A Case Study of the Reasons Behind Why Students Attend Office Hours

Justin Tahara, Tony Hu, Wesley Xiao

University of California, San Diego

ABSTRACT

Office hours (OH) serve a key role in university computer science (CS) education. With large class sizes becoming the norm, OH – which can take a variety of forms such as one-on-ones – provide students with an opportunity to receive more catered assistance outside of class. However, OH are not always well attended and there is a lack of research about the students who attend OH and the reasoning behind their attendance.

In this paper, we aim to better understand the factors that cause students to attend (or not attend) OH and investigate the potential long-term effects of attending OH. We analyzed data collected from students enrolled in CS1 courses at large, public research universities in the United States and Canada.

We found that many students tend to attend OH in order to receive help and guidance on their assignments, but there were a small fraction of students who also attend OH in order to build a relationship with the teaching staff of the course to ask non-related course questions. This led us to believe that different students utilized OH for numerous reasons pertaining to CS in general. We aim to understand the reasoning and the outcomes of attending OH in CS1 courses.

CCS CONCEPTS

• **Social and professional topics** → **Professional Topics**; **Computing education programs**.

KEYWORDS

Office Hours; Tutor Hours; Teaching Assistants; Undergraduate Teaching Assistants; Tutors; Interactions; Assistance

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1 INTRODUCTION

The popularity of computer science (CS) has lead to a huge growth in enrollment in recent years. The increase in students has lead to a commensurate rise in class sizes, as universities handle the increased demand for CS courses. Because of the expansion of classes, it is unlikely that students are able to receive personalized assistance or interact with the instructor and a course's teaching staff; there are too many students and too little time to handle the concerns of all students strictly during class time. Office hours (OH) can help fill this gap, serving a fundamental role in CS courses and the academic success of students in the course.

OH, in its broadest definition, are an optional, outside of class resources where students can meet with the teaching staff to get help in a more private and personal environment. OH take on a wide-variety of forms, in terms of what format they are conducted in – like one-on-ones, group, or virtual – and who is leading them – like instructors, teaching assistants (TA), or undergraduate assistants (UTA).[7] Depending on the course, the content of OH varies. In a programming course, OH may involve a UTA helping debug a student's code; in a theory heavy course, OH may be a whiteboard session lead by an TA.[2] Likewise, course policy could regulate how OH are conducted. For example, an instructor may not publicly release exam answers, but will discuss them during OH.

A key characteristic of OH is that attendance is optional. Regardless of a student's standing in the course, they are not required to attend OH. This leads to some students not utilizing OH and sometimes ending up failing the course that could have been prevented with some extra help. In order to increase the usage of certain resources, professors have created different lesson plans and utilized different techniques in order to promote and increase their usage.

Some of the different lesson plans include discussion sections held by TAs.[1][6] These sections are promoted to alleviate some of the confusion that may be associated with the concepts that are taught in the courses. There are also Tutor hours that play a key role at many institutions in order to help the students with their Programming Assignments. These assignments are code-based rather than traditional pen to paper style assignments. Tutors, who have taken the course in the past, are asked to hold Tutor hours in order to help these students debug their code and help guide the students through the assignments. As stated before, these sessions are optional meaning that the students do not need to attend in order to pass the course.

Research has shown that attending OH does have a positive effect on students.[3] Many students experience a sense of community because they are able to establish connections with the teaching staff during OH. Additionally, due to the minimal grade level difference, some students feel it is easier to converse with the UTAs since UTAs were once in their shoes.[8] Some students may be intimidated with attending the Professor's OH, and these other sessions give them a chance to receive help in different ways.

In this paper we aim to discuss the reasons surrounding the motive for students to attend OH and what students obtain from attending these supplementary course offerings. Our focus is to

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examine CS1 students and how students utilize the different hours of the course. We want to see the difference in usages as we have seen from past researches finding that some students attend to get help while other students attend in order to gain relationships that may aid them in the future such as research positions. We would like to follow the students through their courses as well by asking for permission in these CS1 courses in order to gain more long-term data once these students move on.

In our paper we aim to investigate two questions:

RQ1: What are the demographics of the students who attend Office Hours and why do they utilize Office Hours, while others do not?

RQ2: What are the short and long-term outcomes of attending OH?

To answer these questions we aim to look at CS1 courses taught at different institutions and observe the different uses of Office Hours and Tutor Hours to see the various effects that they may have on the students that do attend the hours.

We predict that students who utilize office hours for assistance including homework help and lecture clarifications from the instructional team will gain positive experiences and perform at least as well as students who do not attend office hours. We also predict that many students who frequent office hours will continue to utilize them in their future courses.

2 RELATED WORK

There has been limited research and discussion regarding office hours in Computer Science. Kathi Fisler et. al. mainly used the Design Recipe, which is a program design methodology, in an attempt to study TA office hours and is centered around two characteristics: unintrusive as possible and simple to comprehend.[8] As part of their study, students followed the six steps of the Design Recipe when solving problems on assignments and TAs assisted students on certain steps and recorded what happened during the interaction. The results suggested that students who earned As at the end of the course attended more hours than students who earned Bs, but students who earned Cs attended the most hours.

In a similar finding measuring the academic performance between students who attend office hours compared with students who don't in political science courses, Mario Guerrero et. al. found that attending office hours have a substantial effect on academic performance because office hours provide additional resources and opportunities for reinforcing course content.[3] Although the paper mainly focuses on political science, office hours between political science and computer science courses serve similar purposes in helping students and promote interactions between teaching assistants and students.

Rachel Berndtson et. al. found that office hours promote interactions between instructors and students.[9] In a survey conducted at a large public university asking students what they thought of office hours, Berndtson found that instructors and students have different views on the purpose of office hours. For example, some students surveyed believed office hours were meant for emergencies or places where they could express their worries. And others believed office hours were pointless if instructors can be reached in classrooms or via email. Berndtson recommends that instructors should explicitly promote use cases of office hours and encourage students to attend for both academic gains and personal growth.

Shouping Hu et. al. used the College Student Experiences Questionnaire (CSEQ) as a tool to gauge factors like student satisfaction between instructor interactions and intellectual gain scores such as general education gain, personal and social development gain.[5] In the study surveying students from 126 colleges, Hu found that the most common interaction between students and instructors were asking questions about the course. The least common interaction was discussions about working on potential research projects. It was also found that students who had a higher interaction score were more likely to put in more effort and was positively correlated to gain scores.

Sharon Shrock et. al. measured 12 different factors including comfort level that may contribute to the success of students in an introduction Computer Science course.[11] Comfort levels were derived from surveys asking students about questions relating to the course during lecture and office hours. Shrock argues that helpful environments such as office hours can increase students' comfort level because students may feel less intimidated asking questions with teaching assistants compared to in lecture. The study also found comfort level has a positive impact on student success.

Our proposed research is different from existing ones because we will not only conduct surveys and interviews related to office hours, but also look into other factors like grades and demographics of students who attend office hours and analyze and potentially predict short and long term outcomes. We are interested in following the long term outcomes as well as short term outcomes of students who attend office hours, which there has been minimal research thus far.

3 METHODOLOGY

We aim to understand who attends Office hours in CS1 courses and what benefits, or lack thereof, these students receive by attending these Office hours. In order to answer these questions we looked to CS1 courses, or introductory programming courses, to collect data from the top universities in the US and Canada. Both countries offer similarly structured course offerings. This way we would be able to collect a larger diversified sampling from two different countries. We will use surveys, grades, and feedback from the students and the instructional staff in order to get a better understanding of the demographic of students who attend OH and see what the instructional staff have seen through their experiences. If possible, we also ask the students if they would be willing to stay in the study long-term so can study the effects and potential changes in OH use over time. Finally, we will compare the academic performance between students who attend office hours frequently and students who do not utilize office hours.

Selecting universities. We plan on randomly selecting 10 universities that offer CS1 courses and consent to our experiment in the US and Canada. This will give us at least ten CS1 courses and we expect varying class sizes that will allow us to generalize our findings about office hours. We chose to select the universities randomly because we do not want to bias only highly research-focused universities and our goal is to measure the effectiveness of office

hours in general CS1 courses. We recognize the difficulty in conducting research at 10 universities at the same time so we plan to check in with the CS1 professors every two weeks to collect feedback and assist with the tools needed. In every CS1 course at the selected universities, we will enroll every student in our study. At the beginning of the course, we will tell the students the purpose of our research and everything that will happen throughout the study so no one is left confused and intimidated with office hours. We believe CS1 students are most likely to benefit from using office hours because it is an introductory programming course and having one on one help during office hours should be beneficial to many students. By conducting our study in an introductory course, we will be able to recruit more students for measuring the long term outcomes of attending office hours in future, advanced courses.

3.1 Collecting Survey Responses

Once we have determined the universities that will be used to collect data, we begin by creating an anonymous survey that we will ask the students to take to gain some perspective of what the student demographic looks like in these CS1 courses. We will send out the survey twice in order to observe the changes over time throughout the course. We will send out the first survey during the midway point in the course. The reasoning behind this is to allow the students to fully understand what resources are available to them and allow them some time to actually use them. At the beginning of the course, there may be a lack of use as the course will be only going over the introductory material and as time progresses, we believe to see an increase in usage.

Towards the end of the course, we will send out a second survey similar to the first, but also ask students who are willing to continue helping us in our research for the next three years by answering more survey questions about future office hour experiences and whether they are continuing to use office hours in their other classes. We plan on compensating the students who volunteer with one hundred dollar gift cards.

Once we have collected this data, we will quantify the results and qualitatively categorize the responses we have received as well. This will all be done at the end of the course in order to see if students have changed their OH usage.

Link to survey that will be sent out twice throughout the quarter in CS1:

https://forms.gle/HY8qZKKvc7UvEKer8

Link to survey that will be sent out twice (during the middle of the quarter and end of quarter) during each quarter to students who consent to participate for 3 years to measure the long term outcomes of attending office hours:

https://forms.gle/YwhRzF7enGKgWkU19

In the long term, we are interested in determining if office hours have some positive impact on students after taking CS1. We hope that students will continue to utilize office hours to not only gain help on homework assignments in their other courses, but also develop relationships with the instructors and teaching assistants. Questions will seek to determine if students are attending office hours in their other classes, the different types of classes such as theory or algorithms and lower versus upper division, why they are attending office hours (homework help, exam preparation, etc), and a scale to measure their satisfaction with office hours. We believe these kinds of questions will allow us to gauge the use cases of office hours in other courses and classify the possible long term outcomes of attending office hours.

Survey Questions
What is your racial ethnicity? (Select all that apply)
What is your gender?
Why are you taking this course? (Major/Minor)
On a scale of 1-5, how often do you attend the Professor's OH?
On a scale of 1-5, how often do you attend TA discussion?
On a scale of 1-5, how often do you attend Tutor OH?
What is your motivation in attending if you do? (PAs, Clarification, Other)
Or if you feel that office hours are not beneficial or there
are other reasons why you do not attend, why?
Do you find the supplemental course offerings beneficial? Why?
Would you like to help continue our research?†
If yes, can you please leave your email for future surveys?†

† Asked on second survey

Figure 1: Questions that will be used in our survey forms to gain insight on the student population. Although anonymous, students may choose to identify themselves in order to help aid in future research on this study.

3.2 Instructor Feedback

Along with the surveys collected from the students we will also collect feedback and responses from the instructional staff which includes the Professor, TAs, UTAs, and Tutors. We want to collect data from the instructional staff in order to understand different aspects of why students attending from their perspectives. Also, since they are the ones holding the OH, we can also observe what they believed to be successful or not successful when they held their OH.

Although the student data is useful, it is not complete without the data from both sides. In order to fully understand what will work, we need to figure out a system that allows the instructional staff to help the students in a meaningful manner without driving themselves to exhaustion. It is important to help the students but the staff should not be holding their hands as they go. With these large institutional campuses, there are too many students to have the staff help each and every one of them. With larger class sizes, the instructional staff must come up with ways to utilize their time better or hire more people to help support the CS1 courses. This would require the department to hire more staff increasing the funding needed to help teach these courses.

That is why the feedback from the instructional staff is needed in order to get a better understanding of how universities should spread their workload amongst the staff. This will allow other universities to adapt similar methodologies that seem to work even in large classroom settings.

At the beginning of each office hour, we plan on having a sign up sheet for students attending. Although this may dissuade some students to not attend, we believe this will be a minor issue because students will be told exactly what will happen during office hours and there will be minimal interference during our study with

Instructor Questions
Classify the interaction(Select all that apply: non-course related, course related)
If course related(Select all that apply: assignment help, lecture clarification, review material for exam)
If non-course related(Select all that apply: interested in research or work position, career preparation or advice)†

Figure 2: Some questions that instructors will respond to after each student interaction.

students seeking help. At the end of each student interaction, the instructor holding office hours will record the experience quickly by answering a few questions such as classifying whether the interaction was course-related, non course-related, or both in anonymous Google form on a computer or tablet.

Link to form: **https://forms.gle/EfQAPVV1jhsaX8ej9**

3.3 Grades

Most universities offer mid-quarter or mid-semester exams along with final exams to measure student performance throughout a course. At the end of the course, we will use the sign up sheets collected during office hours to compare the grades received by students who attend office hours regularly and students who don't.

We chose to analyze the grades of students during the mid-quarter because we believe students will have been introduced to office hours by then and have had the chance to attend office hours if they are struggling in the course or need help on newly introduced topics. In general, exams are an effect tool to measure student understanding of the material introduced and we seek to measure short term outcomes between students who have attended office hours and students who do use office hours.

Similarly, at the end of the quarter, we believe final grades are an effective way to measure student success overall in a particular course and we believe the first survey sent out to students may encourage students who have not attended office hours to participate. We could potentially group students into three groups: students who have attended office hours throughout the quarter, students who attended office hours after the mid-quarter, and students who never attend office hours and measure the graded achieved to determine if office hours are positively correlated with academic performance.

We chose to use a mixture of quantitative and qualitative methods because we want to measure the academic performance, particularly exam scores and final grades, in the short term between students who attend office hours and students. And to answer our first research question, we needed to do a qualitative analysis by collecting student information such as demographics and instructor feedback to determine the motivations behind why some students attend office hours.

4 DATA ANALYSIS

Our experiments will generate both quantitative data (from the surveys) and qualitative data (from the interviews). These two different types of data will be analyzed with their own methods.

Survey Questions
Have you attended at least one office hours in the classes that you are taking so far?
Please include the type of classes you are taking this quarter: upper division or lower division CS, non-CS
If you selected upper division CS courses, please classify the type of the courses: theory, algorithms, operating systems, architecture
If you selected lower division CS courses, please classify the type of the courses: intro to programming, data structures, discrete mathematics
If you have attended office hours, why? (choose from related to course or non course related)
On a scale from 1-5, do you find office hours to be beneficial?
Are there other things pertaining to office hours that you would like to share?†

Figure 3: Some questions that will ask students who volunteer to participate in our 3 year long study regarding office hours.

4.1 Quantitative Data

The quantitative data we will analyze comes from the surveys, namely student demographics, frequency of OH attendance, and the content discussed in OH (from instructor surveys). We will begin by exploring the survey data. We will look at descriptive statistics, like race and gender breakdowns and frequency of OH attendance, response rates, distributions, and averages. We will also display the student attendance in different types of OH.

To see if there is a statistically significant relationship between attending OH frequently and better academic performance in the class, we will conduct an independent samples t-test. We use a t-test because it compares the two independent groups (students who attend frequently and students who do not attend frequently) to determine whether there is statistical evidence that the associated population are significantly different [4].

Another question we hope to answer using our quantitative data is that is there is a relationship between a student's demographics and their OH attendance. We will use Pearson correlation to determine if this relationship exists. We decided on Pearson correlation because it is a method that measures how much of a linear correlation exists between two sets of data [4].

4.2 Qualitative Data

The qualitative data we collect will come from the open-end/free response style questions. We will use inductive categorization to thematically group the responses. The method of inductive categorization is appropriate in this case because pooling responses that have similar themes, we may be able to reveal general principles of the entire population [10]. In our process of coding, we will not use predefined codes; our coders, on their first read through, will identify codes based on the interviews. After that, we will employ an iterative process, with other coders grouping the responses and refining the themes. After coding, we will highlight the key and most prevalent themes that we find. The codes and the number of responses that correspond to them will be displayed in a table.

Figure 4: A pie chart comparing the different genders attending office hours. Note: this is only a sample of what might be collected

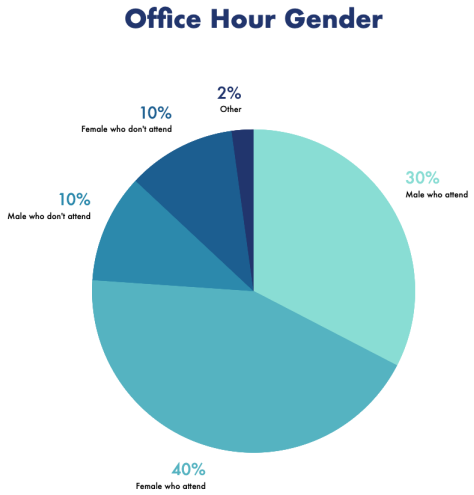
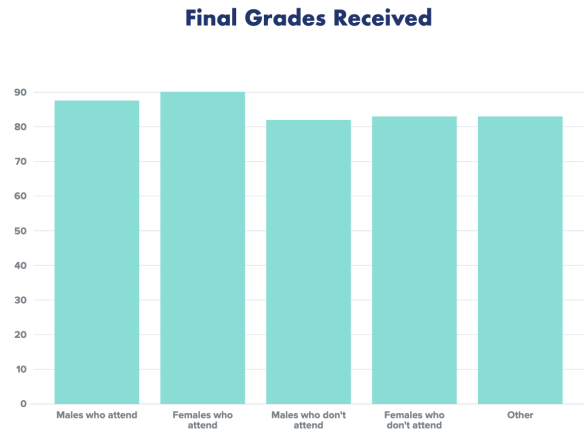


Figure 5: A bar chart depicting the final grades received by different groups of students. Note: this is only a sample of what might be collected



5 POTENTIAL IMPACTS

With this work, we hope to have a better understanding of OH and their role in university CS education.

Our paper will describe the relationship between student's academic performance and office hours attendance. If we can establish that there is a correlation between the two, this can influence instructors to emphasize OH more and may also encourage students to attend. It can provide instructors and students with an understanding of the importance of OH in CS education.

Additionally, our research aims to answers the questions *who* attends OH and *why* they attend, which have not been extensively studied in the CS education research. The results of our work will provide a baseline of information for future researchers to further study OH. One avenue (which we do not address) is the best format of OH. With our data, especially on why students attend, other researchers can design OH interventions that specifically address students' attitudes and desires. Furthermore, this work can be a starting point for instructors to make modifications to their own OH to increase attendance and make them more beneficial to students. Our study provides them with quantified data on the effects of OH and the individuals who attend for instructors to base their decision on. This data can also be used by instructors to adapt their teaching staffs to the needs of their students and better managing the workload of TAs and UTAs.

All in all, the main goal of this paper is to investigate OH in order to make OH as beneficial to students as possible. Despite OH valuable role in CS education, it is not very well studied. With this paper, we hope to prompt further research in OH and encourage instructors to engineer their OH to best suit their students.

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