

“This is not 13th Grade”: Making the Transition to College through Coding

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Abstract

The Summer Coding Academy 2017 at the University of the Incarnate Word (UIW) was designed for the first-year freshman and transfer students with a declared Science, Technology, Engineering and Mathematics (STEM) major. The camp participants were from diverse STEM fields that included engineering, biochemistry, nuclear medicine science, biology, computer information systems, meteorology, and 3-D animation & game design. The objectives of the camp were (1) to improve the student’s preparation for a rigorous STEM degree, (2) to increase their skills in communication and data analytics through coding and robotics. This paper describes the teaching materials that we utilized, the results of students evaluations, lessons learned and the future work.

1. Introduction

Soon-to-be high school graduates from around the world apply to the University of the Incarnate Word (UIW) for their STEM (Science, Technology, Engineering and Mathematics) program. Many of them have yet to fully comprehend the expectations and demands that come along with becoming a first-year student.

Research shows that summer bridge programs are a popular strategy for increasing college readiness among recent high school graduates [5,7,8,9,10]. The University of California conducted a study on effectiveness of a summer bridge program on the academic, personal, and social development of underrepresented and low-income students during their first year study. Their data indicated that summer bridge programs can help facilitate students' transition and adjustment to university life and improve their academic performance and persistence rates [9]. A similar study conducted by Walpole, et. al., examined that the students who participated in a summer bridge program showed an increase in their academic and social engagement and student retention was higher than that of the control group who did not participate in the summer bridge program [10].

Summer Coding Academy - Program

The Summer Coding Academy was a free one-week camp that provided service to a low-to-moderate income student population in STEM major. The objectives of the camp were twofold:

1. Address students’ academic readiness and self-efficacy for a rigorous STEM degree.
2. Strengthen incoming freshman students’ skills in communication, effective collaboration, and data analytics through coding and hands-on robotics activities [1, 2, 3].

The outcome of the first objective was accomplished by the presentations made by the guest speakers from various industries, such as Southwest Research Institute, Boeing, Rackspace, and First Year Engagement Office at UIW. Their presentations emphasized the following skills/attributes that students need in order to be successful in college and career:

- Time management – class attendance, planning, class assignments
- Networking and communication – soft skills, participation in student clubs, gaining information about internships
- Creativity and problem solving – applications of MATLAB used in industry by STEM experts.

The outcome of the second objective was achieved by developing and implementing technical solutions to problems in computer programming, robotics, and presenting the results orally and in a written final report. Specific outcomes in analytical skills were:

- Conceptual mastery of basic programming constructs in MATLAB [4,6]: variables, functions, loops and conditional statements
- Understanding of basic robotics: sensors, actuators, and artificial intelligence
- Moderate understanding of abstraction, computational thinking and development

In the following sections, we described the results of the camps, lessons learned and future work.

Table 1 – Post-Camp Survey Results

For each of the following statements, use the given scale to indicate your level of agreement about how your participation in Coding Camp has impacted your academic life.										
Statement	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
The Coding Camp has improved my problem solving skills.	50%	66.7%	50%	33.3%	0%	0%	0%	0%	0%	0%
The Coding Camp has improved my critical thinking skills.	62.5%	66.7%	37.5%	33.3%	0%	0%	0%	0%	0%	0%
The Coding Camp has improved my collaboration skills.	50%	66.7%	50%	33.3%	0%	0%	0%	0%	0%	0%
I would be interested in participating during next year’s Coding Academy as a Camp Mentor*.	25%	0%	25%	88.9%	37.5%	0%	12.5%	11.1%	0%	0%

* In 2017 student surveys, this question was designed as a ‘Yes’ or ‘No’ question. In order to quantify 2017 survey results, ‘Yes’ and ‘No’ answers were classified as ‘Agree’ and ‘Disagree’ respectively.

2. Results

During the Summer Coding Academy 2017, we conducted pre-camp, daily, and post-camp surveys. Table 1 summarizes student survey results and distribution of 2016 and 2017 participants’ answers to survey questions. The students also submitted a post-camp career goal evaluation during the last day of the camp. Pre-camp survey results indicated that about 82% of students came with zero experience in using MATLAB and 64% with zero experience in using Lego Mindstorms.

Table 2 shows students’ response to a post camp survey question about their understanding on application of MATLAB in their STEM field.

Table 2 – Post-camp survey question about MATLAB

Question: How would you incorporate coding in MATLAB, in your STEM field, as a research interest or project?
• I would create graphs and be able to solve notes in a different way.
• For fun I would create a game, often than that, I can analyze a large graph of medical info.
• I would use it for robotics
• Processing and analysis of data

The post-camp survey results and the statements indicated that the students had increased academic awareness, readiness, and showed enthusiasm in continuing to use the materials in their STEM fields.

3. Conclusions

There were total of 15 students that showed interest and applied to the program. However, we had 11

participants in the camp. The camp dates coincided with the hurricane Harvey. This prevented some students from traveling to San Antonio. However, the Summer Coding Academy 2017 had an increased number of camp participants compared to last year’s attendees (nine students). The survey results, students’ written reports, and their project presentations, also, reiterated the students’ strong interest in the camp. The participants were motivated and excited about starting their first year at the university, had an understanding of various career options in their STEM fields, and achieved a basic understanding in computer programming and engineering design.

3.1 Lessons Learned and Future Work

The goal for the Summer Coding Academy 2018 is to promote the camp earlier in the year. We plan to work with the UIW Admissions office to attend their “Visit UIW” program to promote the camp to the high school students who are interested in applying to UIW. We plan to have a booth setup to promote the coding camp during UIW Admission’s Fall and Spring semester high school recruitment programs. The option of combining the camp with field trips to the local industries in STEM fields is also considered for future.

Acknowledgement

This work was partially funded and supported by Capital One Cybergrants and School of Mathematics, Science and Engineering at the University of the Incarnate Word.

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