A Survey Based Evaluation of the Efficacy of a Girls Who Code Club at USI

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***Abstract*—Programs like Girls Who Code (GWC) are pivotal in working to inspire and equip young women with the skills and confidence needed to pursue careers in computing. Understanding the impact of such initiatives is particularly important for addressing the decline in interest among girls aged 13 to 17, a critical period for career decision-making. By evaluating the effectiveness of employing a GWC club at our university, this research aims to uncover strategies that can successfully attract and retain women in computer science (CS) in our region. The goal is to not only reverse the trend of declining female participation but also to sustain their interest in the field of computing.**

***Index Terms*—Girls who code, student engagement, female enrollment, computer science clubs, gender gap, computer science attitude survey.**

I. Introduction

At the University of Southern Indiana (USI), using the girls who code (GWC) platform, the computer science (CS) faculty and students set up an on-campus coding club for girls enrolled in grades 3-12 in the greater Evansville region.

A. Problem Statement

As a part of this research, we employ a CS attitude survey [1] for evaluating the effectiveness of our GWC club at USI in increasing the interest of girls and young women towards computer science.

B. Motivation

Over the past few decades, the field of computer sciences has experienced a significant decline in female participation. Since 1995, the percentage of women in computer science has decreased by 13%, dropping from 37% to a mere 24%. Addressing this gender gap is essential to ensuring a balanced and inclusive future for computer science [2]. Programs like GWC are pivotal in this effort, working to inspire and equip young women with the skills and confidence needed to pursue careers in computing. This research aims to explore the efficacy of a GWC club at USI in reversing the decline in female participation, and contributing to a more equitable gender representation in computer science [2].

II. Background and Related Work

The under-representation of women and the gender gap problem in computer science is a well-documented issue, with numerous studies exploring the experiences of female students in this field [3][4][5][6]. The gender imbalance in computer science education and the technology industry has garnered widespread attention, leading to various interventions aimed at boosting girls' commitment to computing [7]. Coding clubs have emerged as a unique intervention aimed at fostering interest in computer science among young girls [8]. The impact of coding clubs on women's interest in computer science is multifaceted. These clubs provide a supportive environment where girls can explore computing concepts, collaborate on projects, and build their technological capabilities [9] [4]. They help to challenge stereotypical assumptions of male superiority in the field that can help women feel more technologically capable and motivated to pursue computer science [7].

GWC offers free programs based on coding activities for students in grades 3-5 and grades 6-12. Interested facilitators can set up a GWC club at their respective institutions to promote a safe and supportive environment of peers and role models for girls and young women to see themselves as computer scientists. In a recent GWC report, an impact reaching 580,000 girls across the world has been mentioned. Over 50% of the girls served come from historically underrepresented groups. Notably, GWC alumni major in computer science or related fields at a rate seven times the US average [2].

Despite the potential benefits of coding clubs, there are challenges to their implementation and effectiveness. Therefore, more research is needed to understand the best practices for implementing coding clubs and other interventions aimed at increasing the interest of young women in computer science [9].

GWC club at USI aims to bring GWC's main values to our campus to support young women in our community in their interests in computer science. In the first semester, the club was designed to host girls in grades 6-12. The GWC modules were the primary focus. In the second semester, the club expanded to accommodate girls in grades 3-12. While using the GWC modules primarily, experiences and learning were supplemented with the use of Sphero robots [10]. Moreover, the effectiveness of the club at USI was measured using the computer science attitude survey [1], and the results are discussed in the following sections.

III. Approach and Uniqueness

Our approach began with promoting the GWC club through traditional methods such as flyers and email chains and relying heavily on word-of-mouth promotion to attract participants.

Before each semester, our group collaborated to develop a comprehensive lesson plan with a clear end goal for the students to achieve, focusing on a final project and structuring our lessons around this objective. Each meeting featured a "Woman in Tech" spotlight, highlighting the accomplishments of influential women in the tech industry. Following each video, we encouraged the girls to share their insights and discuss the messages they took away, fostering a deeper understanding and connection to the material.

A novel contribution our program at USI is the integrating of additional coding modules, developed by the facilitators at USI, as an addition to the standard curriculum provided by GWC. The coding activities included robotic programming using the Sphero Bolt robots [10]. This innovative hands-on experience substantially increased student engagement. Moreover, GWC at USI is the only club in the greater Evansville area running a coding project of this scale for students in grades 3-5 and 6-12.

To evaluate the impact of our program and measure changes in students' perceptions of gender and race related stereotypes in computer science, we used the Computer Science Attitude Survey [1] at the end of the semester. Students completed the survey during one of our final sessions, ensuring a high response rate and immediate reflection on their experiences. The survey included questions to assess their confidence in their abilities, interest in pursuing computer science, and views on gender equality.

IV. Results, Analysis, and Future Directions

The qualitative feedback we received provides a compelling narrative of the program's impact. We discuss the analysis of our survey data using our three research questions defined below.

A. Research Question 1: Does the GWC program increase interest in entering the CS field (academics/career)?

Based on the our survey results, approximately 80% of the girls are fairly certain about majoring in computer science, and more than 90% express confidence in achieving good grades in the subject. Over 71% of the participants believe that being recognized as an outstanding computer science student would bring them happiness, while over 85% feel a sense of pride in being regarded as the best in their field. Similarly, over 85% of the girls express enthusiasm for winning a computer science award or securing first place in a programming contest. Notably, around 79% of the girls do not associate earning top grades in computer science with being labeled a "nerd", underscoring a positive perception of academic success in this field. Furthermore, 100% of the girls affirm that studying computer science is equally appropriate for girls as it is for boys. Over 71% of the participants enjoy writing computer programs, highlighting their genuine interest in the discipline. These findings suggest that the Girls Who Code program effectively fosters a strong interest and confidence in pursuing computer science, both academically and as a potential career path.

B. Research Question 2: Does the GWC program change the perception of gender/race-related stereotypes in the field of CS?

Indicating a high confidence in gender equality in programming abilities, 92.9% of the students strongly agreed with the statement: "Girls are just as good as boys at programming." 100% of the students strongly agreed to "It's just as right for girls to study computer science as it is for boys", reflecting a unanimous belief in the appropriateness and capability of girls to pursue computer science. 92.9% of the students strongly agreed to the survey statement, "I would trust a girl as much as a boy to solve important programming problems", showing strong trust in their own abilities to handle significant programming challenges. On the survey statement, "Girls are definitely logical enough to do well in computer science", 92.9% of the students strongly agreed, reinforcing the belief in girls' logical capabilities to excel in computer science. The survey statement, "It's hard to believe a girl could be a genius in computer science", received a "strongly disagreed" response from 85.7% of the students indicating that most students reject the stereotype that girls cannot be geniuses in computer science.

C. Research Question 3: Are there factors that lead to student retention in the STEM field after GWC program?

About 80% of the girls are moderately confident they will major in computer science. The facilitators, who are women majoring in the field, served as relatable role models. Additionally, over 85% of the girls expressed interest in winning a computer science award, and that the use of friendly competitions makes learning enjoyable. Around 85% of the students believe that understanding programming is useful for their future careers, reinforced by the "Women in Tech" spotlights showing real-world *she-roes*. The overwhelmingly positive responses indicating that we fostered a sense of sisterhood and a supportive environment among the students, is evident from comments such as:

- "I enjoyed the "Women in Tech" spotlights because they made me feel more hopeful about the future of girls in CS degrees and occupations."
- "I am very enthusiastic about coding. I plan to continue this for a while."
- "it's fun and i get to know more women who are interested in computer science.
- "I love going here and it's the highlight of my day!"
- "I love this Girls Who Code program very much because it teaches me how to code. Coding is fun."
- "It's the best after school project."
- "This class is one of my favorites!"

In future, we will work towards enhancing our GWC curriculum at USI with a set of innovative and interactive coding activities that cater to specific interests among the 3-5 grade girls and the 6-12 grade girls in the greater Evansville area. Moreover, we plan to design more survey tools for further assessing student engagement and retention of student interest in CS.

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