Number of Low Income Participants	44	35

and post survey responses were analyzed for differences. Of the 139 registered campers, 128 consent forms were obtained from parents, and finally 90 campers provided assent. Table 2 details the characteristics of the campers. Additionally, campers' interest in the camp along with demographic information was obtained. Reliabilities were calculated for each subdimension, three items in the Math subdimension were reverse coded and one item in the code subdimension was dropped to increase reliability. Cronbach's α for all measures were greater than 0.90, which indicates adequate reliability for all subdimensions.

Surprisingly, the number of respondents who took the survey were split evenly amongst male and female campers with three participants identifying as non-binary and the remainder preferring not to say. Approximately 45.45% of respondents were in the sixth grade, 25% in the seventh grade and the remaining 29.55% in the eighth grade. Pre and post means were calculated for each subdivision (see Table 3). Independent-Samples T Tests were run for each subdimension to ascertain differences. Results for each outcome variable revealed insignificant differences for math (t(173) = .021, p = .22), science (t(176) = -1.142, p = .57), engineering and technology (t(174) = - .718, p = .40), coding (t(172) = -1.46, p = .87), and skills (t(174) = -.142, p = .33) (see Table 4).

To determine if any changes existed across grades (6th, 7th, 8th), one-way ANOVAs were run on post camp data on the following variables: attitude toward math, engineering and technology, coding, and science as well as camp experience and skills. Results revealed significant difference in attitudes toward math F(2, 83) = [3.756], p = 0.02), engineering and technology F(2, 83) = [4.928], p = 0.01), and coding F(2, 83) = [4.360], p = 0.01). In relation to attitudes toward Math, 6th graders (*M*=4.100) significantly differed from 7th graders (*M*=3.4728); in relation to attitudes toward technology 6th graders (*M*=3.9587) significantly differed from both 7th graders (*M*=3.4638) and 8th graders (*M*=3.4762); and in relation to attitudes toward coding 6th graders (*M*=3.6844) significantly differed from 8th graders (*M*=3.1429).

Table 3. *Group Statistics. Pre- and post-means of survey.*

	Pre-Survey or Post-Survey	N	Mean	Std. Deviation	Std. Error Mean
Math	Pre-Survey	87	3.7529	.83046	.08904
	Post-Survey	88	3.7500	.96267	.10262
Science	Pre-Survey	90	3.3086	.62959	.06636
	Post-Survey	88	3.4167	.63220	.06739
Engineer	Pre-Survey	88	3.5997	.63963	.06818
	Post-Survey	88	3.6742	.73351	.07819
Code	Pre-Survey	90	3.2356	.76779	.08093
	Post-Survey	84	3.4048	.75950	.08287
Skills	Pre-Survey	89	3.9326	.58364	.06187
	Post-Survey	87	3.9460	.66592	.07139

Overall participants expressed having a positive experience during camp. Seventy-seven percent of campers who participated in the study reported either strongly agreeing or agreeing with the statement "*I enjoyed my camp experience this week.*" Additionally, over 60% learned from the camp coding activities and group activities and enjoyed the field trips. Results of the survey also revealed that activities most reported as beneficial to campers included field trips to experience behind-the-scenes technology applications of retail, campus scavenger hunts and dining, hands-on coding, interactive coding games, and interactions with professionals employed in STEM fields related to coding. Campers reported expanded views of STEM careers and their opportunities in STEM fields, and greater self-confidence in their coding abilities. Additionally, engagement in on-campus, university readiness experiences encouraged interest in education beyond middle and high school.

Results from the post-camp parental survey showed high levels of parental satisfaction regarding camp outcomes: 88.9% of parents (n=27) agreed or strongly agreed with the statement, "*I am satisfied with the activities at the DesignYOU! Code Camp;*" 88.9% of parents (n=27) agreed or strongly agreed with the statement, "*I would recommend the DesignYOU! Code Camp to other parents;*" and 81.5% (n-26) of parents agreed or strongly agreed with the statement, "*If given the opportunity, I would sign up my child for DesignYOU! Code Camp next year*."

Although no significant differences existed between pre and post surveys assessing students' interest in coding, interest in STEM related careers did occur. These results suggest that students, even those from marginalized and underrepresented communities are exposed to coding and other STEM related activities in their current school curriculum. Therefore, the DesignYOU! Code Camp served as a tool for reinforcing STEM related skills instead of introducing these skills to students. Additionally, this camp is unique in its approach allowing students to take a non-traditional approach to coding by incorporating elements of fashion and retailing. Similar to York et al. (2022), camp leaders found that incorporating creative activities along with traditional STEM skills (coding) is effective at instilling interest in STEM careers.

Table 4. *Results from independent samples t-test.*

		Levene's Test for Equality of Variances		t-test for Equality of Means						95% Confidence Interval of the Difference	
						Significance					
		F	Sig.	t	df	One-Sided p	Two-Sided p	Mean Difference	Std. Error Difference	Lower	Upper
Math	Equal variances assumed	1.512	.220	.021	173	.492	.983	.00287	.13598	-.26551	.27126
	Equal variances not assumed			.021	169.891	.492	.983	.00287	.13586	-.26532	.27107
Science	Equal variances assumed	.319	.573	-1.142	176	.127	.255	-.10802	.09458	-.29468	.07863
	Equal variances not assumed			-1.142	175.874	.127	.255	-.10802	.09458	-.29469	.07864
Engineer	Equal variances assumed	.694	.406	-.718	174	.237	.474	-.07449	.10375	-.27926	.13027
	Equal variances not assumed			-.718	170.835	.237	.474	-.07449	.10375	-.27928	.13029
Code	Equal variances assumed	.024	.877	-1.460	172	.073	.146	-.16921	.11588	-.39793	.05952
	Equal variances not assumed			-1.461	171.412	.073	.146	-.16921	.11583	-.39785	.05944
Skills	Equal variances assumed	.950	.331	-.142	174	.444	.887	-.01339	.09433	-.19957	.17278
	Equal variances not assumed			-.142	169.980	.444	.887	-.01339	.09447	-.19988	.17309

Logistical challenges during the DesignYOU! Code Camp were addressed, resolved, and served to refine the preparation process. First, the enrollment process proved much more time consuming than expected, requiring extended time to communicate with school and agency personnel; to respond to questions from schools, agencies, and parents; to distribute and collect paper applications; to review and process applications; and to communicate with parents regarding incomplete information and individual needs. This process was improved by offering the application online. Another challenge was strict campus and state protocols for contracting for goods and services. Therefore, the researchers worked closely with staff to order the needed supplies for a successful camp. Camp staff were used to keep track of materials to ensure sufficient supplies for all three camp weeks.

Interestingly, the 2022 iteration of the DesignYOU! Code Camp provided a new set of challenges not encountered previously. The supply chain issues of COVID-19 affected the ordering of camp supplies and timely arrival, but supplies were quickly ordered from alternate vendors. Another problem arose from the success of recruiting campers underrepresented in STEM which included Hispanic students. The need for Spanish language translation was not anticipated. The camps were conducted in English without issue, but many parents spoke only Spanish. Translation was needed for flyers, posters, application materials, and emailed communications. Upon the conclusion of camp, all camp materials were translated to Spanish, so that, if the next camp is funded, all materials will be fully bilingual. Perhaps the largest challenge was how quickly the students were able to learn how to code and those suggested that coding experiences are becoming more frequent in curriculum. Therefore, summer camps should build on these experiences by integrating more real world, inter-disciplinary applications to expand the reach of STEM interest. In response, camp staff spent extra time outside of the camp day preparing new activities. One person gathered the most prepared and gifted attendees and taught them how to program in the C++ computer language. This extra effort by camp staff provided sequential learning for all campers. Knowing that campers varied in their pre-camp preparation and learning capabilities, the needs of each were met by allowing all to succeed at their own level with no pressure to move in a "lockstep" curriculum. Finally, the unexpected fluidity of camp enrollment prior to the first day of camp was a major challenge, but waitlisted students were admitted and filled those openings as quickly as possible.

In brief, best practices were judged to include: a) recruitment via community partner schools; b) enthusiastic involvement by a diverse, camper-oriented staff; c) partnership with University and community retailers; and d) a well-designed, yet flexible curriculum. Opportunities for improvements and/or attention for the future were found to include: a) the registration process, especially related to online and bilingual registration; b) strategies to build upon the increasing sophistication of camper coding backgrounds and skills; and c) efforts to mitigate the impacts of campers who register and then vacate their slots prior to the camp due to changing family schedules.

IMPLICATIONS AND CONCLUSIONS

While early success stories centered on enthusiasm for the DesignYOU! Code Camps among the school and agency partners, data analysis showed positive results in camper attitudes and perceptions. The University of Houston showed value for the DesignYOU! Code Camps by highlighting the camps in official publications. Retailers were eager to support the camps because of their focus on retail technology and beyond. Commercial retail sponsorship was exceptionally generous. In 2022, parent post-camp surveys showed very positive mean satisfaction ratings (4.4 of 5). In sum, campers, parents, staff, partners, and the University expressed positive perceptions of the DesignYOU! Code Camps!

The experiences shared here illustrate multiple years of successful summer camps, designed to increase interest in STEM and STEM careers for middle school students, especially in the area of coding. It can serve as a stimulus and model for educators seeking means to encourage and extend interest in STEM skills and careers among various populations, perhaps becoming a regular fixture in summer school experiences for students of locally underserved schools, and in supporting communities. Careers involving Science, Technology, Engineering and Mathematics have a promising future for youth but should not be limited to only traditional careers as technology is ubiquitous. According to the U.S. Bureau of Labor Statistics, in 2020 STEM occupations paid more than double that of non-STEM occupations, on average, and those jobs are expected to grow rapidly through 2030. Students of all race, ethnicity, and gender deserve equal opportunities for a successful and productive future in STEM. DesignYOU! Code Camps offer an illustration of one method to increase student perceptions and knowledge of STEM careers and skills.

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The manuscript was written through contributions of all authors. All authors have given approval to the final version of the manuscript.

Note: University of Houston, Institutional Review Board Approval # STUDY00003639.

FUNDING SOURCE

This work was supported by the Texas Workforce Commission grant [000184511]. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the Texas Workforce Commission.

ABBREVIATIONS

POS: Point of Sale; STEM: Science, Technology, Engineering, and Math

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