Work in Progress: Leveraging a Virtual Precollege Summer Coding Day Camp
to Promote DEI in Recruiting Students to Computer Science and Information Technology

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In addition to her primary roles of undergraduate coordinator and instructor for the Department of Computer Science at Southeastern Louisiana, Dr. Achee also serves as faculty advisor for the student chapter of ACM-W, Women in Computing. She founded the Lion's Code Coding Camp to provide a summer program for pre-college students and recruit students to the discipline and university. Her research focus is computer science education.

**"Leveraging a virtual pre-college summer coding day camp
to promote DEI (Diversity, Equity and Inclusion) in recruiting
students to Computer Science and Information Technology
(Work In Progress, Diversity, Women in Computing)"**

Abstract

As part of an ongoing initiative to recruit students to the Computer Science and Information Technology degree programs at Southeastern Louisiana University, a summer coding day camp was formed beginning in the summer of 2019 through a grant with Louisiana Economic Development Fast Start. The 2019 camp was a two-week on-campus experience. In the success of the first year, expansion, to include a satellite campus, was planned for year two. This was never realized due to COVID-19.

The summer 2020 delivery and curriculum was redesigned two short months before delivery. The decision was made to offer a much abbreviated online version of the camp, while maintaining the maximum capacity. Through a partnership with cyber.org, curriculum was selected and a virtual capture-the-flag was offered. The capture-the-flag competition served to promote participation in the recruitment activities. Through the use of pre and post tests, data was collected as to familiarity with the university, the Department of Computer Science degree offerings, job opportunities in the field, and intention to attend college. Additionally, student surveys were administered to collect demographic information.

This paper details the experience of offering a virtual summer coding camp and explores both the challenges and opportunities that were encountered. Details into the specifics of how the camp was administered and recruiting activities are presented as are the results of the survey findings. It is concluded that the experience was a success, reaching maximum enrollment within 48 hours and achieving a wait-list of over 80. Of the students enrolled in the camp, women and minorities represented 50% of the students and the 80% of the students reported that their expectations were met or exceeded.

Introduction

The literature evidences that the impact of summer programs in increasing interest in STEM fields is significant [1], [2], [3], [4]. Additionally, [5], [6], [7]   confirm that well organized, engaging and experiential summer camps are useful for targeted recruiting. With this understanding, the Lion's Code Camp began in summer 2019 as a face-to-face camp on the main campus of Southeastern Louisiana University and utilized the suggestions of [8], on how to organize and make the camp fun.   The Lion's Code Camp provides an enjoyable summer camp experience for high school students that challenges students academically in the foundational concepts of computer science and builds the skills of teamwork, public speaking and relationship building. The Alice [9] visual programming language was used to introduce students in grades 8 - 13 to the basic concepts of programming. Alice [9] was chosen for numerous reasons, including the following: it is free and easy to install thereby allowing students to continue learning after camp completion; as a visual programming language, the stress of syntax is overcome thereby allowing for ease of implementation and prototyping; the "worlds" created by

the language are 2D graphical representations that allow students to quickly implement and prototype simple games; robust support materials are available. The camp filled quickly with 40 total students in attendance. Based on the success of camp, the decision was made to keep the same curriculum in 2020 and expand the camp to two two-week sessions offered on the main campus and a satellite campus. This was not realized due to COVID-19.

With the ever increasing effects of COVID-19 and the extended closure of campus, the decision was made to offer the camp virtually. This pivotal decision provided significant challenges but also offered unique opportunities. The challenges included a complete redesign of the curriculum as well as consideration as to how best to deliver the curriculum. Additionally, the much abbreviated time frame added to the stress already realized by the planning team due to COVID-19. Despite the challenges, two specific opportunities presented themselves: campers were no longer restricted to areas within driving distance of the university and the camp was no longer restricted to limit the number of attendees based on availability of physical computer labs. Additionally, the decision was made to decrease the cost of the camp from $100 the previous year to free in order to provide the opportunity of attendance to a more diverse population and enrollment was increased to 80. Within approximately 72 hours the camp was filled. Within a week there was a waitlist of 100 at which point no other students were added to the waitlist.

Delivery Overview

It became apparent in May that a face-to-face in person delivery would not be possible due to COVID restrictions. At that point the decision was made to pivot to a 100% virtual delivery. Several options were explored including synchronous, asynchronous and hybrid (i.e. part synchronous and part asynchronous). Factors contributing to the decision included, experience of the faculty and student mentors in virtual delivery, ability of the campers to access virtual delivery and capabilities of the university to provide required technology for virtual delivery. A hybrid delivery was deemed most effective and plans ensued for such. To allow for the much abbreviated planning time, the duration of the camp was reduced to three days. The hybrid delivery would be administered as a morning synchronous session with asynchronous afternoon activities. Moodle, the university's learning management system, was used to deliver the camp and Google Meet served as the videoconferencing platform (Figure 1).

The curriculum that was successfully implemented in the previous Lion's Code Camp was not used in the virtual Lion's Code "CyberCamp" for several reasons: the duration of the virtual camp was insufficient to adequately cover the material; requiring the campers to install the software or login remotely was deemed an impediment to the experience as many technology issues were anticipated; the desire of previous campers to attend a second time necessitated a new curriculum. Through a partnership with [10] (formerly NICERC), curriculum in their Cyber Society module and participation in their virtual capture the flag was chosen for the camp.
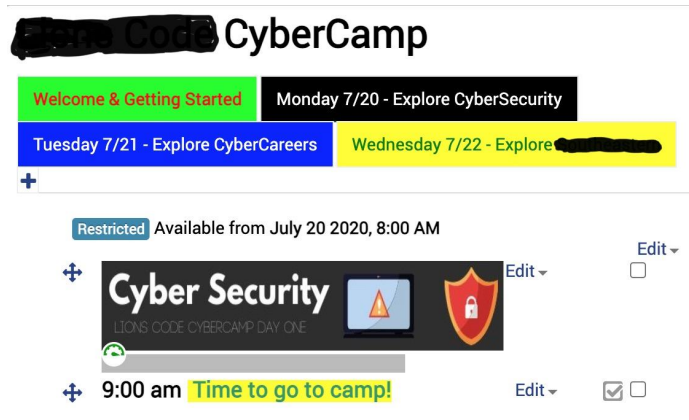
Figure 1
Moodle Page

Based on the positive reaction to an escape room activity of the previous year's camp, a similar activity was sought. Not only did the previous year's students demonstrate high levels of engagement, additionally the skills provided by offering such support the following National Association of Colleges and Employers' Career Readiness guidelines: Critical Thinking / Problem Solving, Oral / Written Communications, Teamwork / Collaborations, Digital Technologies, and Global / Intercultural Fluency [11] Additionally, the learning outcomes align with Common Core ELA Literacy RST Standards 1 and 2 for grades 9 - 12; 6, 7 and 9 for grades 11 - 12; and ELA Literacy SL 1-5 for grades 9 - 10. [12]

The camp moved from teaching coding to working on critical thinking skills vital to computer science in general and more specifically, cybersecurity. Curriculum from the Analysis and Investigation of Cyber Scenarios in the Cyber Society module was chosen. As stated on the cyber.org learning management system, "The modules in Cyber Society are designed to enable teachers to use liberal arts concepts and ideas as an approach to increase cyber awareness among high school students. This course helps contribute to the initiative of developing a better, more educated cyber workforce. The lessons within each easily customizable module improve students' critical thinking and critical reading skills as they pull information from articles and other sources. Students also practice their presentation skills as they participate in debates and group presentations." [10] "The Bridge" scenario was selected for relatability to the local area, appropriate length of delivery time and level of difficulty to reach a solution. In this scenario, "students investigate the collapse of the I-270 bridge in St. Louis, Missouri that has resulted in a few casualties, with eyewitnesses giving conflicting accounts for the cause."[10] This was the activity for the synchronous morning session. The students, a.k.a. Jr Agents in the Department of Homeland Security, were divided into teams of 4 - 6 campers and documents were released throughout the session in the form of briefings. The teams, with the help of a camp counselor, a.k.a. Sr. Agents were to sort through the information, divide it among team members and work together to arrive at a conclusion of who committed the crime, the motive and how it should be handled.

Asynchronous Delivery

Ensuring the independence of the asynchronous component was paramount. The goal of providing enrichment meant that any activity provided asynchronously would be optional and require no assistance from the student mentors. Based on the high level of engagement and positive reaction to the previous year's puzzle-a-thon activity, a virtual capture-the-flag (CTF) activity was chosen.

The virtual CTF was customized for the Lion's Code CyberCamp and was administered by [10] (Figure 2). This added a level of gamification to the camp as a leaderboard was maintained and the winner was announced in the camp wrap-up. Each day was organized on a particular theme. Asynchronous activities (i.e. videos, virtual tours, websites) were offered surrounding that theme and awarded badges for participation/viewing, thus adding another element of gamification. Numerous questions in the CTF reflected the content offered. The CTF opened each day upon the completion of the synchronous component and remained open until midnight.
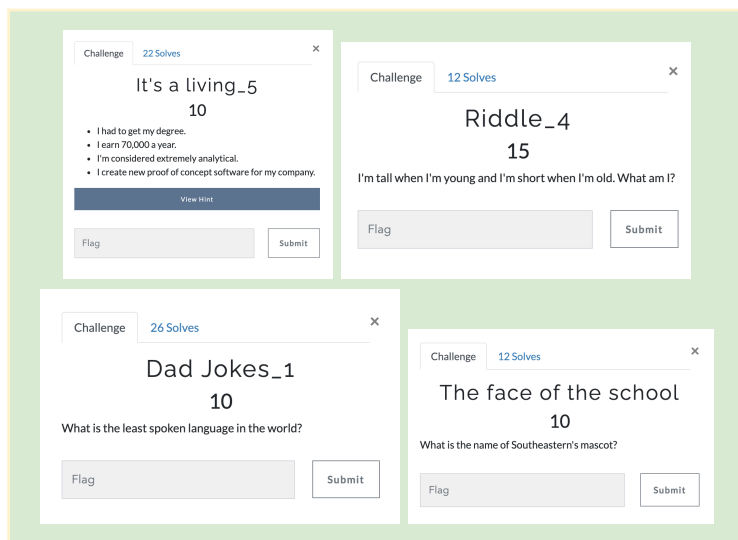

Figure 2
Sample Capture The Flag (CTF) Clues

Synchronous Delivery

The focus of the synchronous portion of the camp was to immerse the students in a "real world" simulation of a cyber crime there by introducing the concept of cyber security and developing the skills of research and analysis, critical thinking, teamwork and written and oral communication which are vital in the field. Prior to the start of camp, the students were welcomed by the Director of HomeLion Security (i.e. the camp's director) and given preliminary instructions via a video that was emailed to all registered participants. Another video email was sent to students by their Sr. Agent (i.e. faculty or student mentor who would serve as their team leader). The videos were meant to be an engaging way to provide preliminary instructions, as well as set the tone for the camp.

Pre-camp:

    Let's Learn About Southeastern Louisiana University / Virtual Tour Badge

Day 1: *Explore CyberSecurity*

    A.M.: Icebreaker - *Favorite candybar*

        Oath of Office / Jr. Agent Badge

        Scenario Briefings

    P.M.: Asynchronous Content

        Capture the Flag

        What are Cookies? / One Smart Web Cookie Badge

Day 2: *Explore Cyber Careers /"Put on Your Thinking Caps to Solve the Crime / Crazy Hat Day*

    A.M.: Icebreaker - *Favorite chips / salty snack*

        Scenario Briefings

    P.M.: Asynchronous Content

        Capture the Flag

        Let's Learn About Cyber Careers / CyberCareer Investigator Badge

Day 3: *Explore Southeastern / "Your Future's so bright, you gotta wear shades!" / Sunglasses Day*

    A.M.: Icebreaker - *Favorite flavor of ice cream (virtual ice cream party)*

        Assemble Presentations

        Deliver Presentations

        Solution is Given

        End-of-Camp Wrap-Up

    P.M.: Asynchronous Content

        Capture the Flag

        Why Choose Computer Science? / CyberLion Badge

        Let's Tour the CSTB / CSTB Virtual Tour Badge

        Meet the CS Department Head / I Met the CS Department Head Badge

        Let's Tour Southeastern / Lion Pride Badge

        Explore Computer Science at Southeastern / Computer Science Explorer Badge

Figure 3
Daily Overview

On the first day of camp, the Director of HomeLion Security administered the "Oath of Office" and students were sworn in as Jr. Agents in the Department of HomeLion Security and awarded a virtual badge. They were assigned breakout rooms with their Sr. Agent for the synchronous portion of the camp. Throughout the camp, the Sr. Agent provided briefings containing evidence to direct them towards a conclusion. It is important to note that there was a definitive single solution, and the students had to wade through superfluous facts in the briefings to arrive at the conclusion. On the final day of camp, teams were to use a Jamboard, or Google Slides to present their solution and advise on how to best handle the situation.

As a way to increase engagement and enjoyment, icebreakers and gamification were part of daily activities. Each day was given a specific theme. The morning (synchronous) portion of the camp included a daily icebreaker and focused on the cyber scenario, while the afternoon (asynchronous) portion focused on activities more closely related to the daily theme. (Figure 3)
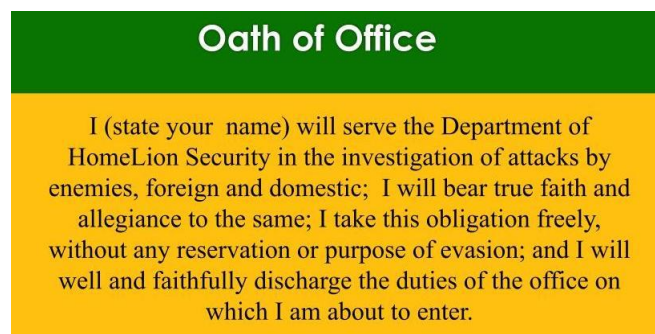
Oath of Office

I (state your name) will serve the Department of HomeLion Security in the investigation of attacks by enemies, foreign and domestic; I will bear true faith and allegiance to the same; I take this obligation freely, without any reservation or purpose of evasion; and I will well and faithfully discharge the duties of the office on which I am about to enter.

Figure 4

Oath of Office

The theme for day 1 was "Explore CyberSecurity". The campers were administered the Oath of Office (Figure 4) by the Director and sworn in as Jr. Agents in the Department of HomeLion Security.   The icebreaker for the day was "What's your favorite candy bar?" Each team met in a breakout room to get briefed on the mission. Throughout the morning, collections of documents, i.e. briefings, were distributed to each team and had to be divided among the team members. Using critical thinking, communication and teamwork they had to sort through the information to extract pertinent facts. The asynchronous activities for the afternoon consisted of viewing the video "What are cookies" to earn the "One Smart Web Cookie" badge and working on the CTF activity.

The theme for day 2 was "Explore CyberCareers". The campers were told to put on their thinking caps to solve the cyber crime, and asked to wear their craziest hat to camp. The icebreaker was "What's your favorite chips or salty snack?". Each team met in their breakout room where they continued to receive briefings throughout the morning. By the end of the synchronous session, they had received all information necessary to solve the case. Afternoon activities for the asynchronous portion included the CTF as well as completing the "Let's learn about cyber careers" activity to learn more about careers in cyber security and earn the CyberCareer Investigator Badge. Each camper was asked to choose a cyber career that most interested them.

The theme for the third and final day of camp was "Explore Southeastern". After the morning icebreaker activity of "What's your favorite ice cream flavor?", the campers collaborated on a Google Jamboard to indicate the cyber career they are most interested in. The first part of the morning was spent finalizing their presentation of their solution to the crime and the actions they proposed with the last activity of the synchronous session reserved for their presentations.

Promoting Diversity, Equity, and Inclusion (DEI)

One of the primary goals of Lion's Code Camp is recruiting a diverse population of students to the university, specifically to Computer Science. The camp was founded to explore new avenues for such and seeks to do so by addressing three concerns: cost, administering a curriculum that is inclusive, i.e. does not require prior experience in the discipline and modeling diversity.

Surprisingly, the concern of cost was the easiest to address, thanks to a grant that fully funded the camp. This allowed the camp to be offered at no cost to the students. While this was the easiest hurdle, it was arguably the most important. By offering free tuition to all, a major economic barrier was removed. It is noted that the issue of connectivity was beyond the scope of the capabilities of this project.

Another concern was administering a curriculum that is inclusive in that it does not require prior experience in the discipline. To promote DEI, consideration was given to the realization that all high school students do not have access to the same opportunities of instruction in computer science or related fields. This fact led to the search for a curriculum that did not require previous knowledge in programming or require special equipment other than internet access and a laptop or tablet device. The decision was made that this would best be accomplished by focusing on the career readiness skills set forth in [11] as they relate to cyber security: critical thinking, problem solving, oral and written communications, teamwork and collaborations, digital technologies, and global and intercultural fluency. This would not only offer participants skills necessary for future study in computer science and cybersecurity, but also strengthen preparation for a career in any discipline.

The final concern involved modeling diversity in the faculty and staff. In recruiting and hiring faculty and staff for the camp, consideration was given to such. Women or minorities were greatly encouraged to apply and represented 5 of the 9 staff members or 56%. Of the five, 100% were women and 20% represented minorities. This mirrored the population of the camp in that 50% of the campers were women or minorities, with approximately 37% of all campers being female and 29% being minorities (male or female).

To determine if the camp had any impact on recruiting a diverse population to the university, pre and post surveys were conducted. With the population in the camp mirroring the diversity of the staff, the final determination of success was that of recruiting students to the university. The survey results are given in Figure 5. The results indicate that after the camp, the students planning to attend college increased by 7.1% and students considering attending Southeastern increased by 6.9%.

Survey Question	Pre	Post	Change
I intend to attend college.	92.9%	100%	+ 7.1%
I am familiar with the majors and opportunities XXX offers in computer and data science.	25%	75%	+ 50%
I am familiar with XXX campus and culture.	44.4%	85%	+ 40.6%
I am considering attending XXX upon graduating from high school.	73.1%	80%	+ 6.9%

Figure 5

Conclusions

As the COVID-19 pandemic roared through the summer of 2020 and the world scrambled to pivot, the second year offering of the Lion's Code code camp was no different. The decision to offer an abbreviated hybrid virtual version (i.e. part synchronous delivery and part asynchronous delivery) of the previously successful camp was implemented with a focus towards diversity, equity and inclusion (DEI) and recruitment. DEI was accomplished by intentionally addressing the issues of cost, inclusive curriculum and modeling diversity. Through successfully implementing measures to address these issues, 56% of the staff and 50% of the campers represented females or minorities. Recruiting efforts included: positive interactions with current faculty and students who served as camp staff, fun and engaging activities promoting teamwork and relationship building and an "Explore Southeastern" day devoted to virtual tours and a Southeastern themed CTF. Results of pre and post surveys confirmed the success of recruiting efforts showing a 40.6% increase in campers' familiarity with the campus and culture and a 50% increase of familiarity with majors and opportunities offered by the university in the fields of computer science, data science and information technology with an overall increase of 6.9% of campers considering attendance at the university upon graduation. With 95% of campers indicating that the camp met or exceeded expectations, this is best summed up in the words of the camper who commented "I really didn't have a favorite part, I really just enjoyed all of it!"

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