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Teacher and Student Experiences in a Gender-Inclusive Secondary Computer Science Program

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Abstract
A significant gender gap continues to exist within computer science (CS) education, despite nationwide emphasis in the U.S. on improving CS education equity and access. To explore this issue, we conducted an ethnographic case study within a classroom at Forest View High School (FVHS, pseudonym) where girls' participation in CS was consistently higher than state averages over 12 years. We sought to understand teacher and student experiences within this gender-inclusive program. Data were collected over three months through observations, interviews, course documents, and reflections. Results indicate three strategies for supporting a more gender-inclusive classroom: (1) Providing personalized and relevant learning experiences; (2) focusing on growth mindset development; and (3) creating a welcoming environment. Implications for practice include providing assignment choice and personalized one-on-one support for students, modeling a growth mindset and providing opportunities to learn from failure, and building personal relationships with students and incorporating humor. Overall, teachers can act as agents of social change within the CS classroom, and play an essential, central role in broadening participation and equity initiatives. However, this work must also be supported by administrators, counselors, and other school stakeholders to be effective for enacting change.

Keywords: Computer science education, K-12 education, broadening participation, equity, gender

1. Introduction

Across the U.S. there are significant and increasing efforts directed towards integrating computer science (CS) content and skills into the K-12 curriculum (Code.org et al., 2020; 2021; 2022; The White House, 2016). One reason is workforce related, another is the idea that regardless of a student's future path, CS knowledge and skills are beneficial (Blikstein & Moghadam, 2019; Nager & Atkinson, 2016). Additionally, justice and equity-related reasons for the importance of CS have been consistently emphasized by researchers and stakeholders alike (Vakil 2018; Jones & Melo, 2020). As a result of these intersecting reasons, numerous district, state, and national initiatives have emphasized the need for all students to receive hands-on CS experience. (Code.org et al., 2020; 2021; 2022).

Despite these reasons for prioritizing K-12 CS education, an enduring gender gap continues to be present at all levels of the CS pipeline (e.g., National Science Foundation [NSF], 2018). On average, women comprise 20% of CS graduates (National Center for Education Statistics [NCES], 2018) and 26% of CS and Mathematical Science professionals (NSF, 2018). This gender gap is problematic not only from an equity and justice-oriented perspective, but also from an innovation and workforce perspective (e.g., Blikstein & Moghadam, 2019; Stiles, 2017). In other words, when CS is more inclusive, we are able to expand the range and types of problems solved and grow the creative capacity of the field. (Santo et al, 2019). In spite of this enduring gender gap, there are some schools in the U.S. where participation in CS has been more equitable. For example, in Indiana, some high schools have seen women and girls' CS participation consistently above the state average of 20% (Ottenbreit-Leftwich et al., 2017). The question then becomes, what is unique about these specific contexts that has led to more inclusive participation?

1.1 Research Purpose

Efforts to support underrepresented groups in CS are typically described as efforts to *broaden participation in computing,* or "meaningful actions that address the longstanding underrepresentation of various populations" in CS (NSF, 2019). Based on the above outlook and the significant, enduring gender gap in CS, it is important to explore broadening participation efforts in K-12 schools and classrooms where girls' participation is happening at higher levels. By exploring these contexts, we may be able to understand which research-suggested strategies are effective for broadening participation, as well as the specific, unique strategies being utilized in the field. In short, the purpose of this study was to examine a CS classroom that had consistently seen more gender-inclusive enrollment and better understand the experiences within their CS program.

1.2 Research Question

We conducted an ethnographic case study (Fusch et al., 2017; Ó Riain, 2009) to situate ourselves within a single classroom at Forest View High School (FVHS, pseudonym) where the percentage of girls in CS was consistently above state averages. The current study is part of a larger study focused more broadly on understanding the history, development, and current experiences within the FVHS CS program (Karlin et al., 2022). This portion of the study centered around one research question: What were the teacher and student experiences within the FVHS CS program?

2. Theoretical Framework and Literature Review

Based on a review of the literature, there are various elements within CS classrooms that can support more gender-inclusive experiences. These often include (but are not limited to): (1) Exposure to a relevant and/or personalized curriculum; (2) developing a growth mindset; (3) creating a welcoming classroom space; and (4) leveraging culturally-responsive and/or relevant pedagogies. The table below defines each of these elements and provides evidentiary support from the literature. This table also represented our a priori coding scheme for this portion of the larger study and was used as a starting point in data analysis.

Table 1. Theoretical framework and a priori coding scheme

Category	Definition	Evidentiary Support
Meaningful, Personalized, and/or Relevant Learning Experiences	Curricular content and support is connected to student, interests, needs, goals, and/or experiences.	Goode & Margolis, 2011; Lachney, 2017; Madkins et al., 2020; Margolis & Goode, 2016; Scott et al., 2017; Seneviratne, 2017
Growth Mindset	Students are given opportunities to make mistakes and fail, focus is on learning and growth over time. CS is not seen as an innate ability, but something everyone can learn.	DuBow et al., 2016; Flannigan et al., 2022; Kwak et al., 2022; Starr, 2018; Wagner, 2016
Creating a Welcoming Environment (Including Physical Space	The teacher and students are familiar with each other's lives,	Cheryan, et al., 2015; Madkins et al., 2020; Margolis et al., 2012;

	interests, experiences, and/or connected by more than course content. The physical space is welcoming to all students and does not reinforce gatekeeping CS stereotypes.	Master, et al., 2016
Culturally-Relevant and/or Responsive Content	CS curriculum is tied to social justice efforts, and explicitly addresses and engages with longstanding racial, gender, and other inequities within the field.	Madkins et al., 2020; Lachney, 2017; Scott et al., 2015; Vakil, 2018

2.1 Classroom CS Elements for Broadening Participation

2.1.1 Meaningful, Personalized, and/or Relevant Curriculum

Research suggests that meaningful, personalized, relevant curricula can impact women's decisions to pursue a career in CS (Goode & Margolis, 2011; Lachney, 2017; Madkins et al., 2020; Margolis & Goode, 2016; Scott et al., 2017; Seneviratne, 2017). Definitions for meaningful, relevant, and/or personalized curriculum are expansive, but in general, this type of learning experience connects with students' culture, community, interests, and/or needs. When CS lessons and curricula are aligned these items, it can be a beneficial approach for broadening participation (Madkins et al., 2020).

For example, a 2011 case study from Goode and Margolis examined the impact of the Exploring Computer Science (ECS) curriculum on students' beliefs about CS. The ECS curriculum has a large focus on incorporating a meaningful, relevant curriculum into the CS classroom and was designed to broaden CS participation for traditionally underrepresented groups (Goode & Margolis, 2011). The case study examined the results after initial pilot testing of the curriculum, which involved 300 students. Women students accounted for 42% of the enrollment in the pilot study program. The authors found that exposure to the curriculum led to increases in students' perceptions of CS usefulness, their beliefs about the appeal of CS, their perceptions of CS as enjoyable, their motivation to persevere through difficult problems, and their likelihood to participate in CS courses in the future (Goode & Margolis, 2011). Overall, creating and/or implementing CS curricula that are personalized and relevant to students' culture, community, interests, and needs can be a beneficial approach for broadening participation efforts (Goode & Margolis, 2011; Lachney, 2017; Madkins et al., 2020; Margolis & Goode, 2016; Scott et al., 2017; Seneviratne, 2017).

2.1.2 Focus on a Growth Mindset

In general, a growth mindset is defined as the idea that intelligence and understanding can grow and change over time (Dweck, 2006). STEM and CS research has suggested that modeling and helping students develop a growth mindset can be beneficial for broadening participation (DuBow et al., 2016; Kwak at el., 2022; Starr, 2018; Wagner, 2016). Developing a growth mindset can help students shift their self-perceptions, so they see CS as something that can be learned, not just something people are born being able to do. In CS specifically, previous research and stakeholders have suggested that emphasizing the development of a growth mindset can increase student performance (e.g., Cutts et al., 2010) and help with broadening participation (e.g., DuBow et al., 2016; Starr, 2018; Wagner, 2016). When teachers, counselors, and other CS stakeholders hold a static view of intelligence this tends to reinforce existing biases about the types of students who should and should not participate in CS (Margolis et al., 2017). Shifting to a focus on a growth mindset can help encourage all students to participate in CS, as well as increase interest and future desire to continue to explore CS (Flannigan et al., 2022).

For example, in a 2010 study from Cutts et al., researchers worked with university students in a programming course. They designed three interventions: a mindset training intervention, which involved a tutor leading the students through growth mindset reflection activities; a crib-sheet intervention, which provided students with a list of strategies to try if they got stuck; and a rubric intervention, which was designed to remind students that challenges could be overcome at the precise moment when they were stuck. All three of these interventions included some element of helping students develop a growth mindset. Finally, there was a control group which did not receive any intervention. The study found that those in the control group developed a more fixed mindset over time, while those in the intervention groups developed more of a growth mindset. Most importantly, those students in both the mindset intervention and the rubric intervention saw an overall shift in mindsets as well as improved CS performance (Cutts et al., 2010).

2.1.3 Creating a Welcoming, Supportive Environment

In CS education, building personal connections and relationships with students can also help broaden participation (e.g., Madkins et al., 2020; Margolis et al., 2012). When students have positive relationships and connections with their CS teacher, students may feel more connected to these fields of study and see themselves as good fits within those fields (Madkins et al., 2020; Margolis et al., 2012). Building relationships with students is also a major component of learner-centered and culturally-relevant CS pedagogical practices and frameworks, which are intentionally designed for supporting broadening participation efforts (Madkins et al., 2020).

Finally, previous research on broadening participation in CS has also suggested that the design of classroom space can be an important factor in addressing these stereotypes (Cheryan et al., 2015; Master et al., 2016). For example, Master et al. (2016) tested whether CS gender stereotypes were communicated by the physical design of a CS classroom such as tech magazines, computer parts, and Star Wars/Star Trek items. They found CS classrooms that did not project common CS gender-based stereotypes, girls (but not boys) were more likely to express an interest in CS when compared to a CS classroom that did project common gender-based stereotypes (Master et al., 2016). Overall, relationships with the CS teacher and classroom CS space impacts students' perceptions of the field and of their own fit within the field.

2.1.4 Culturally-Relevant and/or Responsive Curricula

Current issues of inequity within CS are the result of longstanding, entrenched systems that prioritize certain ways of knowing, being, and doing (e.g., Ensmenger, 2010; Jones & Melo, 2020). These existing systems and practices have led to the current state of the field where students of color, urban and rural studies, low SES students, students with disabilities, multilingual students, and others are significantly underrepresented and underserved (Code.org, 2021; National Academies of Science, Engineering, and Medicine [NASEM], 2021). Researchers and stakeholders have continually emphasized that efforts to address these issues and broaden CS participation should also include culturally-relevant and/or responsive pedagogical approaches (Madkins et al., 2020; Scott et al., 2015; Vakil, 2018). In general, these types of approaches include connections to students' culture and communities in meaningful ways, challenge existing systems of racism, sexism, and oppression, and provide support and scaffolding for students to engage in these types of difficult and challenging topics (Madkins et al., 2020).

For CS courses and programs to address systemic equity issues, there needs to be intentional and explicit curricular focus to ensure these topics are incorporated alongside other necessary content (Madkins et al., 2020; Scott et al., 2015; Vakil, 2018). In short, broadening participation efforts in CS education must be connected with curricular content and discussion around why these efforts to broaden participation are needed in the first place. Overall, when students and educators leverage culturally-responsive pedagogies, students are better able to understand the sociopolitical relevance and importance of CS across individual, community, and societal levels (Madkins et al., 2020).

3. Methods

3.1 Context

The study took place over three-months, in a single CS classroom, at Forest View High School (FVHS, pseudonym), and used an ethnographic case study design (Fusch et al., 2017; Ó Riain, 2009) to examine the experiences of teachers and students within that classroom. FVHS is a large, suburban high school in southern Indiana. Enrollment during the time of this study was 1,833 students with student demographics of 65.7% White, 14.8% Black, 9.7% Multiracial, 7.6% Hispanic, 1.9% Asian, 0.2% Native American. In addition, 56.3% of students were on free/reduced meal plans and 43.7% were on paid meal plans, which is higher than the state average (Indiana Department of Education [Indiana DOE], 2019a). FVHS is one of two public high schools in their school district, with the other school having less racial/ethnic diversity and higher average socioeconomic status (Indiana DOE, 2019b). FVHS was selected for this study based on state-level enrollment data showing consistently high numbers of girls in CS courses (see Table 2) when compared to the state average of approximately 20% (Ottenbreit-Leftwich et al., 2017).

Table 2. CS enrollment data at FVHS by gender

School Year	Course Name	Girls and Total Enrollment	Percent Girl Enrollment
2010 - 2011	AP Computer Science A	8 / 32	25%
	Digital Applications and Responsibility	7 / 28	25%
	Web Design	10 / 28	36%
2011 - 2012	Digital Applications and Responsibility	24 / 49	49%
	Web Design	15 / 50	30%
2012 - 2013	AP Computer Science A	14 / 43	33%
	Digital Applications and Responsibility	18 / 33	55%
	Web Design	19 / 52	37%
2013 - 2014	Computer Science II	8 / 24	33%
	Digital Applications and Responsibility	9 / 17	53%
	IB Computer Science Standard Level	1 / 3	33%
	Web Design	20 / 47	43%
2014 - 2015	AP Computer Science A	16 / 46	35%
	Digital Applications and Responsibility	17 / 38	45%
	Web Design	20 / 57	35%
2015 - 2016	Computer Science I	5 / 35	14%

	Computer Science II	14 / 36	39%
	Digital Applications and Responsibility	11 / 19	58%
	Introduction to Computer Science	1 / 28	4%
	Web Design	12 / 35	34%
2016 - 2017	AP Computer Science A	25 / 61	41%
	Computer Science I	2 / 21	10%
	Computer Science II: Special Topics	13 / 31	42%
	Information Technology Support	13 / 31	42%
	Introduction to Computer Science	58 / 143	41%
	Web Design	50 / 101	50%
2017 - 2018	AP Computer Science A	25 / 61	41%
	Computer Science I	2 / 21	10%
	Introduction to Computer Science	58 / 143	41%
	Web Design	23 / 50	46%
2018 - 2019	Computer Science I	7 / 28	25%
	Computer Science II	10 / 35	29%
	Introduction to Computer Science	35 / 99	35%
	Web Design	13 / 28	46%
2019 - 2020	AP Computer Science A	2 / 12	17%
	AP Computer Science Principles	2 / 2	100%
	Computer Science I	6 / 16	38%
	Introduction to Computer Science	40 / 110	36%
	Web Design	27 / 49	59%
2020 - 2021	AP Computer Science Principles	4/ 13	31%
	Computer Science I	14 / 49	29%
	Computer Science II	4 / 12	33%
	Introduction to Computer Science	53 / 118	45%
	Web Design	16 / 33	48%
2021 - 2022	AP Computer Science A	2 / 20	10%

Computer Science I	14 / 47	30%
Introduction to Computer Science	24 / 63	38%
Web Design	15 / 45	33%

More specific to CS enrollment at FVHS, at the time of this study all CS courses were electives. In other words, there was no requirement for students at FVHS to take a CS course. All CS courses were optional, and students could choose to enroll in CS courses similar to music, art, radio, and other elective courses. Often, positive experiences in previous CS courses or the recommendation of school counselors and/or other students led to CS enrollment (see Karlin et al., 2022 for additional context).

3.2 Participants

The unit of analysis for this study was the CS program, and the participants included those involved in the FVHS CS classroom community, as well as those outside the classroom that still held connections to the course offerings, course materials, etc. Specifically, the participants in this study included:

1. Katy, the current FVHS CS teacher (n=1),
2. Michelle, one of the former FVHS CS teachers (n=1),
3. Current FVHS students (n=55).

Of the current CS students (n=85), 55 (65%) participated in an optional anonymous, end-of-semester reflection. Additionally, ten students (12%) provided assent and parental consent to participate in individual and/or focus group interviews.

3.3 Data Sources and Analysis

Data were collected and generated across seven sources:

1. *33 class observations (27 hours and 30 minutes).* These class observations occurred over 11 site visits, with three separate class observations per visit. Researcher field notes were generated during each observation.
2. *Two programming competition observations (6 hours).* One programming competition occurred onsite and was student-hosted and student-led, another occurred at a nearby university. Researcher field notes were generated during both competitions.
3. *11 individual teacher and student interviews (4 hours and 43 minutes).* These occurred before, during, and after class as time allowed. Individual teacher interviews also occurred off-site to allow for deeper conversation. Interviews were recorded and transcribed.
4. *Six teacher and student focus group interviews (1 hour and 48 minutes).* These occurred before, during, and after class as time allowed. Interviews were recorded and transcribed.
5. *55 individual student reflections (65% of students in the FVHS CS program).* These anonymous reflections explored teacher practices that made students feel welcomed/unwelcomed in the CS classroom and provided space for students to identify their gender if they wished.
6. *25 course assignments.* These were collected as pictures of assignment handouts for each lesson observed. Some assignments spanned multiple observation days.

We employed constant comparative analysis (CCA) to iteratively analyze data throughout data generation (Fram, 2013). Our theoretical framework (Table 1, above) represented our a priori coding scheme, which we challenged, reduced, expanded upon, and finalized throughout the analysis process (Fram, 2013). More specifically, all transcribed interview data and other data sources (i.e., student reflections, course assignments, observation notes) were imported into NVivo for analysis. The aforementioned coding scheme was also entered into NVivo and used to code all data sources. To increase trustworthiness, at the conclusion of data generation a second researcher received all observation, interview, and reflection data and coded all data using the same procedures. We then met to compare results and in cases of disagreement, we discussed until we reached agreement (Saldaña, 2015). We engaged in member checking with all participants throughout data generation (e.g., LeCompte & Preissle, 1993) and at the conclusion of analysis, findings were shared with the current teacher and several student participants for a final member check.

4. Findings

This study initially set out to examine what was happening at FVHS that consistently led to more gender-inclusive CS participation. The study found that while the FVHS CS program did not have a specific goal of broadening participation for girls, it succeeded in doing so through the strategies explored below. In general, their goal had been to expand CS participation for *all* students and in doing so, they also created a more gender-inclusive program. Overall, supporting *all* students was done through: (1) Providing personalized, relevant learning experiences; (2) focusing on growth mindset development; and (3) creating a welcoming environment. These themes and their respective sub-themes are summarized below in Table 3.

Table 3. Summary of major themes

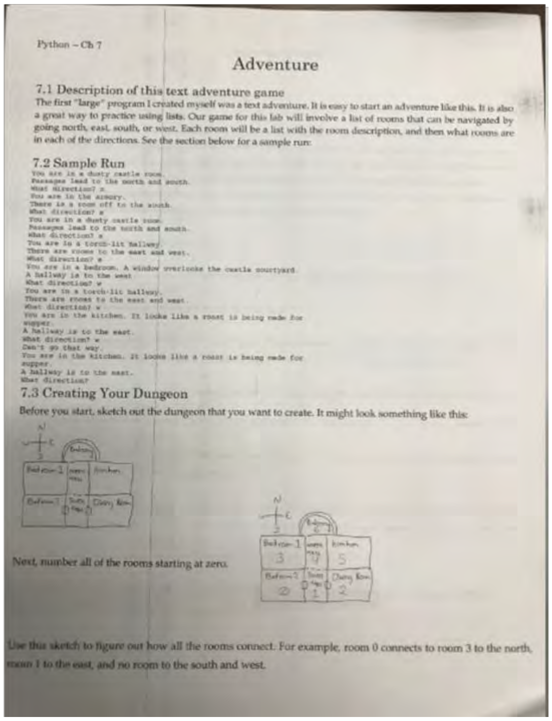
Primary Theme	**Sub-Themes**	**Definition**
Personalized, Relevant Learning Experiences	Assignment Choice	The teacher provided (and the students valued) choices on how to engage with assignments in a variety of ways that aligned with interests and past experiences.
	Personalized Support	The teacher provided (and the students valued) support that was aligned with unique, specific needs.
Focus on a Growth Mindset	Modeling a Growth Mindset	The teacher modeled (and the students developed) a growth mindset and articulated how learning and expertise were not “fixed” but rather could be developed over time.
	Providing Opportunities to Learn from Failure	The teacher provided (and the students valued) the opportunity to resubmit work and learn from past mistakes.
Creating a Welcoming, Supportive Environment	Personal Relationships with Students	The teacher built (and the students valued) personal relationships and connections.
	Incorporation of Humor into the Classroom	The teacher incorporated (and the students valued) humor, jokes, and laughter in classroom lessons and activities.
	Creating a Welcoming Physical Space	The teacher created (and the students valued) a space where everyone felt welcomed and supported, even outside of assigned class time.

4.1 Personalized, Relevant Learning Experiences

Overall, Katy (current FVHS CS teacher) provided personalized, relevant learning experiences for all students in two ways: (1) Assignment choice; and (2) personalized support.

4.1.1 Assignment Choice

Based on observation field notes and course documents, Katy would regularly provide general expectations that a program or assignment would need to meet but allowed students to choose the topic of the program. For example, one of the programming assignments asked students to create a text-based game that involved a map the player could navigate by moving north, south, east, and west (see Figure 1). While students had general expectations for this program, the location and design of the map were left up to the students. For example, one student chose to create a Pokémon-related map, while another made a map of their home.



Python – Ch 7

Adventure

7.1 Description of this text adventure game

The first "large" program I created myself was a text adventure. It is easy to start an adventure like this. It is also a great way to practice using lists. Our game for this lab will involve a list of rooms that can be navigated by going north, east, south, or west. Each room will be a list with the room description, and then what rooms are in each of the directions. See the section below for a sample run:

7.2 Sample Run

```
You are in a dusty castle room.
Passages lead to the north and south.
What direction? n
You are in the armory.
There is a room off to the south.
What direction? s
You are in a dusty castle room.
Passages lead to the north and south.
What direction? s
You are in a torch-lit hallway.
There are rooms to the east and west.
What direction? e
You are in a bedroom. A window overlooks the castle courtyard.
A hallway is to the west.
What direction? w
You are in a torch-lit hallway.
There are rooms to the east and west.
What direction? w
You are in the kitchen. It looks like a roast is being made for
supper.
A hallway is to the east.
What direction? w
Can't go that way.
You are in the kitchen. It looks like a roast is being made for
supper.
A hallway is to the east.
What direction?
```

7.3 Creating Your Dungeon

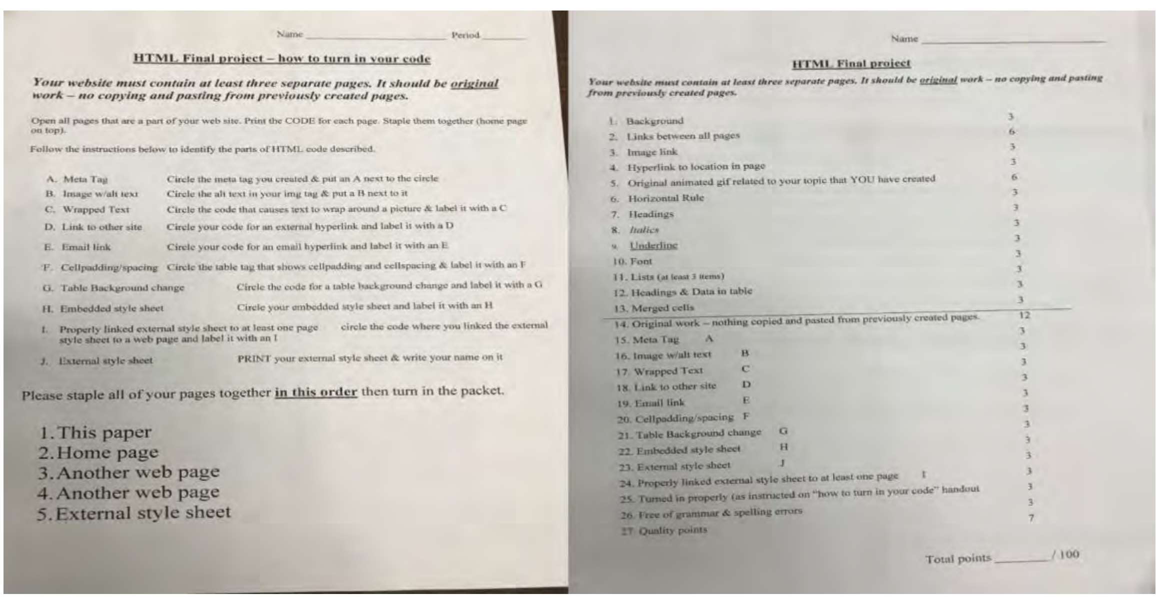
Before you start, sketch out the dungeon that you want to create. It might look something like this:

Next, number all of the rooms starting at zero.

Use this sketch to figure out how all the rooms connect. For example, room 0 connects to room 3 to the north, room 1 to the east, and no room to the south and west.

Figure 1. Example personalized assignment for Computer Science 1 class

A second example of assignment choice came with the Web Design students' final project (see Figure 2). For this project, students had a list of basic requirements (e.g., links, images, text formatting, etc.) but the topic of the web page was left up to the students, based on their individual interests. From observation field notes, some students presented on different animals, others presented on favorite video games or television shows, and others presented on various topics of interest. Overall, these elements of choice allowed assignments to be more personalized and relevant to students and were consistently seen across course assignments. Of the 25 course assignments collected for analysis, 21 contained some element of choice or personalization (84%).



Name ____________ Period ______

HTML Final project – how to turn in your code

Your website must contain at least three separate pages. It should be original work – no copying and pasting from previously created pages.

Open all pages that are a part of your web site. Print the CODE for each page. Staple them together (home page on top).

Follow the instructions below to identify the parts of HTML code described.

A. Meta Tag — Circle the meta tag you created & put an A next to the circle
B. Image w/alt text — Circle the alt text in your img tag & put a B next to it
C. Wrapped Text — Circle the code that causes text to wrap around a picture & label it with a C
D. Link to other site — Circle your code for an external hyperlink and label it with a D
E. Email link — Circle your code for an email hyperlink and label it with an E
F. Cellpadding/spacing — Circle the table tag that shows cellpadding and cellspacing & label it with an F
G. Table Background change — Circle the code for a table background change and label it with a G
H. Embedded style sheet — Circle your embedded style sheet and label it with an H
I. Properly linked external style sheet to at least one page — circle the code where you linked the external style sheet to a web page and label it with an I
J. External style sheet — PRINT your external style sheet & write your name on it

Please staple all of your pages together **in this order** then turn in the packet.

1. This paper
2. Home page
3. Another web page
4. Another web page
5. External style sheet

Name ____________

HTML Final project

Your website must contain at least three separate pages. It should be original work – no copying and pasting from previously created pages.

1. Background 3
2. Links between all pages 6
3. Image link 3
4. Hyperlink to location in page 3
5. Original animated gif related to your topic that YOU have created 6
6. Horizontal Rule 3
7. Headings 3
8. *Italics* 3
9. Underline 3
10. Font 3
11. Lists (at least 3 items) 3
12. Headings & Data in table 3
13. Merged cells 3
14. Original work – nothing copied and pasted from previously created pages. 12
15. Meta Tag A 3
16. Image w/alt text B 3
17. Wrapped Text C 3
18. Link to other site D 3
19. Email link E 3
20. Cellpadding/spacing F 3
21. Table Background change G 3
22. Embedded style sheet H 3
23. External style sheet J 3
24. Properly linked external style sheet to at least one page I 3
25. Turned in properly (as instructed on "how to turn in your code" handout 3
26. Free of grammar & spelling errors 3
27. Quality points 7

Total points ______ / 100

Figure 2. Example personalized assignment for the FVHS Web Design class

4.1.2 Personalized Support

The support and troubleshooting Katy provided was personalized to meet the specific needs of individual students. From fieldnotes, the majority of daily class time was spent providing personalized, one-on-one support for students while they worked on programming projects. For example, in Katy's Programming class, a student was having difficulty getting her code to work when designing the aforementioned text-based game where students could navigate using North, South, East, and West. The student called Katy to help, and Katy provided personalized troubleshooting:

> Katy: "So here you'll have square brackets instead of the number, that number is going to change every time they make a choice. You'll get there! Just trust these instructions."
>
> Student: "I know but they just confuse me."
>
> Katy: "And that's OK!" (*Katy continues to walk her through the instructions)*
>
> Student: "And what is this supposed to do?"
>
> Katy: "It's the same thing as up here (*points to an earlier section in the student's code)*. I think [these directions are] just taking it too slow for you, it's really step by step."
>
> Student: "OK, well I will call you back soon then. It won't be long!"
>
> Katy: "Oh stop it, you're fine!" (*both laugh)*

The troubleshooting Katy provided in this example was specific to what the student was struggling with while getting her game to work. Another example occurred during a Web Design class, when a student was having difficulty creating a target tag within a hyperlink on his website:

> Student: "[Katy] how do you do a target tag again? And what is it?"
>
> Katy walks over to him
>
> Katy: "You know how when you do a hyperlink, you can add target to it, so that the link opens in a new page?"
>
> Student: "Ohhh."
>
> Katy: "So you can add it into a hyperlink that you already have."
>
> Student: "So why do we do this?"
>
> Katy: "So when someone clicks on the link, it opens it in a new tab, instead of in the same page they're already in." (Katy shows him how to add the target tag).
>
> Katy: (Leaving) "So yell at me if there's anything else, but looks like you've got it!"

Here again, Katy provided personalized troubleshooting based on the specific problem. This type of personalized support was observed consistently throughout every observation, for the majority of each class period, with the exception of two testing days.

Additionally, anonymous student reflections also discussed the importance of the personalized support and troubleshooting Katy provided. When asked "What does your teacher do to make you feel welcomed?" the most common emergent theme was *provide support* with 60% of girls (n=14) and 53% of boys (n=18) responding this way. For example, a boy in Programming wrote: "[Katy] is always ready to help or answer questions and seems very interested in our thoughts and questions." A girl in AP Java wrote a similar idea: "[Katy is] always available if I have questions or am struggling to figure out an assignment. She offers help after and before school and never makes me feel less-than for not understanding a concept as fast as my classmates." Finally, a girl in Web Design described how Katy provided personalized feedback and created a welcoming atmosphere: "[Katy] helps you whenever you need it and she makes it easy to ask questions."

This theme of personalized support was also reflected in student interview data. Diya, a sophomore in AP Java, noted that the one-on-one help provided by Katy was helpful for her and her classmates: "I think [Katy's] help works really well because then everybody can go at their own pace and we don't have to all be doing the same thing." This was similar to what Patti and Hope (freshman girls in web design) spoke about during their focus group interview as well:

> Patti: [Katy] helps us a lot when we have questions.
>
> Hope: Like her just answering our questions and working through things with us helps a lot.

> Patti: She's good at explaining it too!

Overall, Katy provided personalized learning experiences through assignment choice as well as support and troubleshooting. Katy consistently met students where they were at in terms of their interests, and designed course learning experiences in differentiated ways to meet a variety of student needs.

4.2 Focus on a Growth Mindset

Overall, Katy supported the development of a growth mindset in two ways: (1) Modeling a growth mindset and; (2) providing opportunities to learn from failure.

4.2.1 Modeling a Growth Mindset

Throughout Katy's interviews and observation field notes, Katy described and provided consistent examples of modeling a growth mindset, admitted gaps in her own knowledge, and emphasized the importance of learning and growth over immediate success. In one interview, Katy described these practices as representing a "Growth mindset" (e.g., Dweck, 2006) and went on to explain why she believed a growth mindset was important, particularly for underrepresented students:

> Especially with our underrepresented populations, I try to model this [growth] mindset. I feel like that it is definitely beneficial, and once you get a little confidence and you have a basic understanding, then maybe you think, "let me try this other [CS] class."

Katy later expanded on this approach in a second interview by using herself and her own growth mindset as an example:

> I try to tell the students that it's about betterment. I don't like to puff myself up very much at all, I just like to let them know "I just learned [CS] at this job two years ago, and when I learned it, I didn't get this part, like with recursives, and I'm still really struggling with that. So, I try to tell them that, when I didn't get this either, I had to really work at it.

Throughout observations and researcher fieldnotes, Katy also regularly admitted to gaps in her own knowledge by calling out mistakes she made or things she was uncertain of, thereby modeling a growth mindset to her students. For example, during an AP Java observation, when a student was struggling with a particular topic, Katy shared her own challenges with the content: "I struggle on these too, they're definitely hard." Katy would also let students know when she made a mistake, and that she was still learning as well. For example, in another AP Java observation, Katy corrected a point she had made earlier in class when a student offered a different solution: "Oh yeah, I was wrong on that, you're right." This type of modeling occurred regularly, across all courses and multiple observations.

In general, students also seemed to be developing a growth mindset and felt comfortable making mistakes and admitting gaps in their own knowledge. For example, in anonymous student reflection data, a boy in the Introduction to CS courses wrote about how he was not afraid to make mistakes or ask questions when he was uncertain: "[Katy] actually takes the time to go around and help students. I'm also not afraid to ask questions because I don't feel judged when I don't understand something like I do in some of my other classes."

As seen in observation data and researcher fieldnotes, students asked questions when they were uncertain. For example, during a Programming observation Katy was filling in a student on an assignment she had missed while she was absent, and the student seemed embarrassed by their question, but also seemed unafraid to ask:

> Katy: I know you were gone for a little bit, just checking in, have you down your Pig Latin assignment yet?
>
> Student: This is probably a really dumb question, but… what is Pig Latin?
>
> Katy: That's OK, it's not a dumb question at all! Have you spoken in Pig Latin before? Or heard that phrase?
>
> Student: I don't think so?
>
> *Katy goes on to explain what Pig Latin is and what the assignment was.*

A second example of this growth mindset development came from Amber, one of the senior students who was taking an independent study in CS. During one interview, she discussed her personal philosophy of it being a good thing to not know everything and to continue to learn from others:

> I might not be one of those [students] places the highest [in competitions], but I want so much to be on the team with people who are better than me. And one of my favorite quotes is, "If you're the smartest person in the room, you're in the wrong room."
>
> I’ve met some people who were in their first year [competing] and they get first place at a competition, and I'm like, that is crazy. Show me what you did. Like, teach me, you know?

Overall Katy modeled a growth mindset throughout observations and student interactions. Students also seemed to be developing growth mindsets within the CS program and appeared to be comfortable making mistakes and admitting gaps in knowledge. In general, these growth practices were consistently and universally supported and modeled by Katy throughout all interviews and observations.

4.2.2 Providing Opportunities to Learn from Failure

In addition to modeling a growth mindset, Katy also supported students when they made mistakes. For example, the following exchange occurred during a Programming observation, where a student was struggling and making mistakes in getting her program to work:

> Student: [Katy]? Can I ask you a question again?
>
> Katy walks over to student, looks at where the student is pointing.
>
> Katy: Oh yeah, this part is definitely tricky.
>
> Student: I think there are a lot of different ways I could do this, but I’m having trouble getting it working, which way did you recommend?
>
> Katy: This is really good. So now you’re going to need a variable to keep track of [this part]. And you have this here [points to specific line of code], which is good. So now we need to set a variable to look for [what you need].
>
> Student: The only way I could be sure is if I could look at my older program, otherwise I’m still a little unsure on this.
>
> Katy: That’s OK! You can always look at your old stuff! That helps me too.

In this exchange, the student had been making mistakes in her program and was unable to get it to work. Katy let the student know it was fine to make mistakes, and that it was a good practice to reference her previous work when facing challenges and problems.

Katy’s grading policy also provided students multiple opportunities to learn from failures and reach success. From observations and researcher field notes across all classes, students could make revisions to previous work and exams, and resubmit that work for additional credit. When asked about this practice during an interview after a Programming class, Katy described that this practice helped maintain students’ interest in CS:

> I never want to squelch a student’s interest in CS, and I want them to know it isn’t always about getting the grade, or getting it right the first time, I want them to know they can keep working and keep trying until they’re happy with the result.

In other words, Katy wanted to make sure to integrate growth mindset practices in her grading policies as well.

Providing multiple learning opportunities was also seen in class observation data. For example, during a Web Design observation, one student had completed their assignment, but had done so incorrectly. Katy went over to help them, and gave them another opportunity to fix the mistake they had made:

> Katy: Make sure you save your animation for web. You saved yours in a different format. That’s one of the mistakes people always make though, it’s OK!
>
> Student: Oh no. Oops. Is it OK?
>
> Katy: You have to make sure to follow these instructions to save it for web so you can actually use it as an animation on your site. It’s OK, you can do it again, just make sure to save it in the right format here [*Katy shows student how to save it correctly*].

Overall, throughout interviews and class observations, Katy demonstrated a growth mindset and created numerous opportunities for learning through failure.

4.3 Creating a Welcoming, Supportive Environment

Overall, Katy supported the creation and development of a welcoming, supportive environment in three ways: (1) Personal relationships with students; (2) incorporation of humor; and (3) creating a welcoming physical space.

4.3.1 Personal Relationships with Students

Across interviews and observations, Katy reported and worked towards building and maintaining personal relationships with her students. Both in formal interviews and in anecdotal conversations, Katy described building relationships with her students, knowing about her students' lives outside of the classroom, and caring about their personal struggles and successes. For example, when asked about why she thought students felt comfortable coming and talking with her about their lives outside of the classroom, Katy described trying to create a welcoming environment:

> I don't have an answer, other than I want them to feel like they can come here [to my classroom]. I have kids that I had last year that aren't taking programming classes this year that come in and print stuff. I want them to feel like this is a place that they can call home.

During one interview, Katy also mentioned that being students' CS teacher over multiple years was important for helping her better connect with students and to learn more about their lives outside of the classroom. Katy described that having these longer relationships were unique in high school and not something most teachers were able to have:

> You don't have very many classes [where you have the same teacher multiple times], unless you take a foreign language, like Latin where there's only one Latin teacher, one German teacher. Then you would have that teacher for four years. Band or orchestra or choir, that sort of thing. But for most part, it's those, and radio, and us. For most classes you have somebody different every year. [Being able to have the same student over multiple years is] good, especially for kids who maybe don't open up that much, who are kind of shy. Then if you have them more than once, that part does help.

While the importance of having the same teacher over time for building relationships was not mentioned by all students, it was explicitly discussed by Amber and Jessica (two seniors enrolled in a CS independent study course). When discussing what Amber and Jessica like about CS, they described the importance of the relationship they had built with both Michelle (former CS teacher) and Katy, and how that would not have necessarily been possible if they had not had them over multiple years:

> Amber: Because, with some of my other teachers, like English or Math that change year to year I got close to them that year but after that the bond didn't stick as well. So yeah of course I talk to my freshman year English teacher, he's great and everything but it's not the same bond that I have with [Katy] or [Michelle], having had them for two, three years in a row. So that for sure helps [build a relationship with them]. So you're not coming into your second programming class with a new teacher and you have to relearn how they teach and everything, you already have that experience.
>
> Jessica: Yeah I think that definitely makes a difference because I've had [Katy] all four years I've been here. Because I had her [my freshman year], and I had her again when she was doing those other classes, and then when she was teaching with [Michelle] for AP and then the past two years. So I think that really makes a difference [in building a relationship] for sure.

Students in general also reported feeling connected to Katy and having a personal relationship with her. For example, in student reflection data, and in answer to the question "What does your teacher do to make you feel welcomed?" The second most common emergent theme for all students related to the teacher building relationships with them (girls n=7, 30%, boys n=14, 41%). For example, a girl in AP Java wrote that Katy was "very personable, so it makes it easier to connect with and learn from someone you're comfortable around."

Students also commented about Katy's overall demeanor, and how she interacted with her students. For example, in the anonymous student reflections, a boy in AP Java wrote that "[Katy] acts like a person and not just a teacher" and another boy in the Introduction to CS course noted that Katy was "always smiling." A different boy in the Introduction to CS class felt welcomed by Katy's regular greetings, saying "when I come in the door [Katy] tells me 'hi'." A girl in Web Design noted a similar welcoming attitude saying, "[Katy] is extremely nice and welcoming, and she always has a positive and upbeat personality." Additionally, Isabella, a freshman girl in Web Design said in her interview that "Katy's just always there to help, so it's really nice. If you just ever need anything, she's always there." Overall, students in general reported that Katy seemed to care about creating a space where students felt comfortable and welcome.

4.3.2 Incorporation of Humor into the Classroom

Across observations and researcher fieldnotes, Katy also worked towards building a welcoming environment with her students through the incorporation of humor. Students would often joke with Katy and talk with her about her own life. For example, the following exchange occurred in a Web Design observation, where students were asking her about her sons, who were also students at FVHS and the local middle school:

> Student: [Katy], have you ever given your sons a detention?
>
> Katy: No, they just kind of sit here, they don't get in trouble. But they do get in trouble at home.
>
> Student: Then what if you gave them a detention at home, for school.
>
> Katy: Oh, so if they don't clean their room or something, I could just give them a detention for it?
>
> Student: Yeah, exactly, and then they'd have the detention at school.
>
> *The class laughs together.*

This example seemed to illustrate a level of comfort and familiarity that Katy had with her students, and that her students had with her.

In another example, students in AP Java were joking with Katy about the curly bracket she had drawn on the board when writing out code ("{"), and the following exchange occurred:

> Student: What is that curly bracket? What happened to it?
>
> Katy: This one? This is a GREAT curly bracket, I am proud of my work!
>
> Student: I don't know if you should be proud about that!
>
> *Class laughs together.*

Finally, the students also recognized Katy's attempts to incorporate humor into the classroom. For example, Amber and Jessica discussed in a focus group interview how Katy incorporated humor and that they considered her to be a funny teacher: "all her humor that comes with having a funny teacher, then you feel the connection with all the other students [as well], and you're all just kind of building each other up."

Overall, these types of short examples involving brief conversations where Katy and the students joked together were common across all observations and all courses. Katy worked intentionally to build relationships with her students by incorporating humor into the classroom, and this was reflected across both interview and observation data.

4.3.3 Creating a Welcoming Physical Space

Finally**,** Katy supported her students by creating a welcoming space in her CS classroom. For example, in one interview, Katy described the effort she put in to helping students feel welcome and part of a classroom community: "It's intentional that I want [my students] to feel like they belong. I want them to feel comfortable in [our] room." Katy followed this up later in the same interview discussing how she try to create a comfortable environment for her students:

> I want [my students] to feel comfortable in here. I try to make it as non-threatening as possible so even if they're not getting something, I try to encourage [them]. So it's like, "Keep on doing it."…I want them to feel comfortable with each other too. I encourage them to try to [help each other].

Katy explained that her philosophy on the importance of creating a welcoming space for her students centered around the desire to have her students feel like someone at the school cared about them, and wanted them to be there: "[I try to setup my classroom so that], it makes it a lot more fun to come to school and just feel like somebody cares if [they're] here or not" (see Figure 3). Additionally, during many observations, students not currently taking a CS course would visit the class to talk with Katy before school, after school, and during lunch.

Figure 3. Examples of Katy's classroom design

Another example where Katy attempted to help her students feel welcome was giving her upper-level students t-shirts that they co-designed as a gift (see Figure 4). This was a practice that Michelle (former CS teacher) originally began, and Katy expanded on. Katy described the T-shirt practice and why it was helpful in building relationships with the students:

> I got them [a t-shirt] last year that just has some nerdy [things on it]…That was their Christmas gift last year. Those were kids who [were] in Programming II who got them last year. Then I had some extras to give to the other Programming [class, and] to the kids who weren't in that class but were still on the [programming] team. Anyway, [I believe that] makes [the students] feel like they're part of something. Even if they're not on the [programming] team, they still got the shirts.

In other words, Katy had continued the practice that Michelle had started, but also expanded it to include students who were outside of the programming club to help the students feel more connected to the CS classroom community.

Figure 4. Examples of t-shirts that Katy and Michelle had co-designed with students.

5. Discussion and Implications

As illustrated in Joanna Goode's work (2007), CS teachers have the ability to "act as change agents to broaden the participation in computing for historically underrepresented students" (p. 65). The results from this study suggest that Katy helped broaden participation by creating a classroom culture where girls felt supported, represented, and welcomed. While this work was not done in isolation (see Karlin et al., 2022 for larger historical context of FVHS's CS program), at the time of this study Katy was the primary driver of supporting equitable CS engagement. As seen in the results, she did this through three primary methods: (1) Personalized and relevant learning experiences; (2) focusing on a growth mindset; and (3) creating a welcoming, supportive environment. The importance of these themes, and their connection to existing literature and future research possibilities are explored below.

Additionally, it is important to note that across all themes, while a more gender-inclusive CS space was created for girls at FVHS, the majority of classes still had less participation than representative of the overall school population (~50%, see table 2 above). This may relate to perceptions girls have around CS, specifically connected to stereotypes of the field, which can often serve as gatekeepers (Karlin et al., 2024). When girls' perceptions of themselves do not align with their perception of a field, they may be less likely to engage in the field (Starr, 2018; Starr & Leaper, 2019). This is common in STEM and CS fields (Karlin et al., 2024; Starr, 2018; Starr & Leaper, 2019), and more work is needed to explore how stereotypes and perceptions around CS impact broadening participation efforts. While positive movement towards equity was seen in this study, and is explored further below, additional time, work, and support are still needed to reach fully equitable participation levels.

5.1 Importance of Meaningful, Personalized, Relevant Learning Experiences

Overall, providing relevant and personalized learning experiences in CS classes and courses has been suggested as one approach for supporting broadening participation efforts (Goode & Margolis, 2011; Lachney, 2017; Madkins et al., 2020; Margolis & Goode, 2016; Scott et al., 2017; Seneviratne, 2017). By providing choice and allowing students to bring in areas of interest and relevancy to assignments, students are more likely to feel connected to CS as a discipline (Goode & Margolis, 2011; Lachney, 2017; Madkins et al., 2020; Margolis & Goode, 2016; Scott et al., 2017; Seneviratne, 2017; Wilson, 2006). For this study, the teacher offered personalized learning experiences through assignment choice and personalized support. Girls recognized these personalized learning opportunities and reported they were beneficial for feeling supported within the CS program.

However, the goal of this study was not to investigate causality. In other words, we did not examine whether the implementation of personalized learning experiences was the specific driver for building a more gender-inclusive classroom. Rather, we found these practices were present, and that girls felt these practices were beneficial. Future research could further explore causality to better elucidate the direct impact personalized learning experiences have on broadening participation efforts.

Additionally, while students were given choice in their assignments, and the CS curricula and activities were personalized to individual interests, needs, and goals, there was a lack of what is typically referred to as culturally relevant or culturally responsive approaches (Madkins et al., 2020). In the Kapor's Center's Cultural Relevant Framework Report (2021), they describe that culturally responsive-sustaining CS pedagogy should ensure that "students' interests, identities, and cultures are embraced and validated, students develop knowledge of computing content and its utility in the world, strong CS identities are developed, and students engage in larger socio-political critiques about technology's purpose, potential and impact" (p. 5). Culturally relevant and culturally responsive approaches often connect to larger cultural ways of knowing and doing, the development of critical consciousness, and the importance of cross-cultural communities and connections (Madkins et al., 2020). At FVHS, these larger cultural aspects were absent (more below), and the focus was more on individualized choice and personalization of assignments based on interests (e.g., video games, television shows, etc.). Therefore, while some levels of personalization, meaningfulness, and relevancy were addressed, it was primarily present at the individual level, rather than the larger community, cultural, or societal level.

5.2 Importance of a Growth Mindset

In general, research has suggested that modeling and helping students develop a growth mindset can be beneficial for broadening participation (e.g., DuBow et al., 2016; Margolis et al., 2015; Starr, 2018; Wagner, 2016). Developing a growth mindset can help students shift their self-perceptions, so they see CS as something that can be learned, not just something people are born being able to do (e.g., Margolis et al., 2015). Alternatively, when teachers, counselors, and other stakeholders see CS as something people are born being able to do well, this reinforces existing inequities around who does CS (Margolis et al., 2017; Margolis et al., 2015). Shifting to a focus on a growth mindset can help encourage *all* students to participate in CS, not just those who see themselves as being naturally capable (Margolis et al., 2015). In this study, girls recognized when Katy admitted gaps in her knowledge and provided opportunities for multiple learning attempts, and reported these practices as being beneficial for feeling supported in the CS program.

In addition to implementing strategies like the ones used by Katy, schools looking to broaden participation by focusing on a growth mindset might consider recommendations from the National Center for Women in Technology (NCWIT, 2014). NCWIT has provided a list of eight strategies teachers can use to support growth mindsets such as focusing on feedback and progress over tests and assignments that only assess skills at a single point in time. However, as noted above, the goal of this study was not to investigate causality. While growth mindset practices were present, and girls reported these as beneficial, future research could more specifically explore the direct impact developing a growth mindset has on broadening participation efforts. Overall, research suggests focusing on a growth mindset in CS can help broaden participation to *all* students, including those who are historically underserved (DuBow et al., 2016; Margolis et al., 2015; Starr, 2018; Wagner, 2016).

5.3 Importance of a Welcoming, Supportive Environment

Previous research on building more gender-inclusive CS programs has suggested the design of classroom space can be an important factor in creating more welcoming environments (Cheryan et al., 2011; 2015; Hoffman et al., 2019; Master et al., 2016). In Katy's FVHS CS classroom, intentional effort was put into designing a classroom space which she believed would feel inclusive to all students. In addition to the physical design of the classroom, this included her relationships and connections with her students. In terms of the classroom layout, Katy's room had an overall Harry Potter theme, as well as a corner that was meant to represent a relaxing forest (see Figure 3 above). Katy had also included pictures of famous computer scientists of different races and genders around the room: "Yes [it was intentional], I tried to make sure it wasn't just a bunch of white men."

As discussed in the results, Katy's emphasis on creating a welcome classroom space through building relationships was recognized by students as being important for feeling supported. However, despite Katy's emphasis on physical classroom design, and the suggestions of its importance in the literature, this idea was never mentioned by students during interviews or reflections. The lack of student discussion on this topic may have been due to this being the only classroom design they had seen for a CS course. In the literature (e.g., Master et al., 2016), students are often exposed to specific images of CS classrooms, to see if that impacts their perceptions of fit within CS.

While the specific design of the classroom space was not noted by the students, what was reported was that Katy had created an environment where students felt comfortable and connected to their teacher. This aligns with previous research suggesting that creating more welcoming spaces can help create more gender inclusive classrooms (Ramsey et al., 2013). Therefore, while the actual design of the classroom was not discussed by students, the results suggested that students felt comfortable and connected in the space due to their relationships with Katy. For teachers who are able to redesign their physical classroom space, creating more inclusive, representative spaces may be beneficial for broadening participation (e.g., Cheryan et al., 2011; Cheryan et al., 2015; Master et al., 2016).

5.4 Absence of Critical, Culturally-Relevant and/or Responsive CS Content

While numerous strategies were in place at FVHS for supporting more gender-inclusive participation, justice-oriented approaches, assignments, and conversations were absent within the results. Within the observed FVHS curriculum, there was an interwoven focus on creativity, problem-solving, student agency, the creation of welcome and accessible spaces, and a de-emphasis on CS for workforce related needs. However, despite these best practices for broadening participation, there was an absence of focus on systemic issues and how CS is used to reinforce and perpetuate systems of inequity and oppression (Vakil 2018; Jones & Melo, 2020). Research and stakeholders suggest that when teachers are working to broaden participation and create more inclusive programs, an emphasis on the historical, systemic, exclusionary issues at play within CS should be essential curricular components (Vakil 2018; Jones & Melo, 2020).

The Kapor Center (2021) created a seminal framework for culturally responsive-sustaining CS education which presents six core components for teachers to implement culturally relevant practices: (1) acknowledge racism in CS and enact anti-racist practices; (2) create inclusive and equitable classroom cultures; (3) pedagogy and curriculum are rigorous, relevant, and encourage sociopolitical critiques; (4) student voice, agency, and self-determination are prioritized in CS classrooms; (5) family and community cultural assets are incorporated into CS classrooms; and (6) diverse professionals and role models provide exposure to a range of CS/tech careers. Although Katy created an inclusive and equitable classroom culture (through her welcoming environment) and utilized student voice and agency through meaningful, personalized, and relevant experiences, there are still many other strategies that could be employed to make the program more inclusive.

Indiana, as a state, is relatively homogeneous, with a predominantly white population. FVHS had a more unique opportunity to engage more diverse family and community cultural assets, and incorporate these into the curriculum. Katy allowed these to surface by having students select their own topics, but perhaps with additional encouragement and scaffolding from Katy, this could have led to a more inclusive practices as described above. In addition, in class observations, there were no sociopolitical critiques about how women voices are often left out of CS innovations, and the importance of diverse voices. Shah and Yadav (2023) argue that to truly broaden participation in computing, we need to start with teachers at the local level and support them to engage with local communities in these types of conversations. Resources for CS teachers to gain competences around inclusive CS practices such as UT Austin's Strategies for Effective and Inclusive CS Teaching course or work from the Computer Science Teachers Association's Equity Fellows can be beneficial in supporting these efforts.

6. Conclusion

Literature on building more gender-inclusive CS programs is often focused on undergraduate students or professionals, asking what factors motivated them to pursue a CS path (e.g., Wang et al., 2015). By situating ourselves within a high school classroom environment, we were better able to gain a more holistic understanding of the specific context of a more gender-inclusive program. In Katy's classroom, no one single practice stood out for the teacher or students as being the most influential in creating a more equitable space. Rather, the teacher and students acknowledged and discussed a range of practices and experiences that led to a culture of inclusion within the CS program. This range of practices included creating personalized and relevant learning experiences, focusing on developing a growth mindset, and creating a welcoming, supportive environment for students. As Goode (2007) argued, and as evidenced by Katy's work at FVHS, CS teachers can act as change agents to support broadening participation efforts.

Overall, our findings suggest that while the individual literature recommendations for best practices on broadening participation are important, having a holistic understanding of a context where broader participation is occurring can shed light on more subtle connections between these strategies and practices. However, more work is always needed to explore the supports and resources teachers need to act as change agents, and more importantly, for scholarship to learn *from* teachers so we can better understand the beneficial practices and approaches being implemented in the field.

Ethics

IRB approval was received for this study. Written consent was received from all participants. Member-checks were used continuously and throughout to ensure alignment with participant perspectives. All names used are pseudonyms.

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