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CODE4her Spring 2019

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CODE4her Spring 2019

Aidan White

Honors Project

Submitted to the Honors College

At Bowling Green State University in partial fulfillment

Of the requirements for graduation with UNIVERSITY HONORS

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Introduction

Developing and overseeing the CODE4her Spring 2019 session served as the Honors Project for Aidan White. Goals of the project were:

- Purchase new SnapCircuits and new Micro:bits
- Obtain desktop towers
- Design a session that is capable of being repeated in future CODE4her sessions.
- Observe how hands on learning increases understanding of the material covered in the session

To reach the first goal of the project Aidan White, Rose Connolly and Ashley Gearheart applied for the Center for Undergraduate Research Grant or CURS Grant and were awarded one thousand dollars for the purchasing of SnapCircuits and Micro:bits. The Computer Science department of Bowling Green State University as well as an individual from the University of Toledo named Tim Kaiser donated in total ten desktop towers to the CODE4her organization. To reach the final two goals five meetings were planned throughout the spring semester of 2019 to teach about the hardware of a computer and what function each component of a computer serves.

Background

CODE4her is an organization that was founded in 2016 by Jadwiga Carlson. The program hosts two sessions per academic year with one being held in the fall semester and another being held in the spring semester. Thirty two girls who are in the grades fifth through eighth participate each session and sixteen mentors who are all Bowling Green State University(BGSU) students. CODE4her was created to make a space where girls can learn about computer science and be in a space where the girls feel comfortable to do so (CODE4her*).*

Literature Review

A major issue faces the technology industry and that is the lack of females who work in the industry. This is caused by a couple of factors. One is that from a very young age girls are told they should not pursue a career in technology and should instead pursue a nursing degree or some other stereotypical female degree. Another factor is that there is a lack of role models for young girls to look up to that are females in the technology field or supportive figures in their lives that tell them that they can pursue a degree in a technology field(Griffith). Lastly there is the issue that the workplace is male dominated which creates an uncomfortable environment for the women to work in (George-Jackson).

Women earn fifty seven percent of undergraduate degrees across the country however women only earn "about twenty percent of the bachelor's degrees in" STEM fields in the United States(White). This disparity is caused by many factors for example little to no support from role models like teachers or parents. There are also the "age-old belief that girls are not high achievers in math and science" that pushes away young girls from STEM fields (Girl Scout Research Institute). When articles talk about possible solutions to this problem they talk about how women need to be introduced to computer science when they are younger and the stereotypes that push young girls away from computer science have not been able to completely push a girl away from STEM (Griffith). Even if a female ends up with a degree in STEM field there is a large chance that women end up leaving the job they got after college that was degree related. Forty percent of women that work in a STEM field have reported that they have been sexually harassed in the workplace by a male co-worker (Palma). For a woman looking to pursue their interest in STEM there are so many obstacles that it makes it very challenging to find a reason to pursue a STEM degree.

It is evident that these issues need to be addressed to help create better environments for young women to grow and learn about STEM. One way to help get young girls interested in computer science and STEM is to give them an opportunity to learn through hands on learning experiences (Hill,Corbett,Rose.) Another way is to be sure from an early age that the girls have role models to look up and push them to pursue STEM degrees later in life.

Kusum Singh offers good insights different characteristics of higher education institutions that keep females from pursuing STEM degrees. A major characteristic forces woman to change degrees is the male dominated classrooms and little support from female faculty. One recommendation is that universities create all women groups on campus that gives the women pursing STEM degrees a space where they can feel comfortable(Singh). Another way to help recruitment of women into STEM degrees is to actively seek out girls who participate in programs like CODE4her and introduce them to the program at the institution that is recruiting (Hill,Corbett,Rose).

The issues still do not end once women finish their degree in Computer Science. Many reports of sexual harassment have been reported inside of software developing divisions of companies(Shapiro). Women have a very low chance of actually remaining in a STEM field once they graduate due to different stereotypes and male dominated work places that make the women who work there feel uncomfortable and out of place in their work environment(George-Jackson). It has been found that companies do better with a split of genders in the company and not just one gender dominating the field which is exactly the issue that STEM fields face today(Women in Computer Science). Like institutions workplaces have been recommended to have groups for the female employees in a STEM field so that it creates a comfortable environment for them to work and provide company wide bias training sessions and in general educate the employees on how they need to act around each other so that work can be done and people can feel safe(Beede,Julian).

Implementing Future Sessions

To improve this session when it is repeated in the future there are some changes that should be implemented to help meetings move smoother as well as enhance the learning experience of the girls who are working through each activity. These changes will be found under each meeting outline.

Meeting 1

Unit	Activity	Duration
Welcome	Mentee Survey	15 min.
Icebreaker	Mentor and Mentee Interviews	15 min.
Binary Introduction	Introduce mentees to binary	20 min.
	Decode Message	20 min.
	Binary Bracelets	20 min.
Snack Break		15 min.
Binary	Finish Bracelets if Unfinished	5 min.
Snap Circuits	Introduction to circuits and components	15 min.
	Let mentors and mentees work through activity book.	Till 5 before session ends
Binary Secret Message	Hand out sheets that let mentors and mentees create a message to decode for each other.	

Our first meeting of the session was designed to show how the girls how computers communicate internally using binary then convert the binary to characters that humans recognized as letters, numbers and other symbols. It also utilized SnapCircuits that allow the girls to see how electricity functions and help identify major parts of a circuit. Lastly it allowed for the mentors and mentees to get to know each other and discuss the expectations they have of each other throughout the session.

To help improve the first meeting it is important that the mentees thoroughly understand binary so that the binary bracelets make sense to them and there is no confusion while they are coding their names into binary. Another recommendation is instead of creating bracelets, have the mentees create key chains as these will be easier to tie off than the bracelet. Lastly if the mentees are older be prepared with an extra activity for SnapCircuits as they will quickly go through the activities that are provided in the booklet.

Meeting Two

Unit	Activity	Time	Duration
Welcome	Go over the secret message that the mentees did for homework.	1:30pm	10 min.
Binary Addition	Introduce the binary addition activity.	1:40pm	10 min.
	Work on the different problems in the hand out about binary addition.	2:00pm	25 min.
Snap Circuits	Pick up where the girls left off and work on the circuits until break.	2:30pm	
Snack Break		3:05pm	10 min.
Micro:bit	Introduce Micro:bits	3:15pm	5 min.
	Work on different activities for the Micro:bits and get comfortable with how they work.	3:20pm	Till 5 minutes before end
Clean Up	Have the teams clean up their areas and be sure all of the Micro:bits are returned.		

For our second meeting we worked with binary again to show how addition works in a base two representation of numbers. We then finished up any activities that the girls had not finished from the previous session when using the SnapCircuits. Lastly Micro:bits were introduced to the girls as well as the programming interface that they would be using to code the Micro:bits they received.

Improvements that could be made to this meeting are firstly cover the binary addition slowly as this is a more advanced topic but is necessary to understanding how computer hardware functions. Walk around to ensure that each mentee understands how binary addition works. Secondly with the Micro:bits be sure to give a thorough explanation on how the programming interface works and how to load programs onto the Micro:bit. Since there are two ways try having the teams stick to connecting each Micro:bit to the web interface for ease of use rather than download each individual file for the Micro:bit. This should help reduce in the confusion of how to operate the Micro:bit.

Meeting Three

Unit	Activity	Time	Duration
Welcome		1:30pm	10 min.
Micro:bits	Introduce Blue Tooth and how it works.	1:40pm	10 min.
	Hot Potato Tournament	2:00pm	60min.
Snack Break		3:05pm	10 min.
Micro:bits	Work on activites provided by Micro:bit.org	3:15pm	Till 5 min. before the end
Clean Up	Have the teams clean up their areas and be sure all of the micro:bits are returned.		

For our third meeting of the semester we worked with the Bluetooth functionality of the Micro:bits. The girls created a hot potato game where a signal is sent from Micro:bit to Micro:bit that specifies who has the virtual potato. This was to illustrate how Bluetooth works and sends signals over short distances. Once the tournament was over they worked on other activities that dealt with parts like the accelerometer that registers the position that the Micro:bit is currently in.

The one improvement to this meeting that needs to be made is have smaller groups of girls compete at a time. An issue with the Micro:bit Bluetooth antenna is that if there are more than four frequencies in close proximity of each other the Micro:bit is unable to adequately process the receive signal. This can cause issues during the competition making the activity take more time than allotted.

Meeting Four

Unit	Activity	Time	Duration
Welcome		1:30pm	10 min.
Sphero Robots	Complete activities and showoff the internal hardware of a Sphero Robot	1:40pm	85 min.
Snack Break		3:05pm	10 min.
Conference Call	Representative from Google calls and talks to the girls about software engineering.	3:15pm	10 min.
Sphero Robots	Finish the activities for the day.	3:25pm	Till 5 minutes before end

Clean Up	Have the teams clean up their areas and be sure all of the Sphero Robots are returned.		

In our fourth meeting we worked with Sphero Robots. They have a clear outer shell that allows for the girls to peer inside of the robot as well as a the ability to look at a 3D model of the robot that identifies each part of the robot. We also had an individual from Google video call in to talk to the girls about what computer science is and what you can do when you get a degree in computer science.

One improvement to this meeting is be sure there are adequate activities for the mentees to complete. There will be girls who have worked with Sphero robots before and will be able to complete activities faster than other teams will be able to. Ensure that this is accounted for to avoid teams finishing before the meeting has concluded.

Meeting Five

Unit	Activity	Time	Duration
Welcome		1:30pm	10 min.
Hardware Introduction	Review a PowerPoint that introduces the girls to the hardware of a computer	1:40pm	30 min.
	Complete a crossword puzzle that reinforces what was covered in the PowerPoint	2:10pm	20 min.
Scavenger Hunt	Have the girls complete a scavenger hunt of the desktop tower	2:30pm	35 min.
Snack Break	Finish the activities for the day.	3:05pm	10 min.
Scavenger Hunt	Finish scavenger hunt and test the girls to put the computers back together	3:15	Till end

In our final meeting we focused on the internal hardware of a desktop computer. We covered a PowerPoint that introduces the girls to different parts of a computer. They then were given a puzzle that reinforces what the girls learned form the PowerPoint and prepared them for the final activity of the meeting which was to take apart computers searching for specific parts and completing a scavenger hunt.

There are two improvements that can be made to this meeting. One is to take time in explaining each part of a computer and give ample time for the mentees to look at each piece of hardware that is passed around. Secondly have a meeting with the mentors before the computers are disassembled and show them how to take apart the computer and identify for them what each piece is and what the function of each

piece is. This will make it so that the scavenger hunt will take the full time since mentors will be able to ask questions about the computers and enhance the learning experience of the mentees.

Methodology

The girls take a survey before the first meeting and then one after the last session. The survey asks about what they know and have learned during their time in CODE4her and then also ways that we could improve the session to make it more informative and entertaining for future girls. We decided on this method of data collection because it offers an anonymous way for the girls to give any feedback, they have without the pressure of myself or the program coordinator knowing who said what. This ensures that the girls feel comfortable to give us real feedback about the program and how we are able to make it better. Data collected from the pre-survey shows that a majority of the participants think the only aspect to computer science is programming. During the time the girls spend in the program they hopefully will be able to see that there are other equally interesting parts of computer science. At the conclusion of the session our goal is an organization is to see a higher number of girls that agree that they can pursue a STEM degree in college.
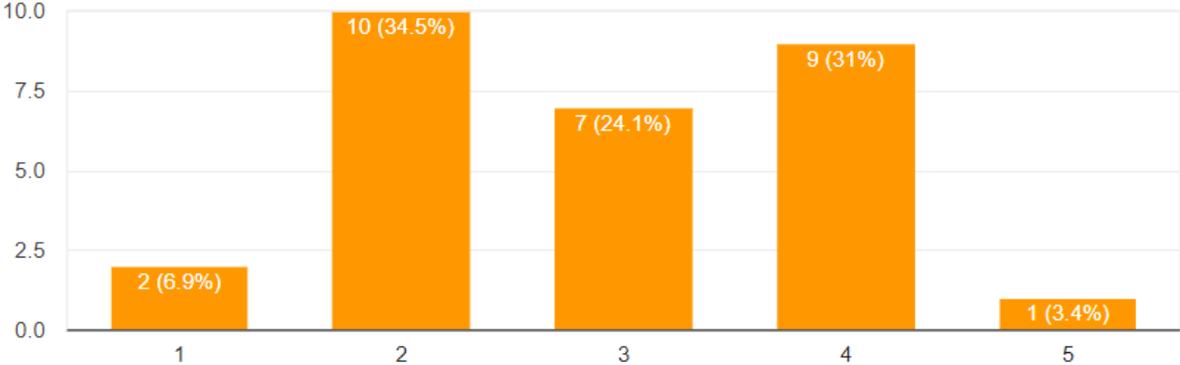
Mentee Pre-Survey Results

For the graphs for the pre-survey the reason that there are only twenty nine responses rather than thirty two is that there were three girls that arrived late to the first meeting and arrived after the survey had been completed. The scale for any bar graph below is one being strongly disagree and five being strongly agree.

From the answers provided by the girls who participated in the surveys we see that a majority of them feel pretty comfortable around technology and feel that they could in fact pursue a Computer Science degree. This is promising that at their age they have not been pushed away by their school or other role models in their life and told to pursue something other than a STEM degree.
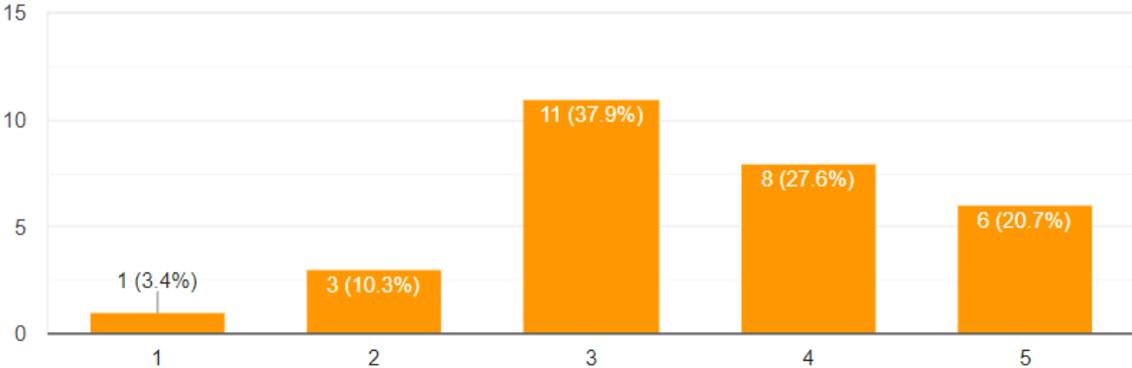
I know about careers in computer science.

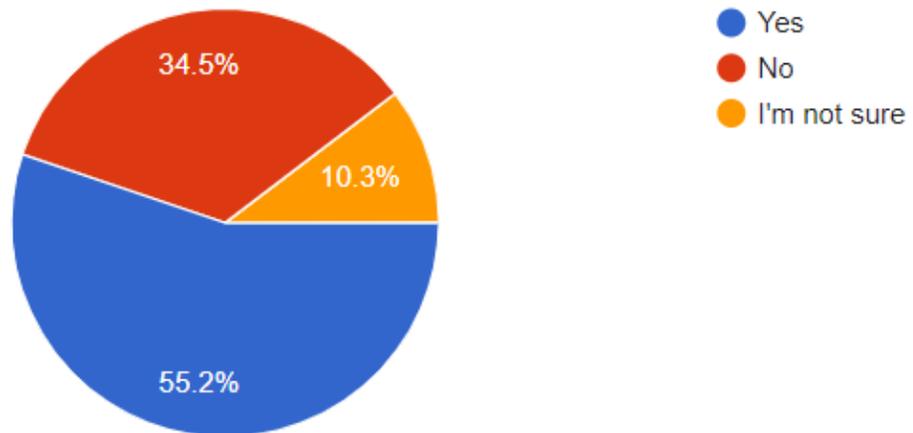29 responses

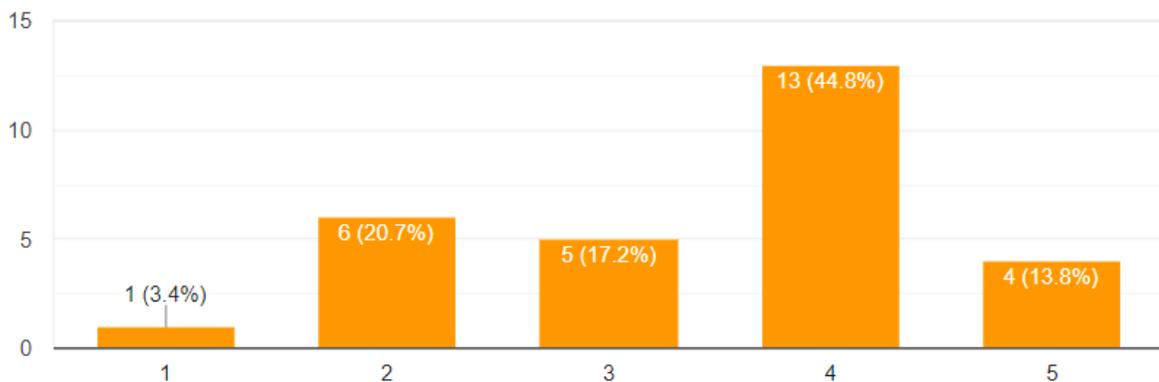## I think I could study computer science in college.

29 responses

Does your school offer computer science classes?

29 responses

- ● Yes
- ● No
- ● I'm not sure

34.5%

10.3%

55.2%

## I think I could pursue a career in computer science.

29 responses

Mentee Post-Survey Results

From the results gathered it is nice to see that there was an increase in the participants feeling that they could pursue a degree in computer science at the conclusion of CODE4her. It is also promising that from the responses the participants gave a majority really enjoyed taking apart computers and learning about the hardware aspects of computer science. Lastly it is good to see that the participants feel that they have improved in their logic skills and problem-solving since the start of the

program. These two skills are important for any career that the participants will have in the future and benefit from learning earlier in life rather than later.
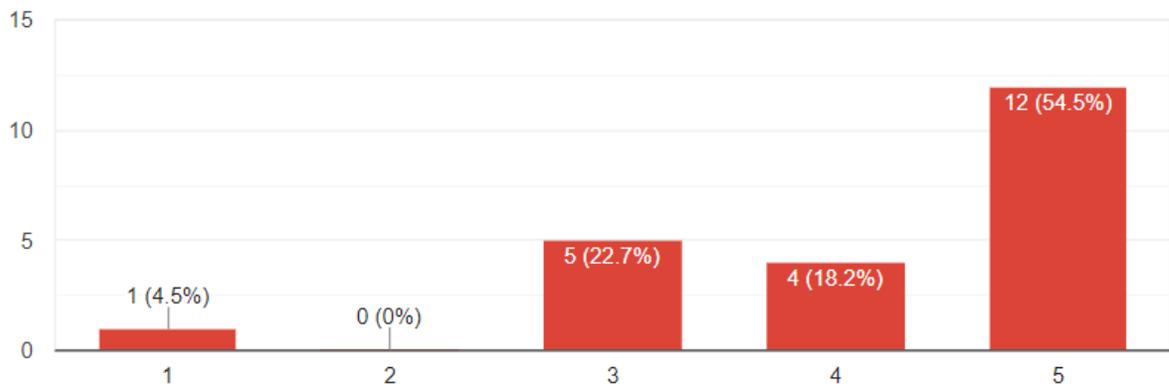
I think I could pursue a career in computer science.

22 responses
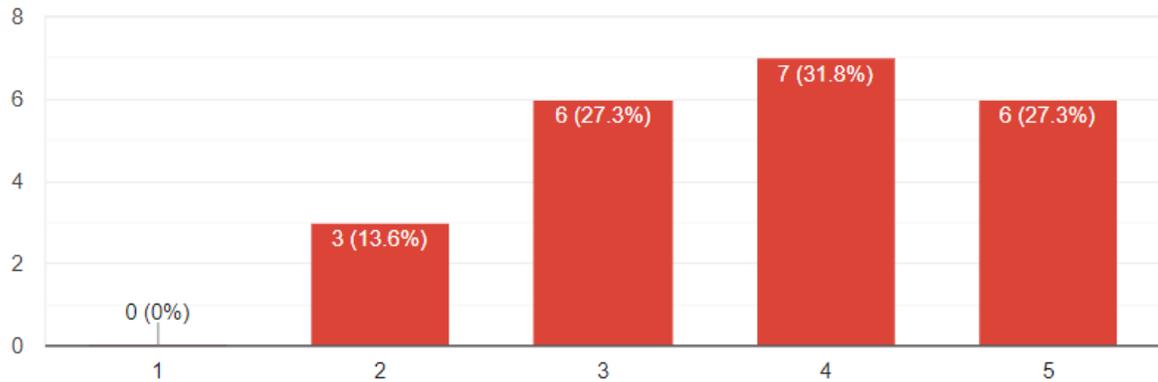
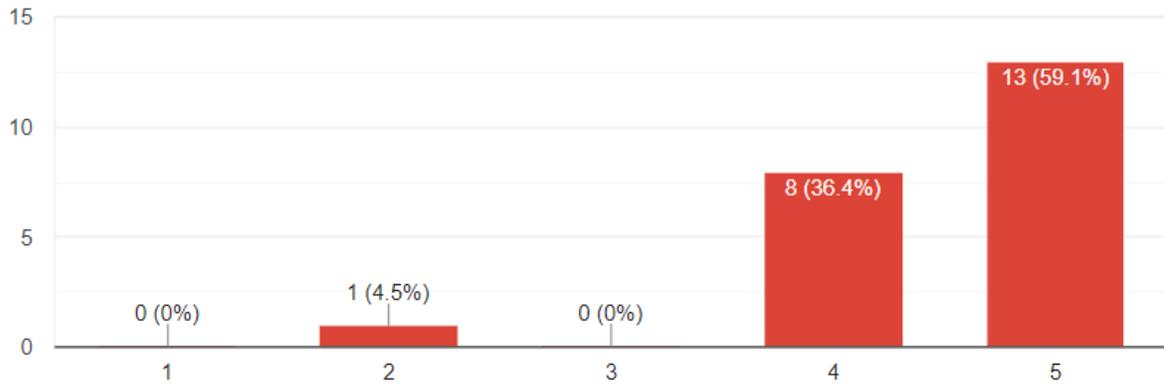## I've strengthened my logic and problem-solving skills.

22 responses

I felt comfortable approaching a mentor if I had a question or was having trouble with my work.

22 responses

What was your favorite part of CODE4her?

22 responses

Taking apart the computer
Taking apart the computers
Learning binary code/taking apart computers
everthing
Learning how computer work overall
The computer
micro:bit
Taking apart the PC
sphere+
sphereos was my faverite
ALL OF IT!!!!!
taking apart a computer

Joking around, being funny.
The sphero robot.
I loved taking apart and then putting back together computer.
idk
circut boards
facetiming the guy working at Google
My favorite part was coding the Sphero.
My favorite part in Code4her was using the computers.

Discussion

A couple of notes on the results is that over half of the girls from this session came from the same school They were scattered throughout different grades, but they were in the same area. I believe this does skew the results somewhat since all of the girls that came from the one school have access to computer related classes. I believe if there was more of an even spread of schools, we would see this number decrease as more girls from rural areas rather than a city. Another note is that even though the girls feel they could pursue a computer science degree they are unaware of the fields that the degree leads to. I do feel that this should be addressed in their schools if they are taking a course related to computer science so that it gives the girls a direction when they attend college.

Recruitment for CODE4her is done through flyers passed to out to schools as well as twitter announcements and website announcements using the CODE4her accounts. As mentioned before many girls from a single school that received a flyer advertising CODE4her. This school has a high rate of girls that participate in the computer courses that are offered and can assume that the teachers push more for participation in CODE4her compared to a rural school that surrounds Bowling Green

that does not have a computer course would make a difference in who participates in the program heavily.

From the Post-Results it is good to see that the girls really enjoyed learning how to take apart computers and learning about how computers communicate. It shows that coding is the not the only interesting part of Computer Science or the most important. Both the hardware and software side of Computer Science. It shows that CODE4her sessions need to alternate between software and hardware so that the girls who participate get a holistic view of what Computer Science is.

I feel also that the age gap that is present in the organization among the mentees is too large. This semester's session saw a lot of older girls participate rather than an even spread of girls of different ages. This could be caused by the fact that this is the first new session in a year which brought back many of the older girls that had participated in the first two sessions. It could also be that the schools that already educate their students in computer science pushed their female students to participate in CODE4her. It is challenging to create a meeting that is stimulating and fast paced enough for the older girls but not too complicated for the younger mentees. This is where many of the improvements to each meeting come from. If it was only a two-grade gap rather than fifth grade to eighth grade I feel it would make each session run smoother and create a better learning experience for those who participate in CODE4her.

Additional Documents

Spring 2019 Program Overview

Introduction

CODE4her is a mentorship program with a goal of sparking interest in computer science

organized by the BGSU Women in Computing (BGWIC) student organization. Program

participation is open to middle school girls (grades 5-8), and participants are paired with BGWIC

members who serve as mentors.

Goals

The program seeks to provide the following:

● Benefits to Participants

○ Provides an opportunity to learn computer science principles through hands-on and active learning.

○ Encourages teamwork and communication by working collaboratively on projects

○ Increases self-confidence through exposure to an empowering, inclusive learning environment and positive role models

● Benefits to Mentors

○ Provides an opportunity to get involved on campus and in the community

○ Encourages the sharing of knowledge which increases sense of self-worth and confidence.

○ Encourages leadership, communication, and personal responsibility

○ Fosters collaboration with other computer science students

○ Increases personal satisfaction with the college experience

● Benefits to BGSU Computer Science Program

○ Improves students' satisfaction with the program

○ Provides an opportunity to get more students involved.

○ Potential to help retention of students by creating a more positive experience

○ Increases program visibility through community outreach

○ Promotes collaboration and sense of community within the CS program.

Program Details

The Fall 2018 program will consist of 5 meetings, occurring from 1:30 - 4:00 PM on the

following dates:

● February 10

● March 3

● March 24

● April 14

● May 5

Mentor Selection

The BGWIC advisor will screen the applicants and select the final mentees into the program.

Number of mentor positions may vary based on the number of interested mentees and physical

supplies such as robots or laptops. Minimal mentor requirements for the program are:

● Be in good academic standing with at least a 3.0 overall GPA

● Excellent written and oral communication skills

● Prior leadership experience

● Mentorship experience is not required but preference will be given to students with prior

mentorship experience

Spring 2019 Mentor Agreement

Congratulations! By becoming a mentor, you are choosing to act as a positive influence in

someone else's life! You will serve as a role model, teacher, and trusted friend. Your

commitment indicates a high level of responsibility, and we hope that you find this

experience encouraging, inspirational, and personally fulfilling. Thank you for helping to

inspire the next generation of computer scientists!

Program Details

● The Spring 2019 program will consist of 5 meetings, occurring from 1:30 - 4:00 PM

on the following dates:

○ February 10

○ March 3

○ March 24

○ April 14

○ May 5

Mentor Expectations

● Attend EVERY meeting

● Arrive to meetings by 1:00 PM

● Stay until the room and all equipment has been returned to its original state/location

and you are dismissed

Page 2 / 4

CODE4her CS Mentorship Program for Girls Spring 2019

- Be in good academic standing with at least a 3.0 overall GPA

- Respond to all (email and Slack) communication within 24 hours (excluding weekends)

Absences

- Mentors who miss a mentoring meeting without a valid reason will be dismissed from the program immediately

- Mentors who miss more than one meeting for any reason will be dismissed from the program immediately

- Mentors who are dismissed will receive compensation for mentoring meetings they attended up to the day of dismissal

- One excused absence will be made only for the most serious reasons such as illness, hospitalization, death in the family, or other emergencies.
  - If such an emergency arises, please contact jacarls@bgsu.edu AND aidanw@bgsu.edu as soon as possible.
    - Documentation will be required and expected upon return or within 3 days of missed meeting and submitted to program coordinator Jadwiga Carlson.

Being a mentor

- Mentors will be paired with two mentees to form a team over the course of the program

- Tips for working with your mentees

○ Be a friend

■ Be encouraging and use reassuring language. Compliment your mentees on their perseverance, hard work, and creativity!

■ If your mentees become frustrated, reassure them that it's ok to struggle.

CODE4her CS Mentorship Program for Girls Spring 2019

■ Your mentees may be shy, quiet, or hesitant at first. Be patient and don't force it.

■ Get to know your mentees and help them get to know you! Ask them about their hobbies and interests.

○ Be a role model

■ Stay off your phone and use appropriate language.

■ Don't be a distraction. When someone is presenting, be quiet, attentive, and direct your mentees' attention to the presenter.

■ If you don't know the answer, ask the program facilitator or mentor leader or another mentor for help!

○ Be a facilitator

■ Don't leave a mentee behind. Make sure each of your mentees have the opportunity to perform the tasks. If there are roles, ask the mentees to switch the roles half-way through the meeting so each gets

a chance.

■ Adjust to the pace of your mentees. Some learners will take more time to grasp new ideas, and that's ok!

■ Don't just do things for them - work through it together.

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