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Analyzing Motivation and Sense of Belonging in CS1 Review Sessions

An Honors College Project Presented to
the Faculty of the Undergraduate
College of Integrated Science and Engineering
James Madison University

by Cory Longenecker

May 2023

Accepted by the faculty of the Computer Science Department, James Madison University, in partial fulfillment of the requirements for the Honors College.

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PUBLIC PRESENTATION

This work is accepted for presentation, in part or in full, at James Madison University on April 21, 2023.

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Dedication

I would like to dedicate this project to my advisor Dr. Weikle for all of the guidance and support she gave me for this project, to Dr. Michael Stewart for all of his help on this project, especially in the survey collection and analysis, Dr. Kenn Barron for suggestions for increasing motivation, Dr. Chris Mayfield and Dr. Chris Johnson for help writing my paper, and to all of my friends and family for their continued support in this process.

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Abstract

Analyzing Motivation and Sense of Belonging in CS1 Review Sessions

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James Madison University, 2023

Thesis Advisor: Dee A. B. Weikle, Ph.D.

The Computer Science Department at James Madison University has a Teaching Assistant program which aims to help students succeed in early-level Computer Science courses. Part of this program is a review session, the Fourth Hour, which provides students extra help on the concepts taught each week in class. Historically, attendance at this review session has been low. Because of this, the study aimed to increase attendance by motivating students through interventions, primarily offering quiz retakes to students who attended. Additionally, this study looked at the reported sense of belonging for participants who attended.

We made three conclusions from survey data we collected. First, giving students incentives in the form of quiz retakes notably increased attendance. Second, students who did not attend the Fourth Hour had a greater sense of belonging, likely because many of them were not struggling. Third, the primary reason students reported not attending is that they did not see value in attending, possibly because they have a greater sense of belonging than students who attended.

Chapter 1: Introduction

1.1 Purpose and Objectives

The purpose of this work was to study how to motivate students who would benefit by attending and participating in review sessions for their CS1 (CS149 programming fundamentals) course at James Madison University. We offered incentives like quiz retakes and developed promotional material, and then we observed how these interventions impacted students' sense of belonging. These incentives were based on the idea that motivation is increased with higher levels of expectancy, higher levels of value, and lower levels of cost [1].

1.1.1 Purpose

The past few semesters, the Fourth Hour review sessions have had poor attendance, which suggests that students have been unmotivated to attend. We aimed to learn why students were not coming and then to motivate students to attend the Fourth Hour through the opportunity to retake weekly quizzes, better advertisements such as posters displayed in the hallways, and in-class visits from TAs. These interventions aimed to increase student expectancy and value and reduce the costs of coming, hopefully increasing motivation [1].

1.1.2 Objective

The objective of this study was to learn what motivates CS1 students to attend review sessions and use that to promote higher attendance. Additionally, this project aimed to identify changes in sense of belonging that could result from better attendance, and whether students with a higher

sense of belonging were more motivated to attend. Data on learning outcomes was also collected in a coordinated study [2].

1.2 Background

The Computer Science department at James Madison University requires students to take two courses before they can be fully admitted into the major, CS149: Introduction to Programming and CS159: Advanced Programming. Students need to receive a B average in these classes to move on in the major.

The department has a Teaching Assistant (TA) program that aims to help students succeed in these early level classes in Computer Science [3]. This is done primarily through lab hours in which students come and ask for help about specific problems from one of 3-4 student TAs present for the shift, as well as in class TAs who assist professors during class times. In 2019 through a related study done by Gilbert et al., the program added review sessions in the form of the Fourth Hour to help students succeed in the first programming class in the beginning of the Computer Science curriculum [4]. While the few students who attended during the study had very positive feedback, attendance was low that semester and in subsequent semesters there were often weeks when no students attended.

1.3 Related Work

Research supports the idea that motivation is influenced by three factors: expectancy, value, and cost [1]. Essentially, motivation is increased as expectancy and value increase, but motivation is decreased as the cost increases. This can be described with the following formula [5]:

$$\textit{Motivation} = \textit{Expectancy} + \textit{Value} - \textit{Cost}$$

In this context, expectancy refers to the extent a student thinks they can be successful in the review session, value is how much they believe the review session will help them, and cost is the social and physical barriers preventing students from attending, such as not knowing where the classroom is or who the TA is. The incentives used in this study aimed to increase expectancy and value and decrease cost, thereby increasing students' motivation to attend the Fourth Hour.

The Fourth Hour review session was originally designed by Gilbert et al. in 2019. This research outlines many reasons students can benefit from the Fourth Hour, including a greater sense of belonging, a greater understanding of the material, and experience working together with students in other sections. However, something noted in the research is attendance is significantly higher on weeks where there is a test review. In the Spring 2022 semester, this trend held true, with weeks without test review sometimes having no students attend. Gilbert et al. presented a solution to this problem: to reduce cost and increase value as much as possible. This research was modeled in part through the proposed approach [4].

Prior research indicates that students are more motivated to attend classes that affect their grade point average [6]. Since the Fourth Hour does not give a grade, it is possible that students see less value in attending. Therefore we introduced quiz retakes as a means to improve their grade that would not lower their grade, with the hope it would lead to an increased sense of value and therefore motivation in attending. In the Fall of 2021, two faculty informally experimented with weekly assessment quizzes and their students attended the Fourth Hour more often.

Another important idea with potential impact on review session attendance is the way faculty and TAs communicate a growth mindset [7]. Having a growth mindset in computer science education involves a student believing that they can improve and that just because they are not perfect at coding right away, that does not mean they will not get better with practice [7]. By communicating to students that they are not alone in their difficulty learning computer science and that there is a safe space for them to practice, students can achieve a better growth mindset. This in turn could increase their perceived value of the review session and subsequently their motivation to attend.

Sense of belonging in this context involves students feeling like they are a part of a community within computer science [8]. Prior research suggests that a lower sense of belonging in entry level Computer Science classes correlates with poor course outcomes, so increasing students' sense of belonging in these classes is important [9]. This is something that prior research suggested the Fourth Hour provides [4]. The hypothesis was that this increase in sense of belonging would motivate students to attend.

The study done by Gilbert et al. included survey questions about each student's sense of belonging. The study asked 5 questions that all began with "In this computer science class . . ." and ended as follows:

1. I feel that I belong to the computer science community.
2. I feel accepted.
3. I feel like an outsider.
4. I try to say as little as possible.
5. I trust my instructors to be committed to helping me learn.

These were meant to gauge student's sense of belonging in a numerical form [4].

After the study by Gilbert et al. there was another study which validated a sense of belonging survey. Many of Gilbert et al.'s questions were discussed in this study, but some of them were removed due to ambiguity. Because of this, this research selected questions from the verified study [10].

Chapter 2: Implementation

2.1 Quiz Design

Online, primarily autograded quizzes were designed by a faculty member based on each week's material and attempt to address misconceptions from the literature [11]. The quizzes were delivered as part of the course. The goal was for the faculty member to administer a retake of the same quiz each week to students who attended the Fourth Hour that week. All students would take the quiz once, and if they were unsatisfied with their grade, professors would open up the quiz for a retake if that student attended the Fourth Hour session that week. These retakes were available to all instructors, and 10 of the 13 sections reported administering them at least once. These quizzes aimed to increase students' perceived value of attending the Fourth Hour.

2.2 Promotional Design

The CS department created new promotional material in the form of posters to help increase student awareness of the review sessions. These posters were put up in the hallways and common spaces in King Hall and promoted a growth mindset and sense of community. As part of administering surveys, TAs visited some sections of CS 149 to explain what the Fourth Hour is, where it took place, and when it was offered to reduce perceived costs. These efforts were designed to promote the idea of community or belonging in computer science. The hope was that these materials made the Fourth Hour feel more accessible and increased the expectancy component.

2.3 Attendance

Each week, attendance was taken at the Fourth Hour review sessions and stored in a spreadsheet shared with the student's professor so that they could receive credit for attending if they were coming for a quiz retake. The attendance was also recorded in an effort to determine if these interventions yielded a higher attendance from past semesters.

2.4 Survey Design

Anonymous surveys were administered on paper three times throughout the semester, which asked students questions regarding demographics, sense of belonging in CS, and motivation for Fourth Hour (see Appendix A.2). Surveys were administered in Weeks 4, 10, and 14. The first survey asked students to report demographic information such as preferred pronouns, race and/or ethnicity, age, and prior programming experience. Since the first survey was administered early in the semester, students were not asked if they had attended. The second and third surveys included questions which asked for reasons students attended or did not attend. There were also questions about how students heard about the Fourth Hour. Additionally, there were questions on all three surveys which track students' sense of belonging. These sense of belonging questions were chosen from a verified study which explored measuring sense of belonging in computing [10]. There were 12 sense of belonging questions on each survey. All of the questions had students answer on a 1-5 scale, 1 being disagree and 5 being agree. For 8 of these questions, a score closer to 5 indicated a higher sense of belonging, and in an effort to validate the results, 4 of these questions were inverted, meaning a score closer to 1 indicated a higher sense of

belonging. This was to make sure scores were not unduly influenced by those just answering the same number to each question.

2.5 Review Session Design

The Fourth Hour sessions were designed to create a comfortable space for students that emphasizes a growth mindset. Each session was led by two TAs, which is intended to help students feel more comfortable since they are with their peers instead of an instructor. They also use peer-instruction which helps students feel more comfortable with each other and aims to increase their sense of belonging. Each session was designed with 2 peer-instruction questions which were answered anonymously to encourage participation. The questions also addressed specific CS1 student misconceptions and were used in a coordinated study to measure learning gains [2]. A hypothesis is that students' value for the review session would increase if they can see their improvement through the peer-instruction questions.

Chapter 3: Results

3.1 Attendance

3.1.1 Weekly Attendance

328 Students enrolled in CS149 in Fall of 2022 and 70 of those students attended the Fourth hour at least once over the course of the semester. Attendance was taken each week at both the Monday and Tuesday sessions. Each weekly total includes the combined attendance totals from both the Monday and Tuesday sessions of that week. Similar to the findings of Gilbert et al., the data shows a trend that typically more students attend on exam weeks and attendance decreases more than usual on the week following an exam [4].

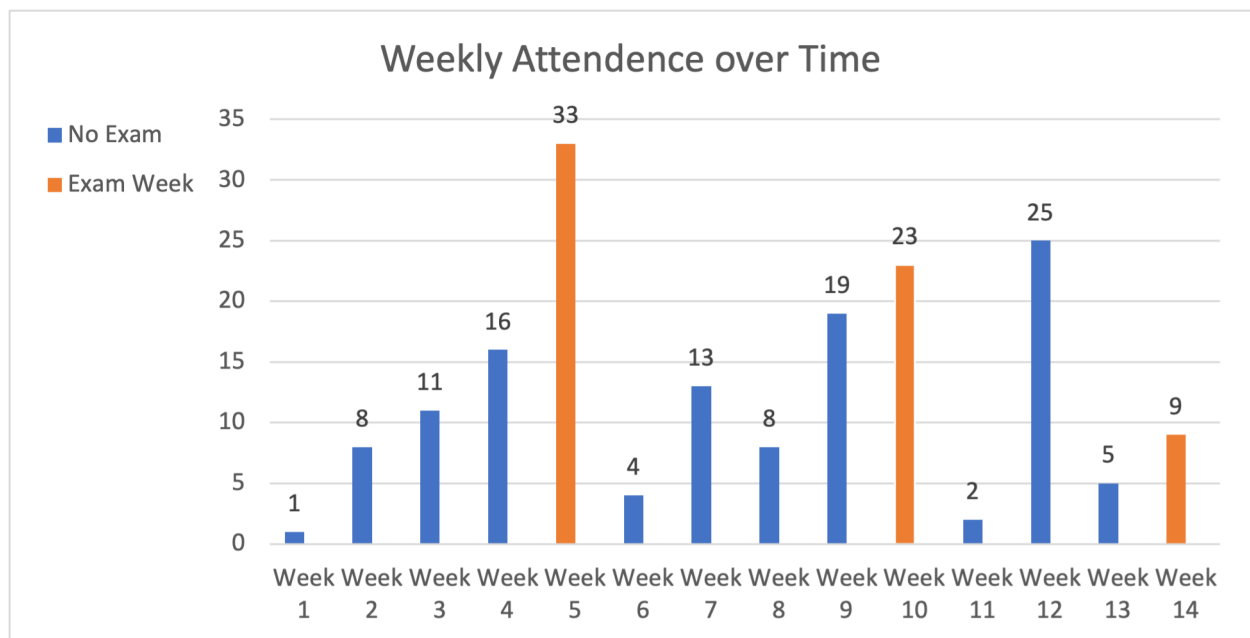


Figure 3.1 Fourth Hour Weekly Attendance

3.1.2 Attendance compared to the previous semester

During this study in Fall 2022, there were 328 students enrolled in CS149, but the semester before in Spring 2022, there were only 222 students enrolled. To compare attendance in these two semesters, this study looks at the percentage of students attending instead of the overall number of students at the Fourth Hour each week.

The data suggests that overall, the Fall semester when the incentives for this study were used had a higher percentage of students attending the Fourth Hour. While there were a few weeks in which a higher percentage of students attended in the Spring, the Fall semester with interventions had a consistently higher attendance rate. This would seem to suggest a positive correlation between increased incentives and increased attendance.

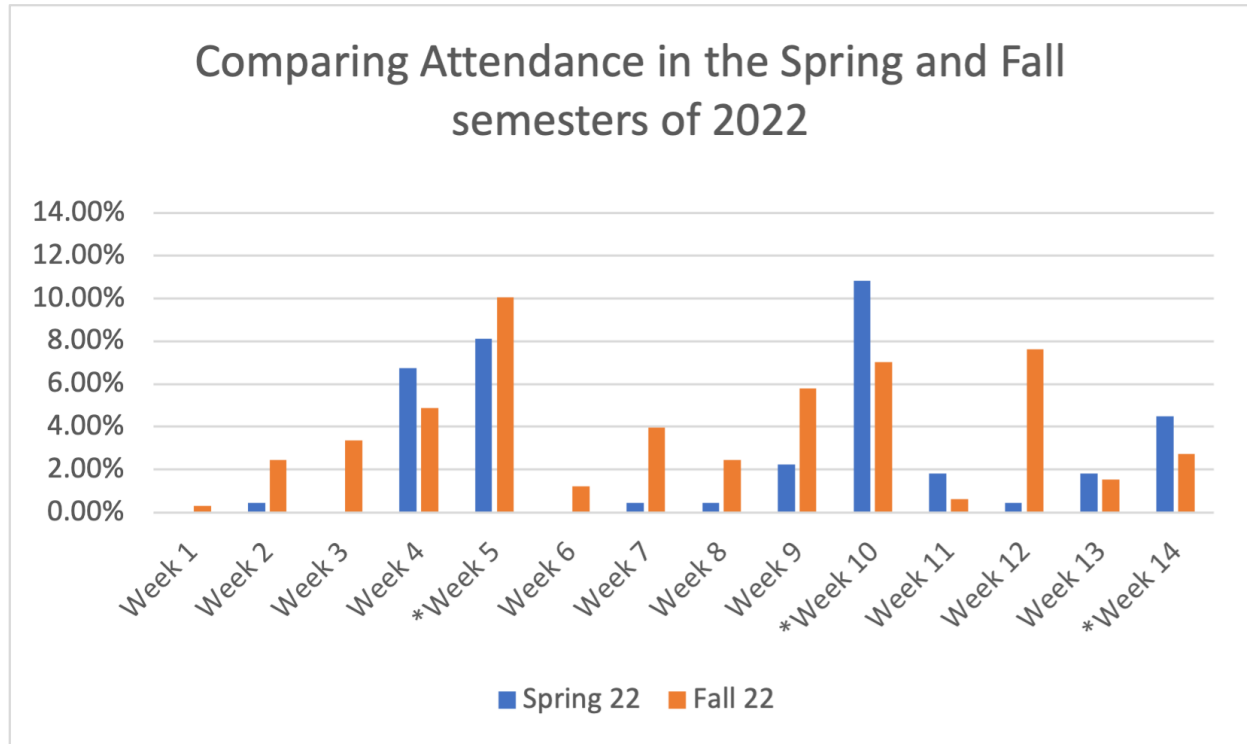


Figure 3.2 Percent of Students who attended in the Fall vs the Spring of 2022

An argument could be made that the change in attendance was related to the Spring and Fall semesters being intrinsically different. However, the data currently available from the Spring 2023 semester, in which professors are continuing interventions, is also demonstrating higher attendance than the Spring 2022 semester without interventions.

3.2 Survey Results: Demographics

Of the 238 Students enrolled in CS149 in the Fall of 2022, 184, students gave consent to participate in this study. However; not all of them completed all three of the surveys throughout the semester. This makes it difficult to accurately portray changes in the data, so the results of this study only include responses from the 100 students who filled out all three surveys. The first survey collected demographic information including race and/or ethnicity, pronouns, and programming experience prior to taking the class.

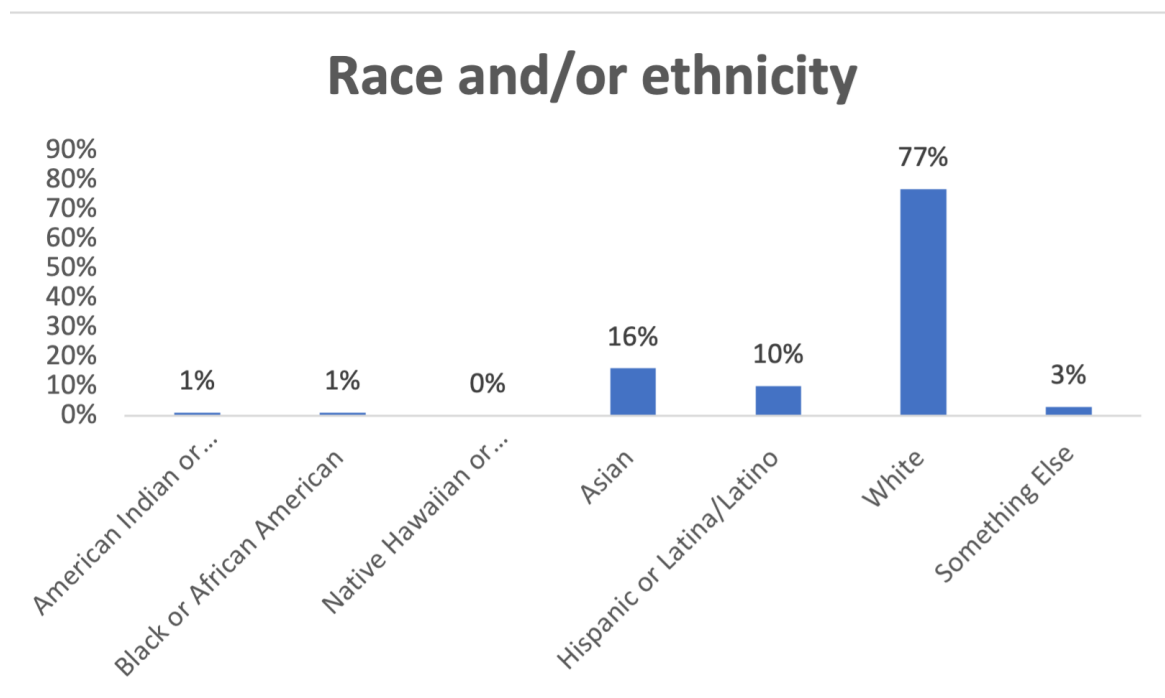


Figure 3.3 Participant Race and/or Ethnicity

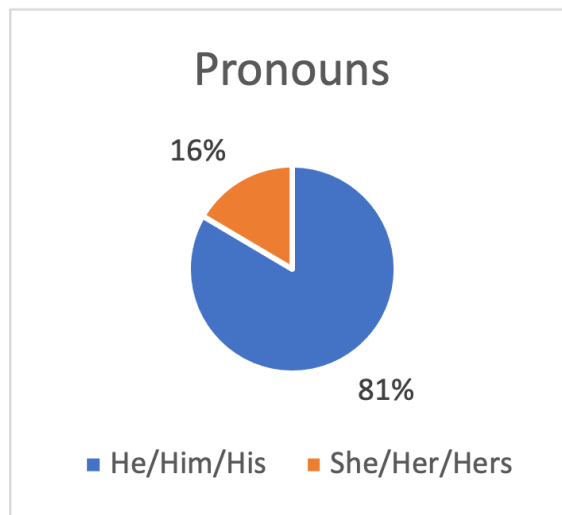


Figure 3.4 Participant Pronouns

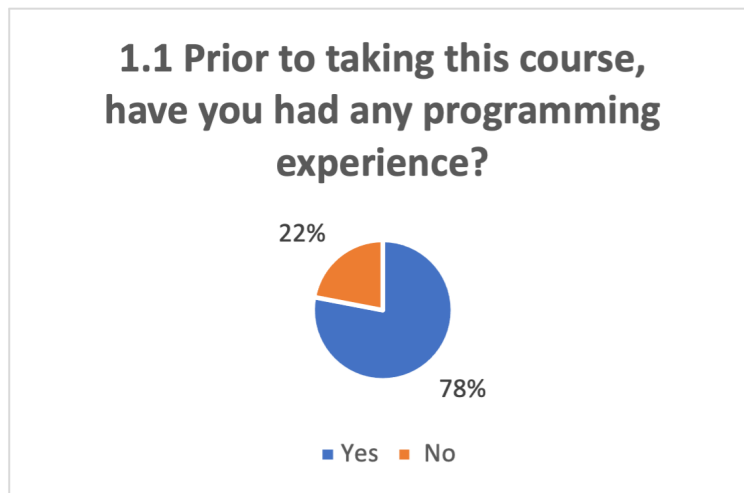


Figure 3.5 Participant's Prior Experience

3.3 Survey Results: Participant Motivation

3.3.1 Motivation to Attend

One of the survey questions asked participants why they attended the Fourth Hour. Since the first survey was administered early in the semester, this question was only asked on the second and third surveys. The data from both the second and third surveys showed that most students who

attended across all sections reported attending the Fourth Hour because they wanted all help possible.

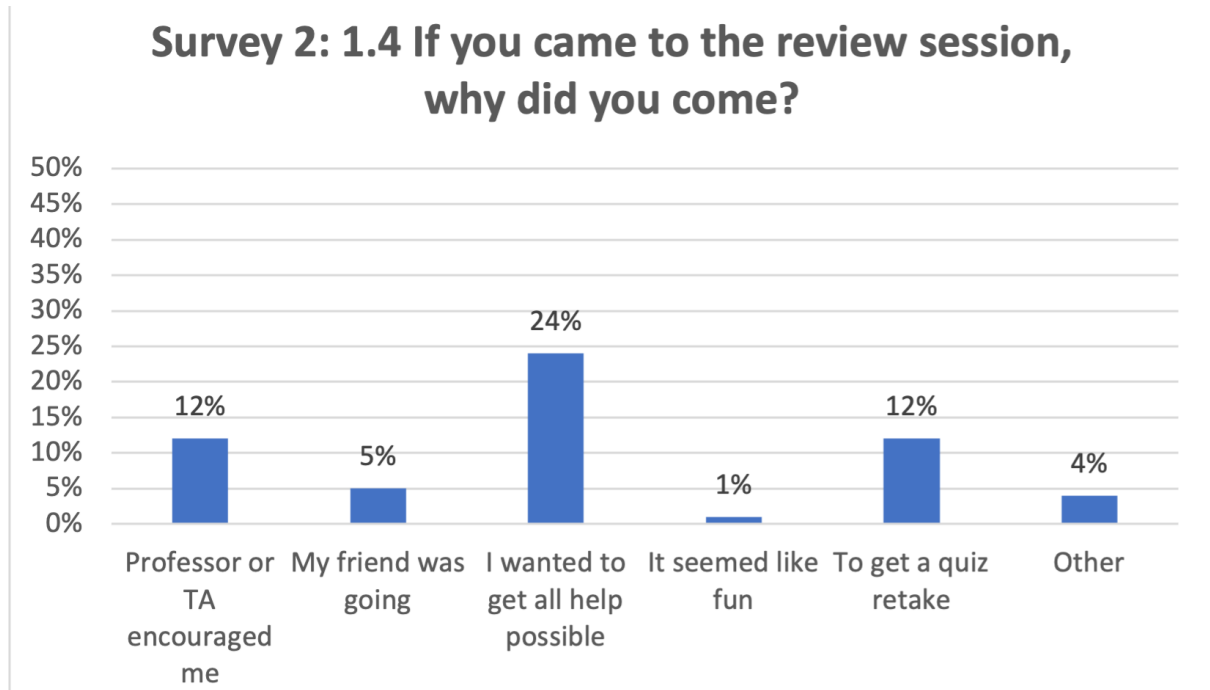


Figure 3.6 Reasons Participants Report Attending the Fourth Hour in Survey 2

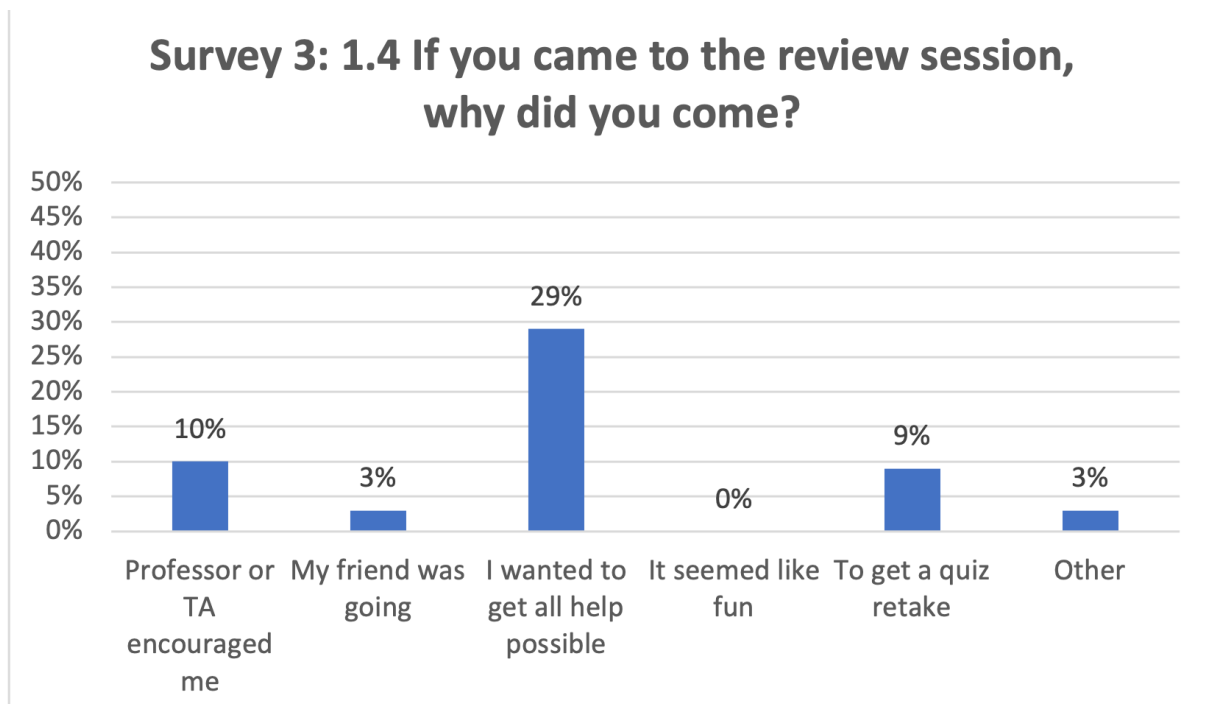


Figure 3.7 Reasons Participants Report Attending the Fourth Hour in Survey 3

Similarly, the second and third surveys asked participants to identify the most common reason they did not attend the Fourth Hour. This data showed that most students who attended across all sections reported not attending the Fourth Hour because they did not think they needed to go. This suggests that students have a low sense of expectancy that the Fourth Hour will help them. Additionally, 40% of participants in survey 2 and 37% of participants in survey 3 reported that it was either too hard to come in person or the time was not right. This suggests a high perceived cost in attending.

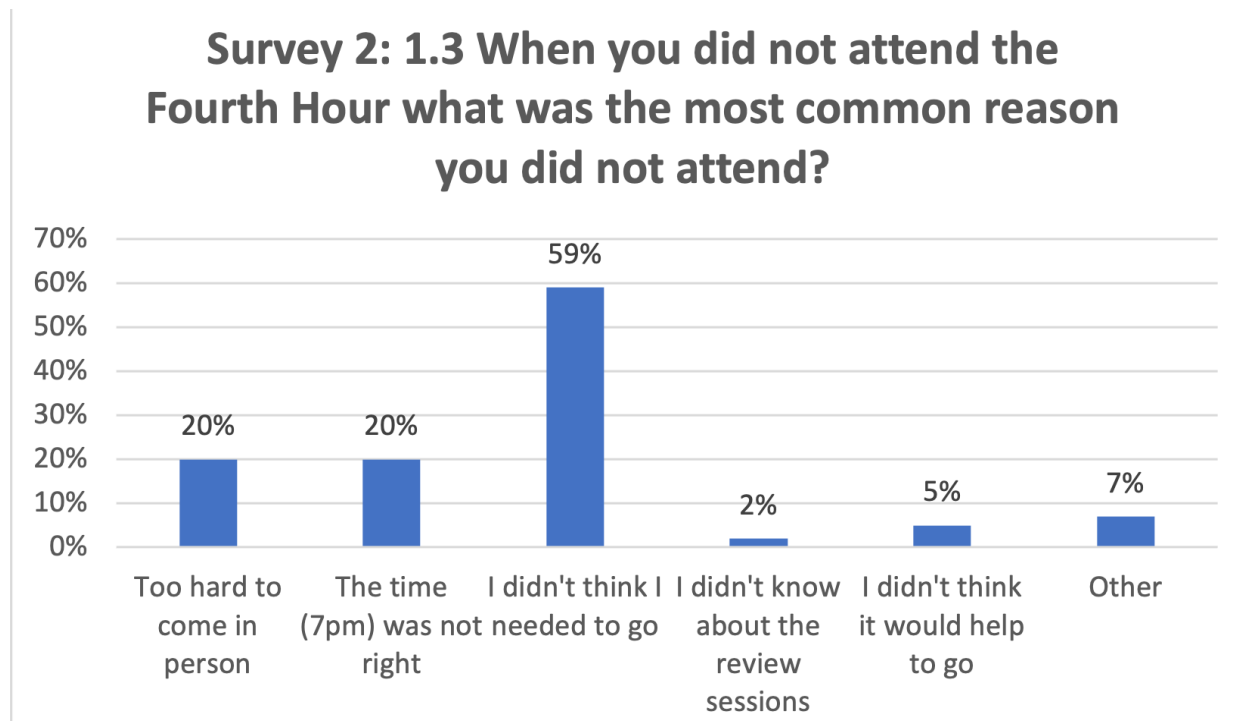


Figure 3.8 Reasons Participants Report Not Attending the Fourth Hour in Survey 2

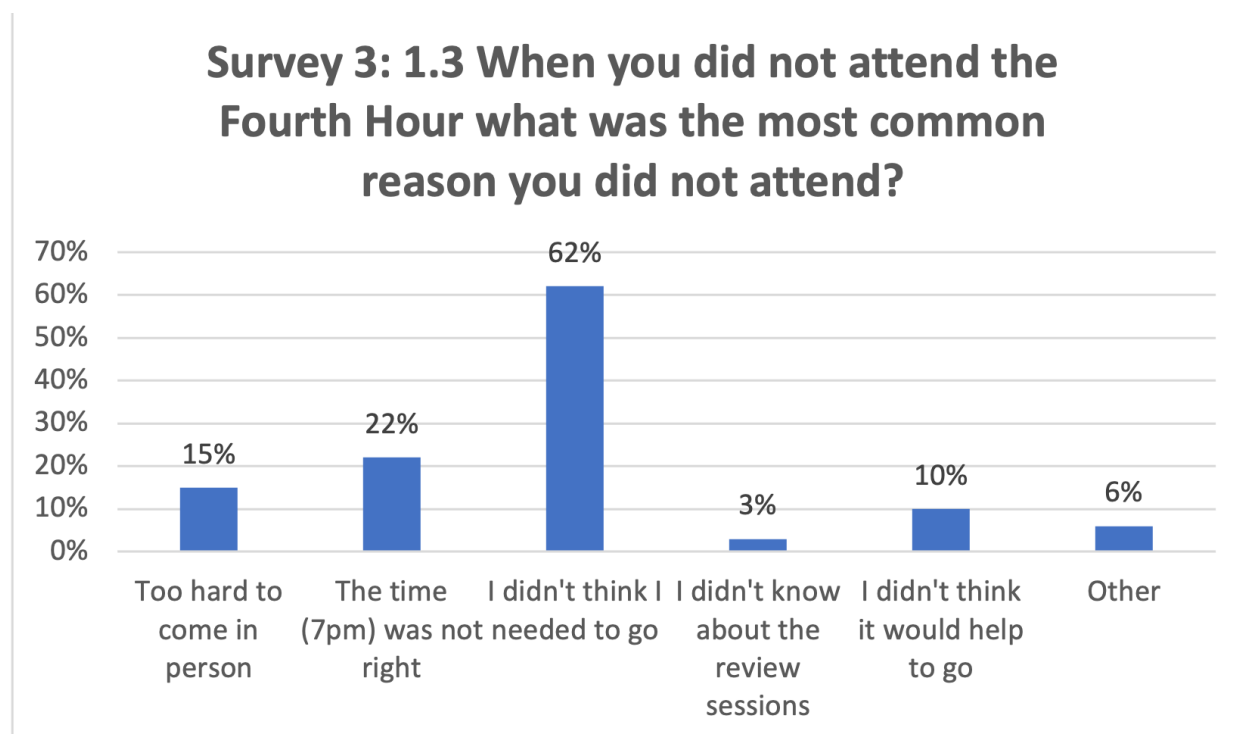


Figure 3.9 Reasons Participants Report Not Attending the Fourth Hour in Survey 3

3.3.2 Class Performance's Impact on Motivation

To see if motivation to attend the Fourth Hour changes for students who appeared to need more help, this section looks at the responses from specifically students who scored below an 80% on the first exam. The data shows that for these students, a much more notable percentage of students said they attended the Fourth Hour because they wanted all the help possible. When asked what the most common reason they did not attend the Fourth Hour was, these students had a much more balanced set of responses. While many students followed the general trend of responding that they didn't think they needed to go, the same percentage of students reported not knowing about the review sessions and a slightly lower percentage reported the time not being right. It is unclear why exactly this is the case, but more research could better explore this question with a larger sample size.

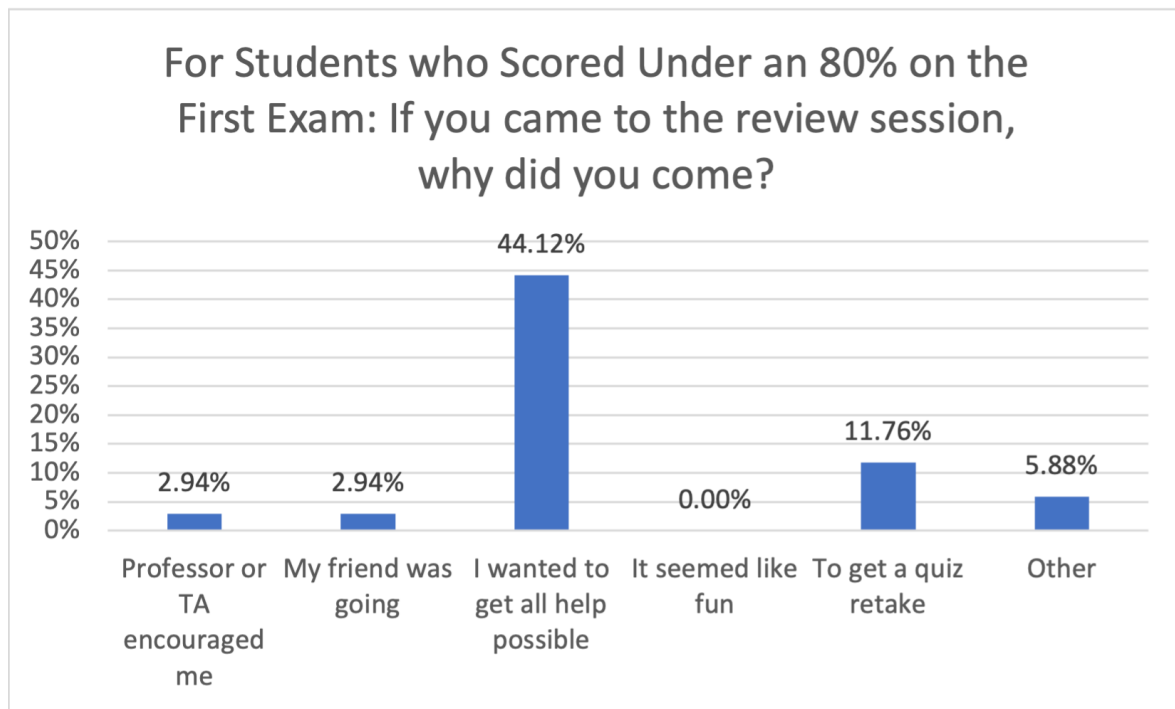


Figure 3.10 Reasons Students who Scored Under an 80% on the First Exam Came to the Fourth Hour

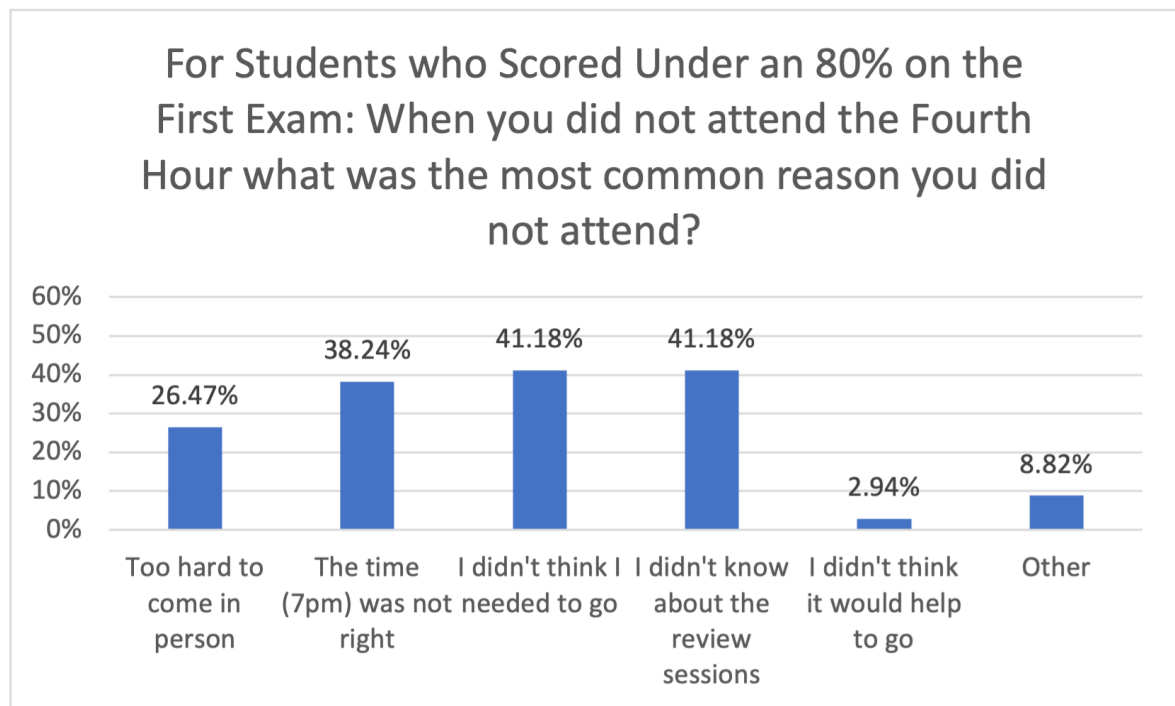


Figure 3.11 Reasons Students who Scored Under an 80% on the First Exam Did Not Come to the Fourth Hour

3.3.3 Quiz Retakes' Impact on Motivation

There were 13 sections of CS149 in the Fall of 2022 and of those 13 sections, 10 of them reported using interventions in the form of quiz retakes at some point throughout the semester. When considering only the sections that had quiz retakes, a notable percentage of students who attended listed a quiz retake as their reason for doing so.

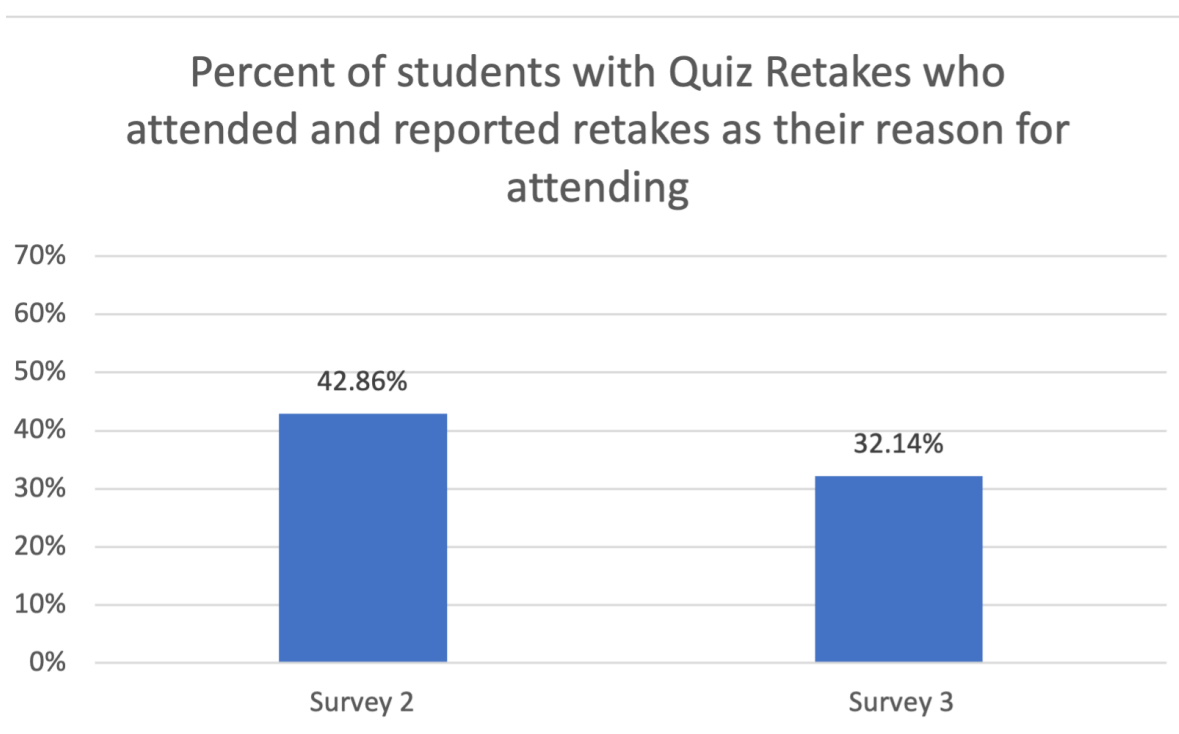


Figure 3.12 Percent of Students in sections with Quiz Retakes who attended and reported a Quiz retake as their reason for attending

Additionally, when comparing attendance of students in sections who had interventions in the form of quiz retakes with those who did not, a notably higher percentage of students attended within sections that had a quiz retake offered at some point throughout the semester than those within sections without them entirely.

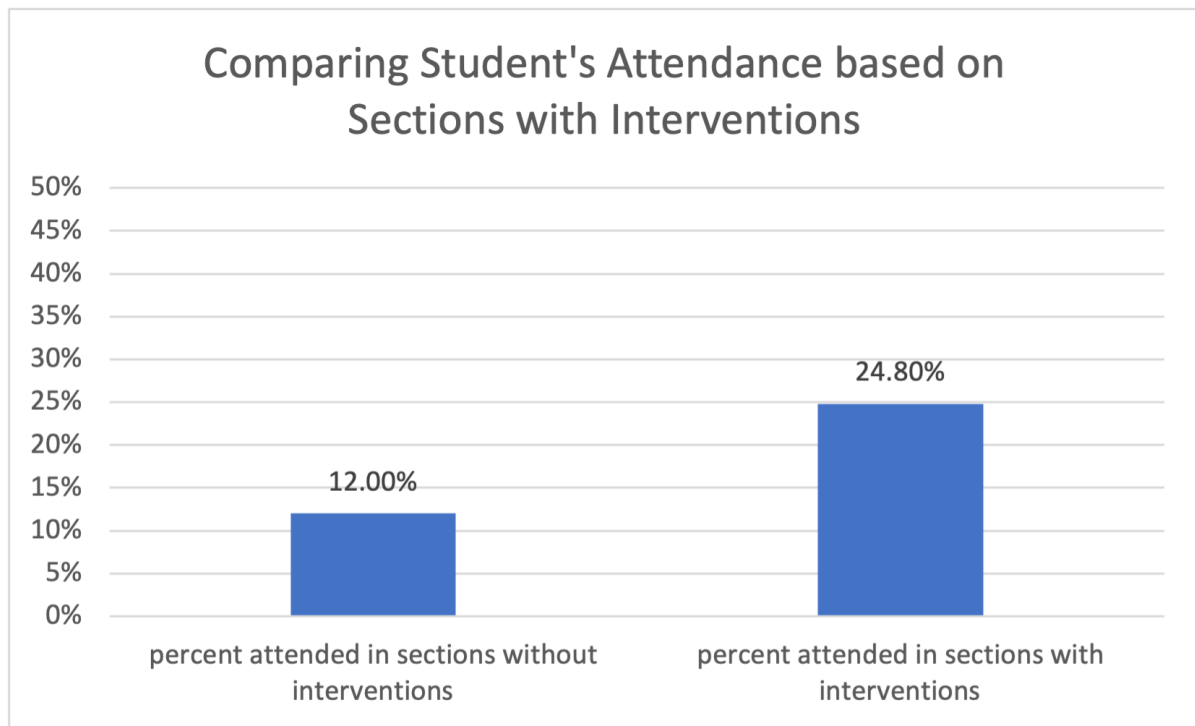


Figure 3.13 Comparing Student Attendance Based on if Their Section Had Interventions

3.4 Survey Results: Participant Sense of Belonging

3.4.1 Overall Sense of Belonging

All three of the Surveys had twelve questions used to measure each participant's sense of belonging in Computer Science. The questions were preceded by the statement "In this Computer Science class ..." and included the following:

1. I feel that I belong to the computer science community.
2. I consider myself a member of the computer science world.
3. I feel like I am a part of the computer science community.

4. I feel a connection with the computer science community.
5. I feel accepted.
6. I feel respected.
7. I feel valued.
8. I feel appreciated.
9. I feel disregarded.
10. I feel neglected.
11. I feel excluded.
12. I feel insignificant.

Students were asked to rank all of these questions on a scale from 1-5, 1 being disagree and 5 being agree. For questions 1-8, higher scores were considered positive, while for questions 9-12 higher scores were considered negative. To normalize the data, the numerical values of the responses to questions 9-12 were reversed. Each student's sense of belonging was calculated by taking the mean scores of these 12 questions.

The data does not show that the average sense of belonging fluctuated by more than .01% throughout the semester for the participants as a whole. Subsequent sections break down the sense of belonging results for different demographics with respect to Fourth Hour attendance.

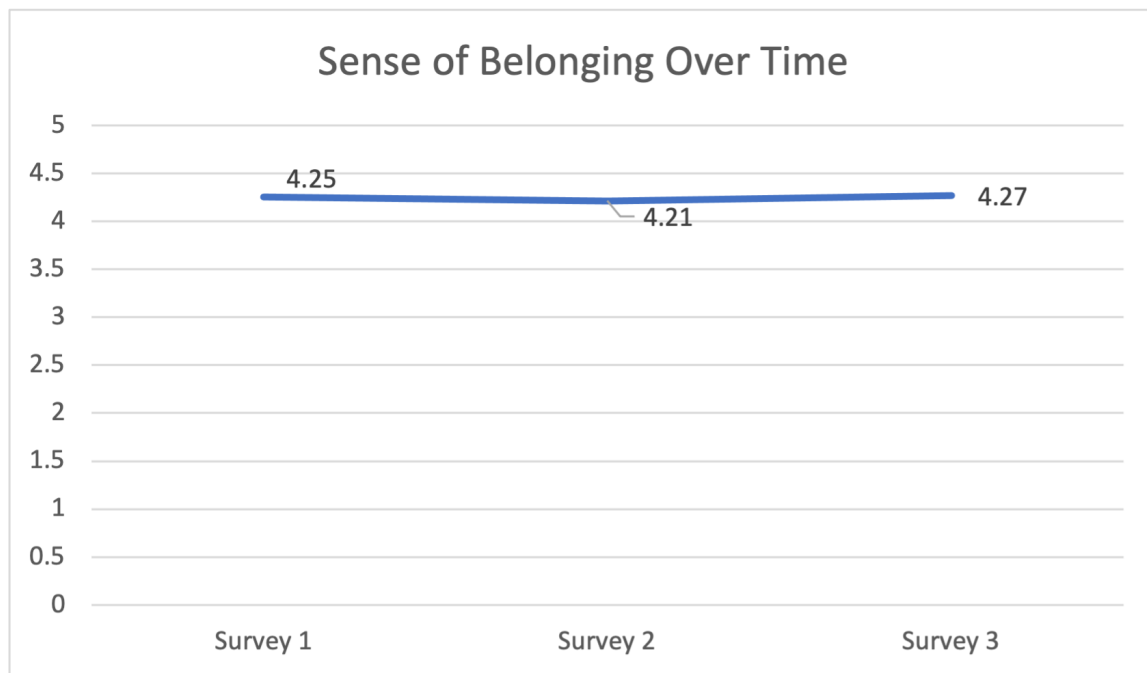


Figure 3.14 Average Sense of Belonging Scores for Participants across 3 Surveys

3.4.2 Sense of Belonging and Attendance

One of the questions this study aimed to look at was whether participants' sense of belonging was correlated with Fourth Hour attendance. The data seems to suggest that students who attended the Fourth Hour had a lower sense of belonging than those who never attended.

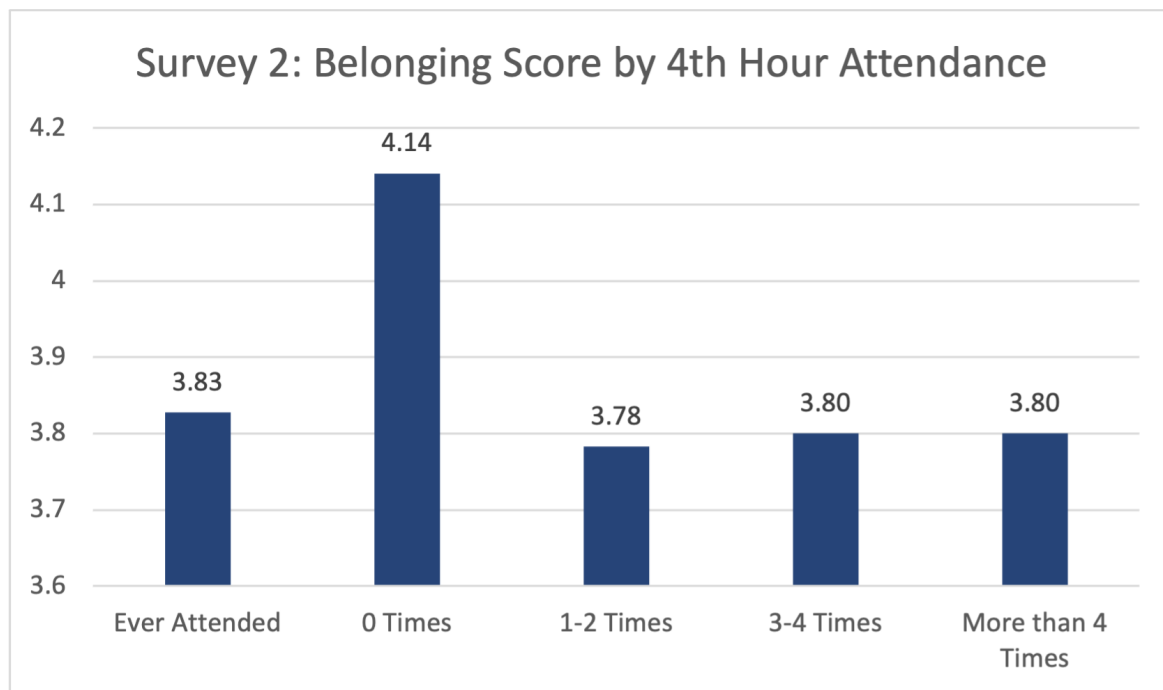


Figure 3.15 Survey 2 Average Sense of Belonging Scores Based on 4th Hour Attendance

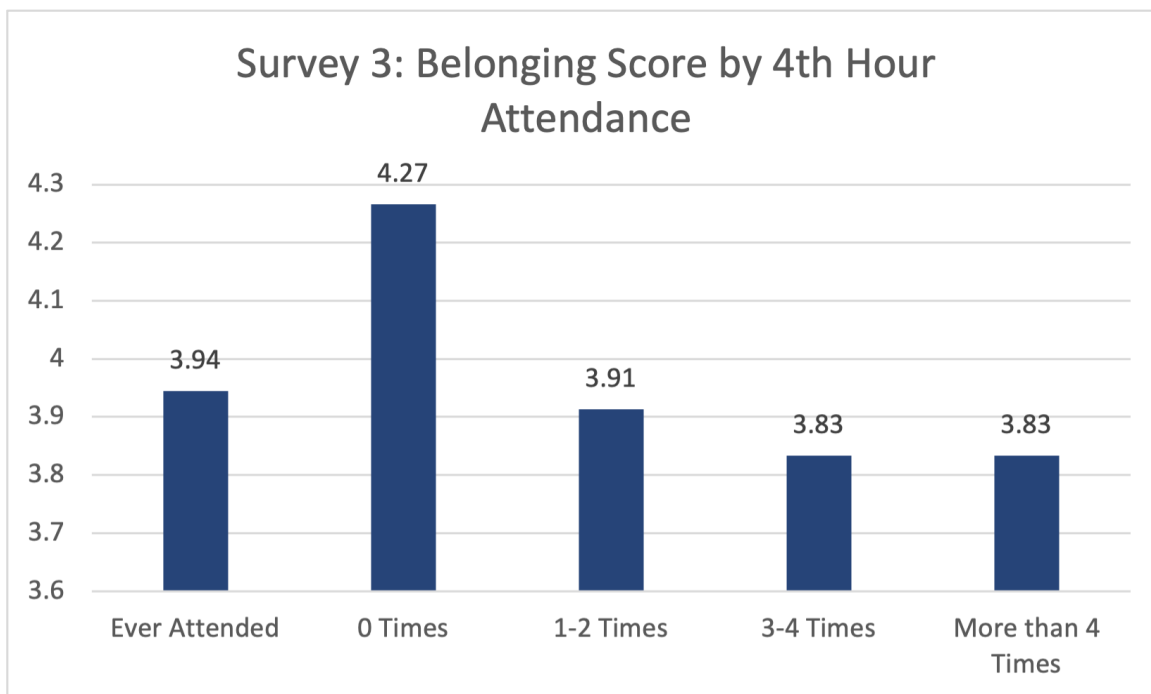


Figure 3.16 Survey 3 Average Sense of Belonging Scores Based on 4th Hour Attendance

3.4.3 Sense of Belonging and Motivation

Since the motivation data indicates that many students who did not attend the Fourth Hour didn't think they needed to go, and many students who attended did so to receive all help possible, this section explores whether that has an impact on sense of belonging. The data shows that students who reported not coming because they didn't think they needed to go had a notably higher average sense of belonging compared to the students who reported other answers.

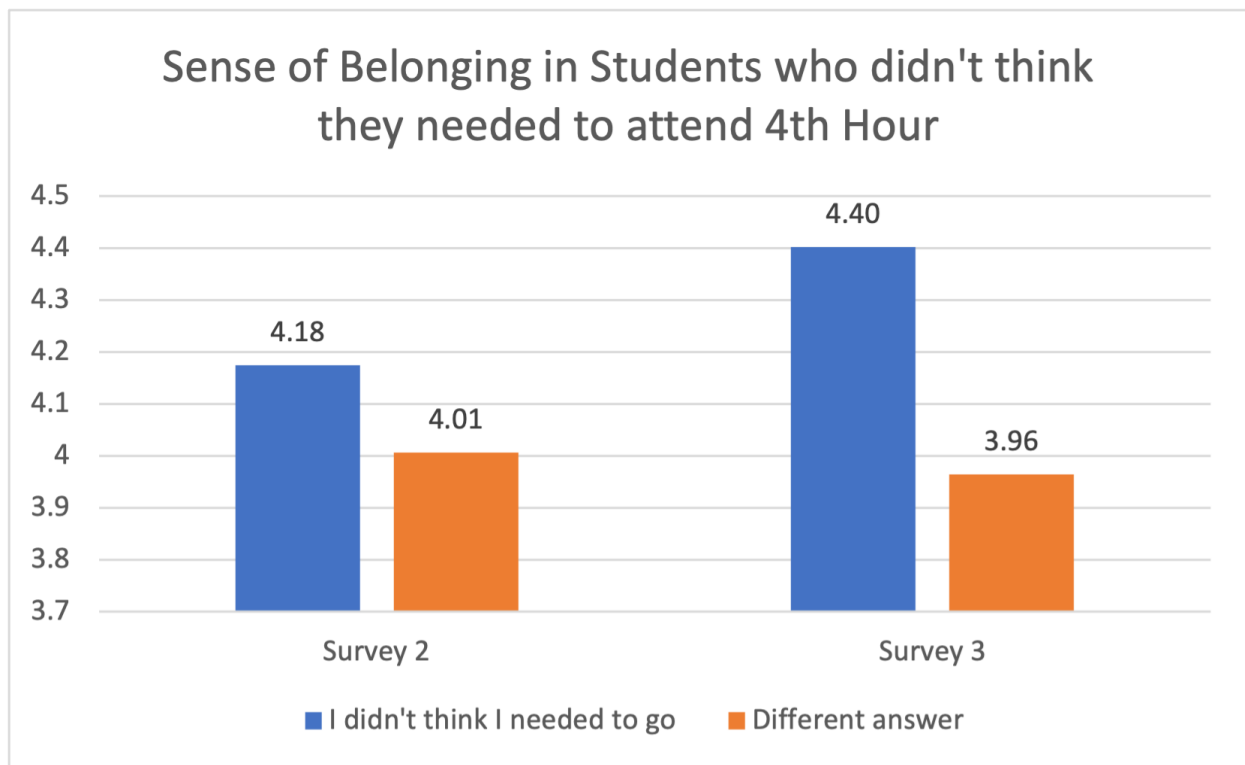


Figure 3.17 Sense of Belonging for Students who Answered Not Thinking They Needed to Attend the Fourth Hour

Similarly, students who reported coming to receive all help possible reported a noticeably lower sense of belonging than the students who reported other answers.

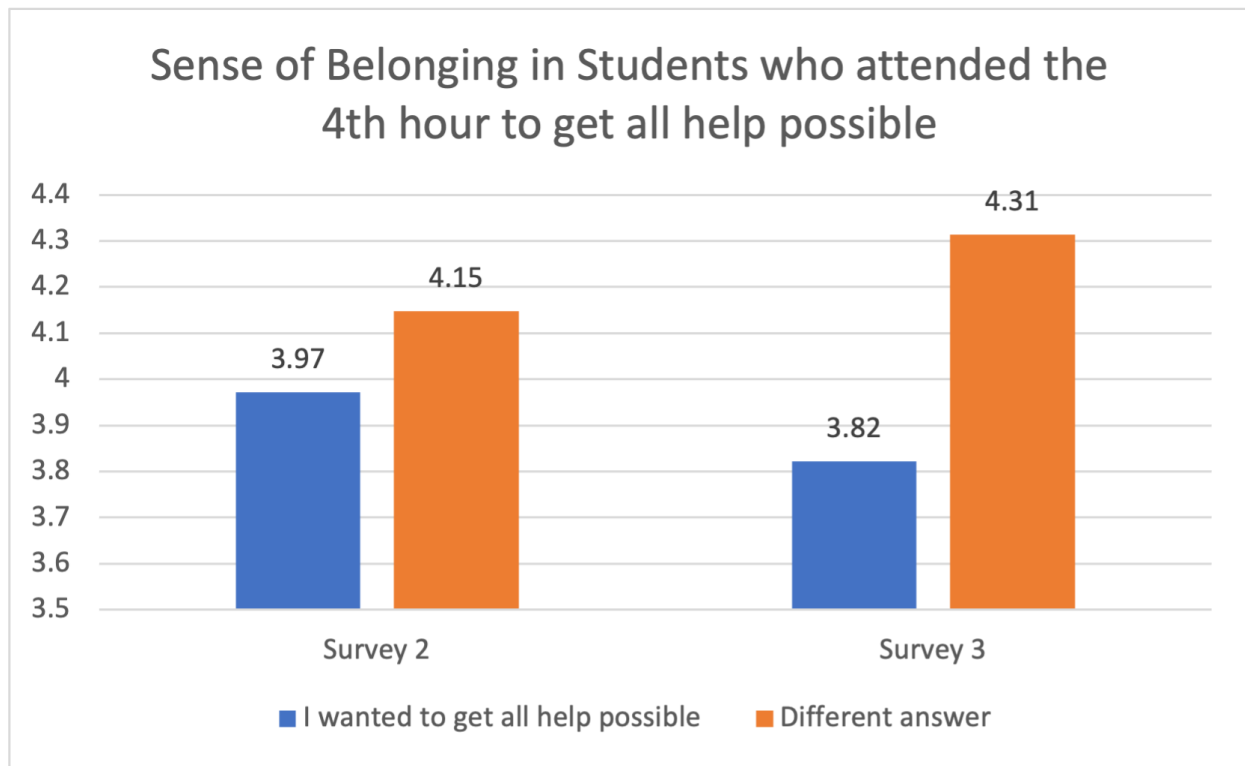


Figure 3.18 Sense of Belonging for Students who Answered Attending the Fourth Hour to Get All Help Possible

3.4.4 Demographics and Sense of Belonging

This section looks at participant's sense of belonging scores based on demographics. Unfortunately the sample sizes were too low to compare each demographic group, so instead historically underserved racial groups (students who identified as American Indian or Alaska Native, Black or African American, Native Hawaiian or Pacific Islander, Asian, Hispanic or Latina/Latino, or something else) were grouped together and compared to students who identified as white.

The survey data shows that throughout the semester on average, the sense of belonging scores in white students does not fluctuate much throughout the semester, while students

identifying as a part of a historically underserved racial group (HURG) experienced a noticeable increase in sense of belonging throughout the semester. Additionally, students who reported being in historically underserved racial groups were more likely to attend the Fourth Hour. This seems to suggest that the Fourth Hour was a factor in this increase in sense of belonging, although more research is needed to determine how much of a factor it is.

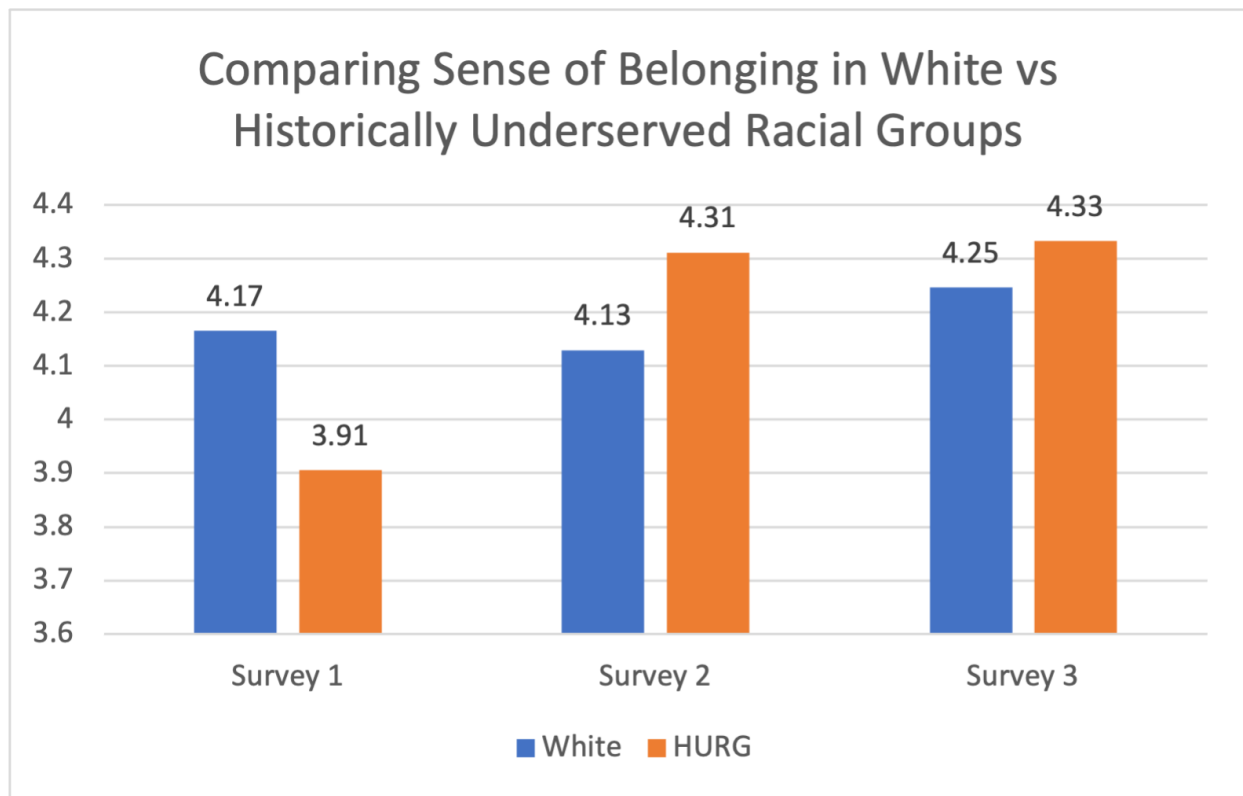


Figure 3.19 Comparing Sense of Belonging in White vs Historically Underserved Racial Groups

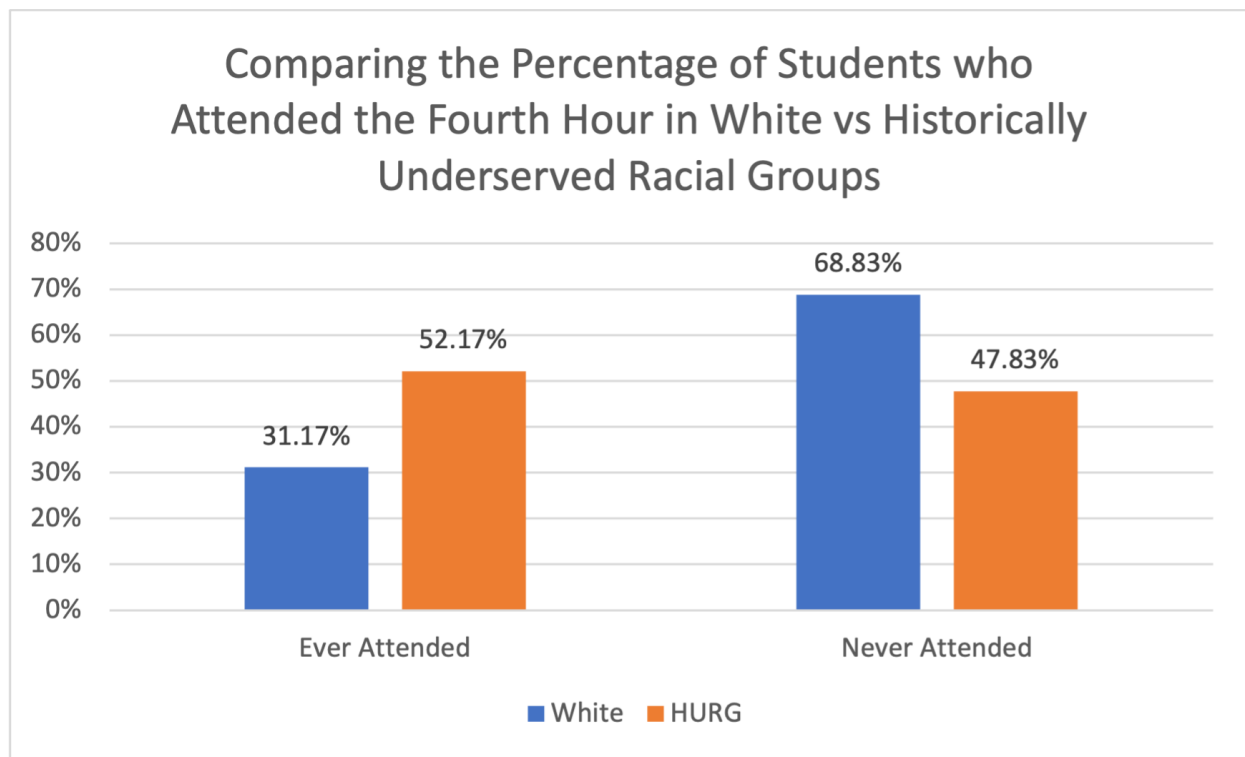


Figure 3.20 Comparing the Percentage of Students who Attended the Fourth Hour in White vs Historically Underserved Racial Groups

When looking only at historically underserved racial groups, the average sense of belonging scores seems to have increased for students who never attended the Fourth Hour, while it stayed fairly consistent in students who attended the Fourth Hour at least once. These also seem to follow the general trend that students who attended the Fourth Hour have a lower sense of belonging on average than those who never did.

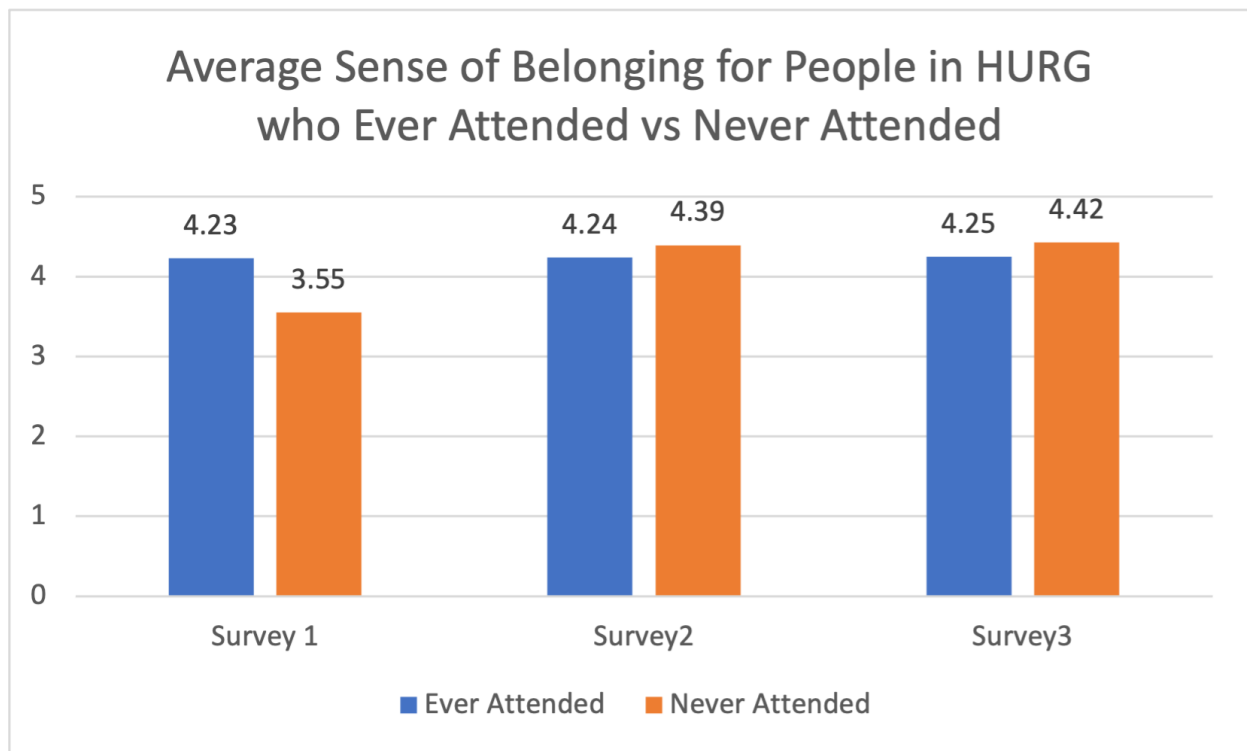


Figure 3.21 Average Sense of Belonging for People in HURGs who Ever Attended vs Never Attended the Fourth Hour

Additionally, when looking at students who identified with he/him vs students who identified with she/her pronouns, there does not appear to be a notable difference in average sense of belonging. The data also looks only at students who identified with she/her pronouns and compares students who ever attended the Fourth Hour to those who never attended. This data continues to demonstrate the general trend that students who attend the Fourth Hour have a lower sense of belonging than those who never attend. Additionally, it shows that students who identified with she/her pronouns and attended the Fourth Hour experienced an increase in sense of belonging. However, more research is needed to further prove any correlations as there is a small sample size of both students who identified with she/her pronouns and students who identified as being a part of a historically underserved racial group.

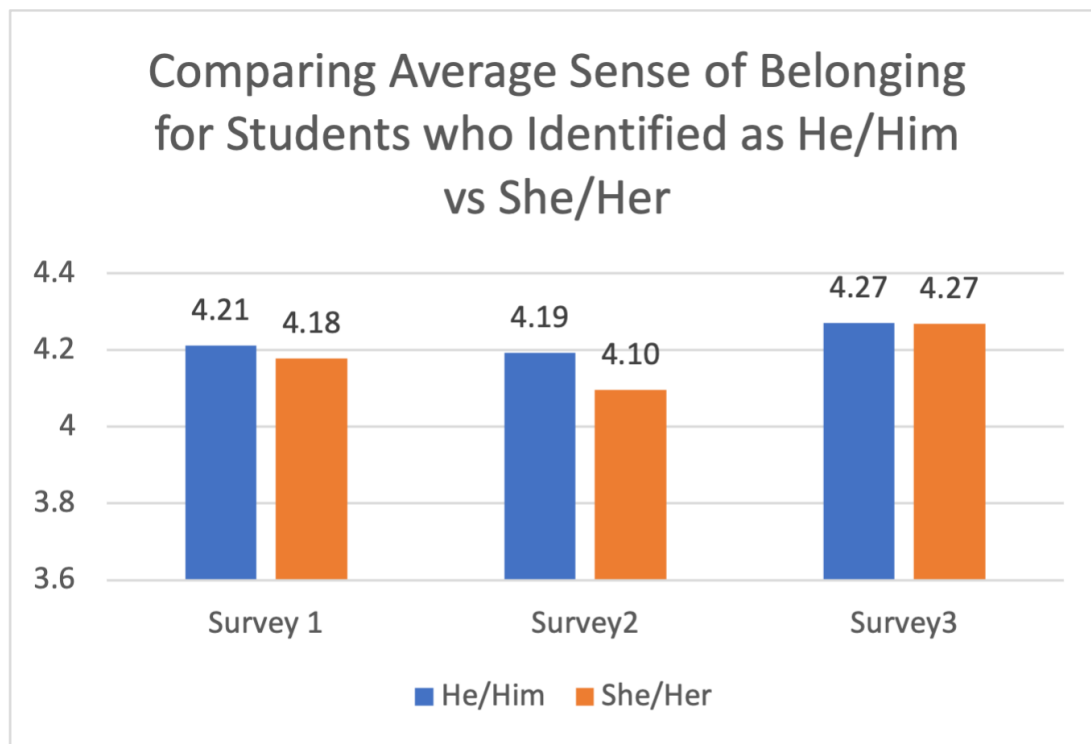


Figure 3.22 Comparing Average Sense of Belonging for Students who Identified with He/Him vs She/Her Pronouns

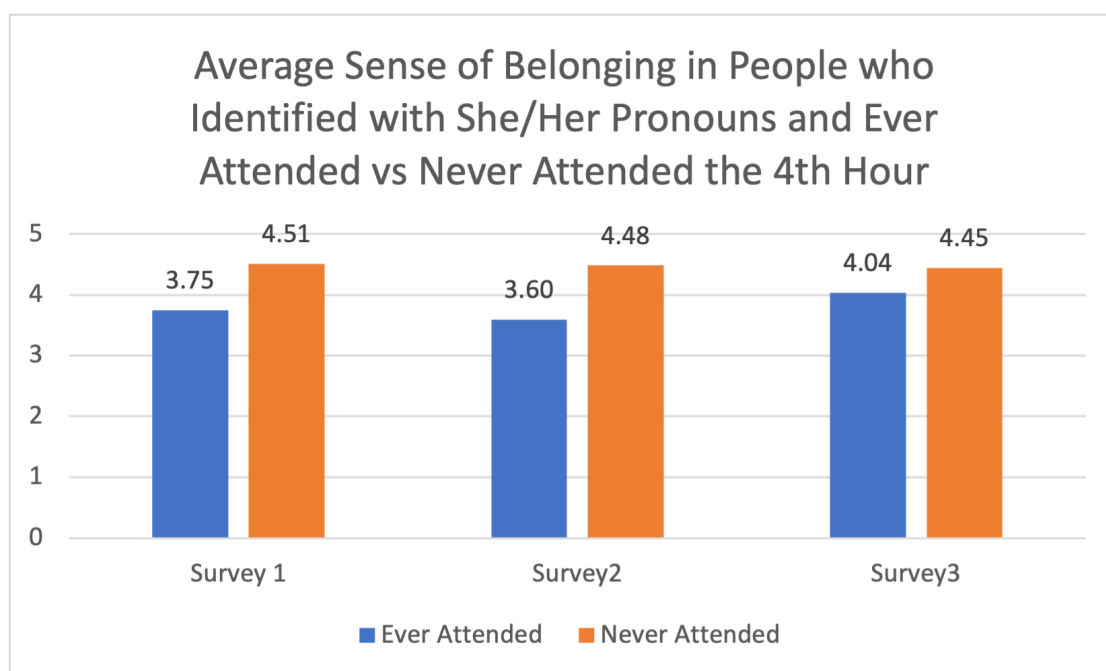


Figure 3.23 Average Sense of Belonging in People who Identified with She/Her Pronouns and Ever Attended vs Never Attended the 4th Hour

3.4.5 Class performance and Sense of Belonging

Due to findings in reference to a coordinated study where there was a difference in learning gains for people who scored under 80% on the first exam, this study also looked at this to see if sense of belonging trends were different for those students. The data seems to show that it followed the general trend of students who didn't attend having a higher sense of belonging. It does show a decrease in average sense of belonging for the students who attended the Fourth Hour at some point during the semester. This could be partially due to the fact that the first survey was administered before the first exam and students might have felt more confident.

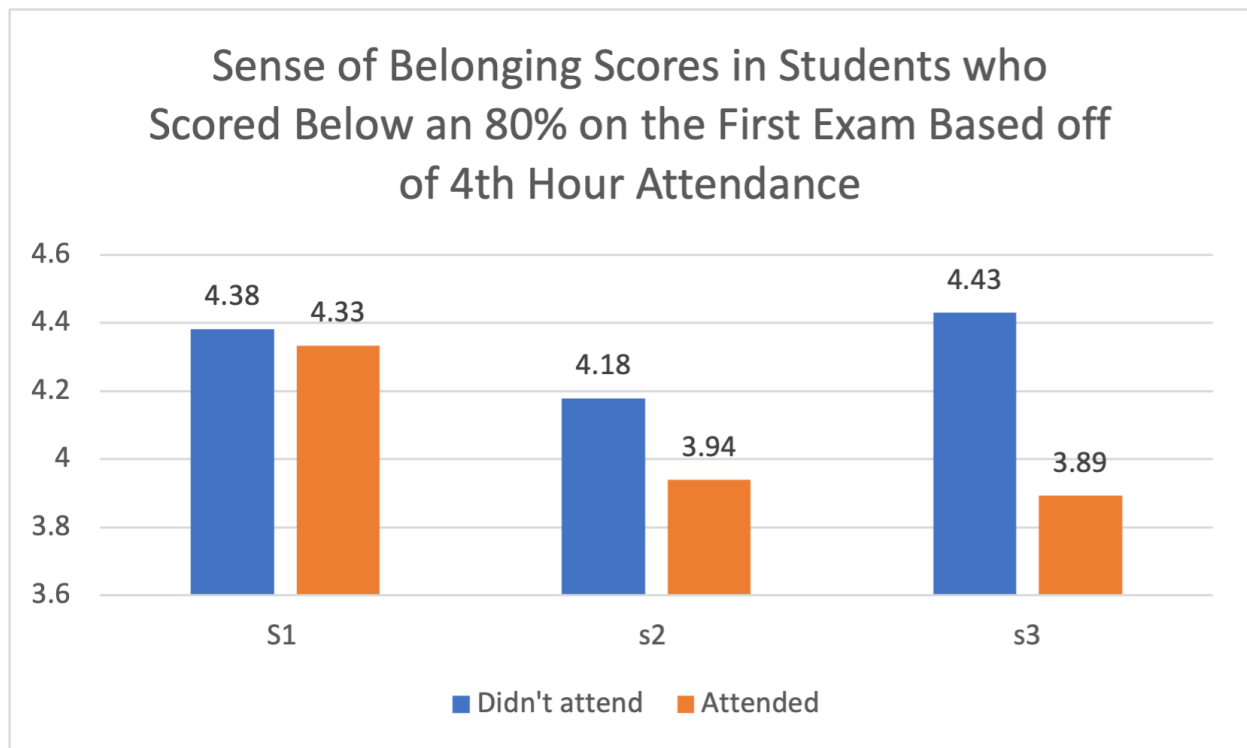


Figure 3.24 Sense of Belonging Scores in Students who Scored Below an 80% on the First Exam Based off of 4th Hour Attendance

3.5 Measuring the Effectiveness of Promotional Material

This section discusses how students learned about the Fourth Hour. One of the survey questions asks how participants found out about the Fourth Hour. The results show that most students find out through their professor or TA. It is unclear whether these students found out from a TA due to in-class visits, in-class TA, or TA hours, which is a question that would be interesting to address in future research. It did show that a notable percentage of students found out about the Fourth Hour through posters. It is also unclear whether these posters motivated students, which is also something that would need to be addressed in a future study.

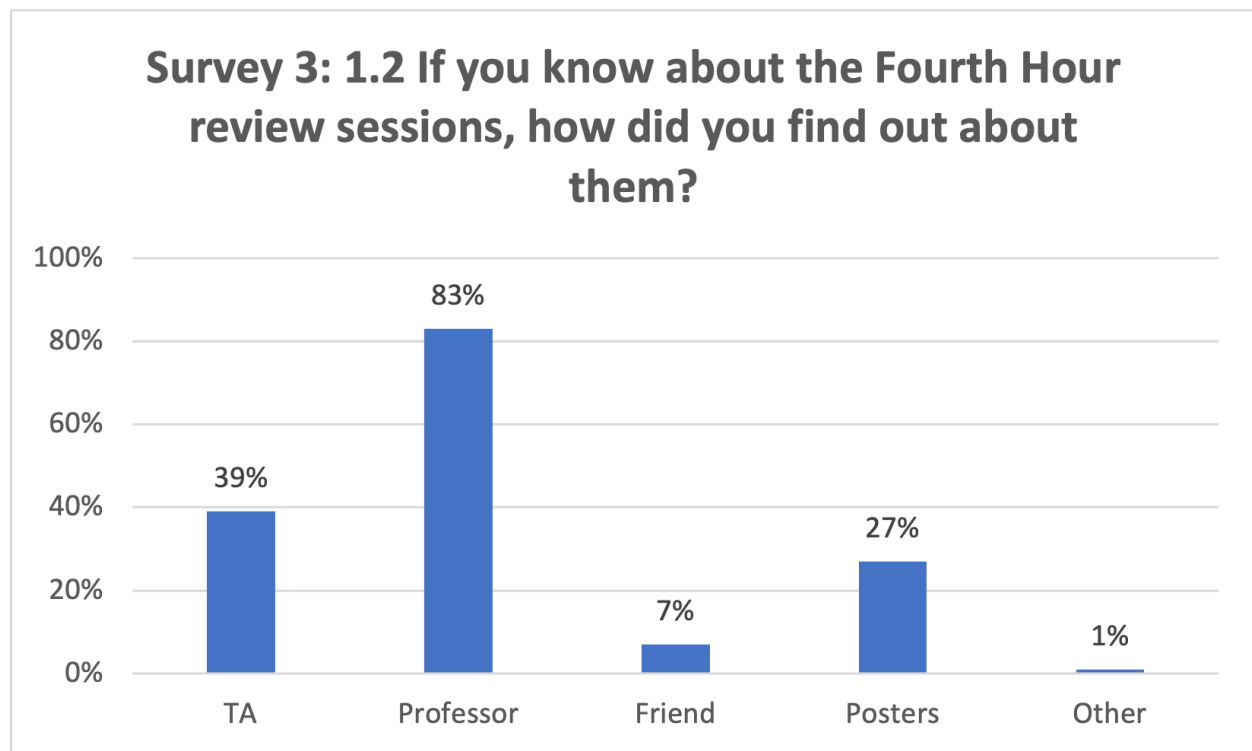


Figure 3.25 Methods by which Participants Found Out About the Fourth Hour

Chapter 4: Conclusions

4.1 Primary Results

To summarize, the primary results from this study were:

1. Giving students incentives in the form of quiz retakes seems to have an increase on consistent attendance.
2. Students who did not attend the Fourth Hour had a greater sense of belonging throughout the semester.
3. The primary reason students seem to not attend is that they do not see a value in attending, possibly because they have a greater sense of belonging or expectation they will succeed without the review sessions.

4.2 Future Research and Lessons Learned

While there were many promising results from this study, further research is needed to better determine the correlations found in this study.

- a. A larger sample size is needed to better understand the effect the Fourth Hour has on specific groups of people. The study done by Gilbert et. al. found that historically underrepresented students had lower average sense of belonging scores and were likely to attend the Fourth Hour [4]. However, this study was not able to as effectively do so given such a small sample size of students, especially considering historically underserved students. In the future, having more students participate in the study would be helpful. The surveys handed out for this study were on paper and given during class time,

meaning students who were late or didn't attend the day of a survey missed the chance of being included in the data. It is possible that administering online surveys to students that can be completed outside of class would increase participation, allowing for more conclusive data.

- b. More research could be done into what motivated students to attend the Fourth Hour. One limitation of this study is that the survey does not address how much promotional material actually encouraged students to attend. In the future there could be a better designed survey to identify these differences for why students did or did not attend.

Appendix

A.1 List of Data Collected

Fourth Hour

- Attendance Data

Survey 1

- Demographics
- Prior Programming Experience
- Fourth Hour Motivation
- Sense of Belonging

Survey 2

- Fourth Hour Motivation
- Sense of Belonging

Survey 3

- Fourth Hour Motivation
- Sense of Belonging

Other

- Section/Instructor
- Exam Scores
- Section Interventions

A.2 Surveys

CS 149 Student Survey 1																																			
Name: _____	Email: _____@dukes.jmu.edu																																		
This questionnaire is evaluated automatically. Please use a pen to fill in your answers as follows: <table style="width: 100%;"><tr><td>☐ Multiple-choice (select all applicable options)</td><td>☒ Selected</td><td>☒ Undo select</td></tr><tr><td>☐ Single-choice (select only one option)</td><td>☒ Selected</td><td>☒ Undo select</td></tr></table>		☐ Multiple-choice (select all applicable options)	☒ Selected	☒ Undo select	☐ Single-choice (select only one option)	☒ Selected	☒ Undo select																												
☐ Multiple-choice (select all applicable options)	☒ Selected	☒ Undo select																																	
☐ Single-choice (select only one option)	☒ Selected	☒ Undo select																																	
<i>Please help us learn more about the impact of this class on your interest in computer science by completing the following questions. There are no right or wrong answers; we are interested in your honest reactions and opinions.</i> <i>This survey is part of a research study for which you have previously given consent. (If you did not give consent, you do not need to complete this survey.) As a reminder, you will have the opportunity to win a \$25 gift card if you complete all three surveys. If you have any questions about the research study or wish to withdraw, please contact Dr. Stewart <stewartmc@jmu.edu>. Thank you!</i>																																			
1 Background																																			
Major(s): _____ Minor(s): _____ Year at JMU: _____ Graduation(month and year): _____ 1.1 Prior to taking this course, have you had any programming experience? (e.g., Java, Python, Scratch) ☐ Yes ☐ No 1.2 If yes, mark all that apply. Please also write the programming language(s) to the right of each course. <table style="width: 100%;"><tr><td>☐ AP Computer Science A (Java) or equivalent</td><td>☐ AP Computer Science Principles or equivalent</td></tr><tr><td>☐ Other high school Computer Science course(s)</td><td>☐ Summer camp(s) or other short-term course(s)</td></tr><tr><td>☐ Learned programming on your own (e.g., websites)</td><td>☐ Already took CS 149 at JMU and retaking it this term</td></tr><tr><td>☐ Other programming courses at JMU (e.g., CIS, ISAT)</td><td></td></tr></table>		☐ AP Computer Science A (Java) or equivalent	☐ AP Computer Science Principles or equivalent	☐ Other high school Computer Science course(s)	☐ Summer camp(s) or other short-term course(s)	☐ Learned programming on your own (e.g., websites)	☐ Already took CS 149 at JMU and retaking it this term	☐ Other programming courses at JMU (e.g., CIS, ISAT)																											
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☐ Other programming courses at JMU (e.g., CIS, ISAT)																																			
2 Fourth Hour Motivation																																			
2.1 Are you aware of the Fourth Hour evening review sessions that review materials from the previous week of CS149? ☐ Yes ☐ No 2.2 If you know about the Fourth Hour review sessions, how did you find out about them? <table style="width: 100%;"><tr><td>☐ TA</td><td>☐ Professor</td></tr><tr><td>☐ Friend</td><td>☐ Posters</td></tr></table>	☐ TA	☐ Professor	☐ Friend	☐ Posters	2.3 If you were to come to an evening review session, what would be the best day and time? <table style="width: 100%; text-align: center;"><thead><tr><th></th><th>5-6pm</th><th>6-7pm</th><th>7-8pm</th><th>8-9pm</th></tr></thead><tbody><tr><td>Sunday</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td></tr><tr><td>Monday</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td></tr><tr><td>Tuesday</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td></tr><tr><td>Wednesday</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td></tr><tr><td>Thursday</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td></tr></tbody></table>		5-6pm	6-7pm	7-8pm	8-9pm	Sunday	☐	☐	☐	☐	Monday	☐	☐	☐	☐	Tuesday	☐	☐	☐	☐	Wednesday	☐	☐	☐	☐	Thursday	☐	☐	☐	☐
☐ TA	☐ Professor																																		
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	5-6pm	6-7pm	7-8pm	8-9pm																															
Sunday	☐	☐	☐	☐																															
Monday	☐	☐	☐	☐																															
Tuesday	☐	☐	☐	☐																															
Wednesday	☐	☐	☐	☐																															
Thursday	☐	☐	☐	☐																															
2.4 What would make you more likely to attend the Fourth Hour? Write a short response below.																																			



3 Belonging

In this Computer Science Class...

3.1 I feel that I belong to the computer science community.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

3.2 I consider myself a member of the computer science world.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

3.3 I feel like I am part of the computer science community.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

3.4 I feel a connection with the computer science community.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

3.5 I feel accepted.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

3.6 I feel respected.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

3.7 I feel valued.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

3.8 I feel appreciated.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

3.9 I feel disregarded.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

3.10 I feel neglected.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

3.11 I feel excluded.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

3.12 I feel insignificant.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

4 Demographics

4.1 Age

☐ 18-20

☐ 21-24

☐ >24

4.2 Pronouns

☐ He/Him/His

☐ She/Her/Hers

☐ They/Them/Theirs

☐ Something else: _____

4.3 Race and/or ethnicity (mark all that apply)

☐ American Indian or Alaska Native

☐ Native Hawaiian or Pacific Islander

☐ Hispanic or Latina/Latino

☐ Something else: _____

☐ Black or African American

☐ Asian

☐ White



CS 149 Student Survey 2

Name: _____ Email: _____@dukes.jmu.edu

Please help us learn more about the impact of this class on your interest in computer science by completing the following questions. There are no right or wrong answers; we are interested in your honest reactions and opinions.

This survey is part of a research study for which you have previously given consent. (If you did not give consent, you do not need to complete this survey.) As a reminder, you will have the opportunity to win a \$25 gift card if you complete all three surveys. If you have any questions about the research study or wish to withdraw, please contact Dr. Stewart <stewarmc@jmu.edu>. Thank you!

1 Fourth Hour Motivation

1.1 How many times so far did you attend the Fourth Hour evening review sessions run by CS Teaching Assistants?

- ☐ 0 times ☐ 1-2 times
☐ 3-4 times ☐ More than 4 times

1.2 If you know about the Fourth Hour review sessions, how did you find out about them?

- ☐ TA ☐ Professor
☐ Friend ☐ Posters
☐ Other: _____

1.3 When you did not attend the Fourth Hour what was the most common reason you did not attend?

- ☐ Too hard to come in person.
☐ The time (7 pm) was not right
☐ I didn't think I needed to go
☐ I didn't know about the review sessions
☐ I didn't think it would help to go
☐ Other: _____

1.4 If you came to the review session, why did you come?

- ☐ Professor or TA encouraged me
☐ My friend was going
☐ I wanted to get all help possible
☐ It seemed like fun
☐ To get a quiz retake
☐ Other: _____

2 Belonging

In this Computer Science Class....

2.1 I feel that I belong to the computer science community.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

2.2 I consider myself a member of the computer science world.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

2.3 I feel like I am part of the computer science community.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

2.4 I feel a connection with the computer science community.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

2.5 I feel accepted.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

2.6 I feel respected.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

2.7 I feel valued.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

2.8 I feel appreciated.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

2.9 I feel disregarded.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

2.10 I feel neglected.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

2.11 I feel excluded.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

2.12 I feel insignificant.

Disagree ☐ ☐ ☐ ☐ ☐ Agree



CS 149 Student Survey 3

Name: _____ Email: _____@dukes.jmu.edu

Please help us learn more about the impact of this class on your interest in computer science by completing the following questions. There are no right or wrong answers; we are interested in your honest reactions and opinions.

This survey is part of a research study for which you have previously given consent. (If you did not give consent, you do not need to complete this survey.) As a reminder, you will have the opportunity to win a \$25 gift card if you complete all three surveys. If you have any questions about the research study or wish to withdraw, please contact Dr. Stewart <stewarmc@jmu.edu>. Thank you!

1 Fourth Hour Motivation

1.1 How many times so far did you attend the Fourth Hour evening review sessions run by CS Teaching Assistants?

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☐ 3-4 times ☐ More than 4 times

1.2 If you know about the Fourth Hour review sessions, how did you find out about them?

- ☐ TA ☐ Professor
☐ Friend ☐ Posters
☐ Other: _____

1.3 When you did not attend the Fourth Hour what was the most common reason you did not attend?

- ☐ Too hard to come in person.
☐ The time (7 pm) was not right
☐ I didn't think I needed to go
☐ I didn't know about the review sessions
☐ I didn't think it would help to go
☐ Other: _____

1.4 If you came to the review session, why did you come?

- ☐ Professor or TA encouraged me
☐ My friend was going
☐ I wanted to get all help possible
☐ It seemed like fun
☐ To get a quiz retake
☐ Other: _____

2 Belonging

In this Computer Science Class....

2.1 I feel that I belong to the computer science community.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

2.2 I consider myself a member of the computer science world.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

2.3 I feel like I am part of the computer science community.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

2.4 I feel a connection with the computer science community.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

2.5 I feel accepted.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

2.6 I feel respected.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

2.7 I feel valued.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

2.8 I feel appreciated.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

2.9 I feel disregarded.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

2.10 I feel neglected.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

2.11 I feel excluded.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

2.12 I feel insignificant.

Disagree ☐ ☐ ☐ ☐ ☐ Agree



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