A Study on the Mental Health
of Women in the CSSE Department
# of California Polytechnic State University

Senior Project

Students: Gabriella Nobili and Sophia Lao

Adviser: Dr. Hasmik Gharibyan

Computer Science Department
California Polytechnic State University
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1. Introduction

We, Gabriella Nobili and Sophia Lao, are both Seniors studying Computer Science in the College of Engineering at California Polytechnic State University in San Luis Obispo. Throughout our college experience we noticed many of the women in computing majors seemed to be overwhelmed more than their peers within other majors, and we wanted to see if our observations were not baseless. We set out to explore the reasons for the extensive stress among our female peers at our university and to discover how this stress influences their mental and physical health.

Before studying the women in computing at our university, we researched what papers are already out there to gain more insight on the subject of "Women in computing and mental health". We found a study done at Cal Poly in 2017 by Andrew Danowitz and Kacey Beddoes [2] that looked at mental health across several engineering majors at our institution. This study found that Engineering students at our college suffer from certain mental health issues at a higher rate than the average rate for college students across the United States. Within engineering majors, our CSSE department was found to have one of the higher rates of students having a risk of suffering from serious mental illness.

Another relevant paper we found was in the Journal of Personality and Social Psychology. This article, titled *Ambient Belonging: How stereotypical cues impact gender participation in computer science* [1], investigated computer science stereotypes and their impact on a woman's sense of belonging in tech. One of the studies presented in this article found that simply changing objects in a computer science classroom from those that are considered to be stereotypical computer science objects (like a Star Trek poster) to objects that are not considered stereotypical of computer science (like a nature related poster) had a positive and calming influence and caused an increase in female undergraduate interest in computer science.
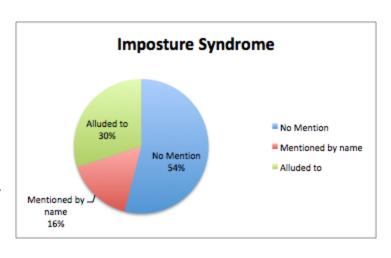
The goal of this paper is to explore the perceived effect that the Computer Science Curriculum has on the mental health of female students. To discover these effects we conducted 50 interviews over a period of several months with the female students of the Computer Science and Software Engineering (CSSE) department at California Polytechnic State University in San Luis Obispo. The total amount of Computer Science (CSC) majors at this institution is approximately 680, with 150 of them being female, so we were able to gather responses from 33.3% of the female CSC students from our interviews. It is worth noting that the overwhelming majority of interviewees (68%) were Seniors who provided extensive information on their experience in the major. The

purpose of the questions we asked was to gather data on depression, anxiety, and how the CSC curriculum influences on their overall happiness. This paper will highlight the major trends that we saw in the responses such as the imposter syndrome, the difficulties of sophomore year and CPE 357, the benefits of having friends within the major, and the negative mental health impacts resulting. From there it will propose potential causes for the trends as well as solutions that may be helpful.

2. Trends Observed

2.1 Imposter Syndrome

Imposter syndrome is an expression characterizing the feeling in which an individual doubts that their achievements are from their own competence and hard work; rather, they feel like their accomplishments were due to luck, and that they do not deserve what they have achieved. Basically feeling like they are an "imposter" and that those around them with similar achievements to their own

are more deserving. Imposter syndrome within Computing stems from self doubt and insecurity in one's ability to code, or general knowledge about the field. We found in our interviews that many of the women we spoke to were internalizing strong feelings of self doubt during their experience as a woman in Computing at California Polytechnic State University. 8 out of 50 women we interviewed mentioned imposter syndrome by name, and 15 women alluded to feeling it. These feelings of doubt were found in students just starting their studies as well as students about to graduate.

Starting out within the major many women were thrown into a world that they did not know much about, while many of their male counterparts seemed to have come in with much more experience. Lots of women we interviewed pointed out specifically that they came in with zero coding experience and felt out of place. Starting from a baseline where they already feel behind from the beginning, feeling they will succeed can be much tougher. As a result, even when they do well in classes, they can still feel as though they are lacking. Generally, women expressed feeling more belonging and

competence as they gained more seniority within the major. One senior student in an interview explained:

"CS has constantly been affecting my confidence. Even though I do not feel like I belong here I now feel like I have a right to be in the classes, but it took a long time to get to this point."
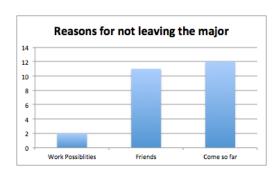
However, even though they felt more confident, they still expressed that they were not yet where they would like to be. Even with the improvements from freshman year, a constant theme was still needing to improve on self confidence. Many seniors still say it remains a significant problem as they are entering the workforce. During an interview, one senior said as follows:

"Honestly, sometimes I still feel like I don't belong. I feel like I'm not smart enough or people don't really want me in the major".

Imposter syndrome has long been identified as a problem affecting women in engineering fields [3] In our interviews we determined that this was an obvious problem for the women in CSSE at Cal Poly. One thing that we found to be correlated with feelings of belonging and increased assurance for the women in our major was having friends, particularly close friends, within the computing majors or the engineering majors more generally.

2.2 Support system: Friends in Computing

In our interviews we found out that the women who have close friends within the major were significantly more likely to feel like they belong to the major. While this might seem obvious, it is also an indication of some of the reasons students are struggling. Even though there are many resources available to help, women still may feel isolated or undeserving of the resources. One woman we interviewed noted that the reason she has not switched majors to something other than computer science is solely because of the support she's found from her peers in the major. She said:

"The people that I've met in my classes have kept me in this major. Seeing them have the same questions as me. Joining up with them to be each other's' support group; I don't feel alone in this; community has made a difference."

Another woman in computing said:

"Me and my friends from class would do bachelor night every Tuesday and sushi every Thursday. Having my women in STEM with me makes me proud and excited to be a woman in computer science."

She was not alone in having a support group keeping her from switching out of computer science. 22% of the women we interviewed cited their friends in the major as their reason for not switching to a new major. In an interview, one woman said:

"I feel like I belong in computer science now that all of the computer science girls have grouped up. It feels good."

Having strong female friendships in the major clearly impacted the college experience of many of the females in computing that we interviewed from our school. Another said:

"I wanted to switch out but I stayed because of the people I met, especially the other females. They made me realize that I was not alone and they were facing the same challenges."

On the other hand, several women actually noted in their interviews that if their friends were not in computer science, they found it to be difficult staying friends with them. For example, one woman said:

"It is hard to hang out with people that are not in computer science, because they sometimes do not understand the same struggles that I face with my projects and they can't understand that sometimes plans can't be made."

Another girl explained how she could not find empathy with her struggles through coursework if her friends were in non-computer science majors. She would talk to her non-computer science friends about her hard classes and it would not provide her with the support she needed to feel like she could get through it.

One girl found that making more friends in the major made all of the difference in her computer science experience. In an interview, she said:

"I felt alienated all of second year because I didn't have a lot of computer science friends. Over the last year and a half, I made efforts to be close to people in the major

and it has made a huge difference - it has greatly improved my sentiments towards my major and I no longer want to switch out."

Experiences like these show us the importance of finding a strong female community of allies to get through the tough curriculum.

2.3 CPE 357 Systems Programming Course too Stressful

The data we collected showed that sophomore year was especially difficult for many of the female computing majors at our school. We found that 24% of the women we surveyed mentioned the class CPE 357 specifically. CPE 357 is our Systems Programming class. It is a notoriously hard class commonly taken in the sophomore year. The class has many time-intensive projects. Many women recounted the quarter they took CPE 357 and remarked how they didn't sleep as much as they would have liked, and had doubt in continuing with their computing major during this time as well. One girl noted in an interview:

"When I was taking CPE 357 I was only able to sleep for four hours a night but my other quarters I slept for 8 hours a night."

This caused for the mental health of many of such women to suffer. One female student's remark that illustrates this point is as follows:

"I remember this one incident when I was walking to CPE 357 from my house and I had the worst panic attack in my life. It was super scary because I was walking with my roommates and I couldn't comprehend a thing they were saying, when I got onto campus, I felt like I kind of blacked out and had no idea on how I got to campus, and began disassociating from reality. This was all because I was anxious to go to 357…and I still didn't even make it to class that day…"

This story was not unique to this particular student. Many students had similar stories, and brought up this class when they were asked if their major had an impact on their mental health, citing CPE 357 as a negative source. Another student describing the way this class impacted her mental health said:
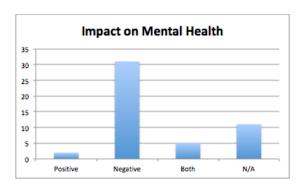
"During 357 I stopped seeing my friends. My mental health had never been worse. My parents even considered not sending me to school anymore."

While certain courses in the CS curriculum are necessary for the field, there could be a way to not put so much negative pressure on students when teaching these courses.

2.4 Project Grading System causes Stress

From the interviews it became evident that the rigor of some courses, particularly CPE 357 as mentioned before, tended to have a negative impact on the mental health of female students. 76% of the interviewed women encountered a negative impact on their mental health at some point during their college experience due to computer science coursework. 62% of the interviewed women reported that CSSE courses caused them anxiety.

When exploring the causes of stress from the CSSE courses at the school, we found that 84% of the women we spoke to cited the project deadline system as sources of negativity. A rolling deadline is where a project cannot receive full credit until it passes a set of test cases from an autograder; the test cases check the functionality of the code written. Usually the deadline for this type of grading system is around 11pm at night. In our department many courses commonly use this grading system; for example CPE 103/202 (Data Structures), CPE 357 (Systems Programming), CSC 453 (Operating Systems), and CPE 430 (Programming Languages). Additionally, the autograder of this system causes an "all or nothing" nature, because no one is actually looking at the written code, and the grade is solely determined by passing the test case suite. This idea of passing in an "all or nothing" manner without partial credit was the source of anxiety for many of the women we spoke to. One of the women said the following regarding the auto grading system in place:

"*Classes become very stressful when the only thing grading you is an autograder. It makes it hard to have a sense of partial grades. Even if you're really close but can't pass the core tests, you cannot receive credit. No one is actually looking at your code whereas other majors have their work looked at.*"

Because of this "all or nothing" grading where you must pass the set of core tests in order to receive credit, we found that women would isolate themselves until the late night deadline in order to pass the test cases to receive the credit. They would put off

showering, social interactions, and eating to do so. One of the females shared her project experiences with us in an interview, saying:

"Honestly, it's pretty bad. Sometimes I accidentally skip meals. I don't work out as much as I used to because there's no time. School makes it seem that meeting a deadline for a project is more important than health. My sleeping schedule is the worst thing ever."

When questioned on it, the female computing majors at our school expressed wanting a change to this type of grading system. Another student on the topic told us:

"The way that classes are structured here, there is a certain vibe you get where you think you need to code all weekend long and stay up late. They promote unhealthy behaviors and are not inclusive because people learn differently and at a different pace. Computer science has a lack of collaboration where the grading system feels really harsh and like maybe it could be another way. I do not like 'right' or 'wrong' grading."

Potential solutions to the deadline system may include changing the due dates and times associated with projects. The data we collected showed that people would work up until late night deadlines like 11:59 pm, putting off all social and healthy behaviors to do as much work on the project as possible up until the deadline. If a professor must use the autograding test case system (due to having too many projects to grade), the proposed deadline could instead be at the end of the class period, so that students cannot sacrifice self-care for the entire day to work on their projects. To solve the all or nothing nature of an autograder, professors could potentially offer partial credit for having a solution that almost works, i.e. passes a large percentage of test-cases.

2.5 Pressure to Perform Well Comes from Self

In our interviews we found that all of the women we talked to believed that the majority of pressure they felt to succeed came from internal sources rather than external sources. Many stated relatively little or even no pressure from parents. Women stated that they put pressure on themselves to do well academically, to get internships, and to achieve as much, if not even more than their peers. A few women in computing at our school seemed to put an unhealthy amount of this pressure on themselves. One woman we spoke to said that she is often told she needs to calm down.

Many women mentioned the competitive environment within classes causing them to put more pressure on themselves. One surveyed woman mentioned how students "*not taking care of themselves, by staying up all night coding and not sleeping, is praised*". It

is this competitive climate that leads to comparisons. There is a premium placed on grades over mental wellness. One woman explained how she felt, saying:

"I feel like I am judged by my personal achievements because the people here want to work their hardest and push themselves not to sleep. I feel like sleeping and not eating are glamorized by my classmates."

Even if it isn't out right said, there is an unspoken rule they should not sleep in order to finish a project. Finishing a project becomes the most important task, and overtakes other tasks such as eating, showering, and any other self-care activity. Finishing projects becomes a part of one's identity.

Other women explained that they put pressure on themselves because they did not want to create a poor image for women in computer science. They felt like as a minority they had a duty to do well for the sake of not making other women in their major look bad. One girl said as follows regarding this idea:

"I feel overwhelmed a lot because of the expectations I put on myself and also feeling like I need to prove to people that I belong in CS. Honestly, I'm really afraid of being called a dumb girl in CS and putting out a bad reputation of women in CS."

Another woman in different words expressed the same thing, saying:

"I put a ton of pressure on myself since I feel like I shouldn't do/act a certain way, or it puts out a bad stereotype of women in CS. I feel like I'm my biggest enemy and I'm the one that puts a ton of pressure on myself."

This was a common trend that we saw with our interviews. Another woman said:

"A lot of the stress that I have is about other peoples' opinions of me and whether they think that I am qualified for what I am doing."

This shows that women had felt the need to prove to themselves that they belong here. Potentially, due to being a minority in the major as a female, several girls in put unhealthy expectations on themselves to perform well.

2.6 Peer Pressure to Perform Well

Even though pressure mostly came from internal sources, it should be noted that peer pressure was still a prevalent source of anxiety for female students at our school. We found 34% of the women we talked to mentioned their peers as a source of stress. Notable sources included project peer pressure and career peer pressure. One woman describing pressure from peers said:

"My mental health is more negatively affected by the people in computer science than computer science itself. Classmates are very critical."

Another student noted how the culture in general is *"masucline"* and *"competitive"* in the classroom setting. A female student we interviewed described this further, saying:

"When I'm in class and a bunch of guys talk, its hard to speak up; if a girl asks a question she's stupid but guys asking questions, they are curious."

Other women reported overhearing classmates' discussions on assignment topics and progress that made them feel like they were not far enough in their own work or that they were not smart enough to understand or be a part of the conversation. In an interview, one woman said:

"I remember constantly eavesdropping on the guys in our class with how far they were with their project. It would hurt me because I would feel the need to get further faster or like I did not even understand the conversation. This was very harmful."

Peer pressure like this tended to cause a negative impact on the mental health of females in computing at our university because they would view their intelligence as lacking and feel anxiety over being behind their peers in their project progress.

Regarding career pressure from peers, several women reported that hearing other students discuss interviews and internship opportunities would give them stress and pressure in an unhealthy, competitive way. One female computing student we spoke to said that this "*fancy internship culture*" was destructive to her confidence in the field. In an interview, one woman shared a negative experience she faced from male peers. She said:

"For a while it took me a long time to realize that I earned/deserved my spot in the major because I would get comments from guys either in or not in CS saying things like I didn't
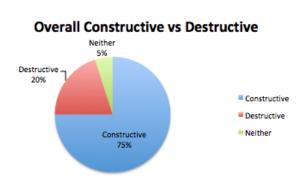
deserve things, I only got opportunities because I'm a woman, and I didn't "look" like a CS major. It really sucked feeling unsupported, so I had thoughts about leaving the major."

This trend was not uncommon throughout our interviews. Another woman noted that:

"Peers had a competitive nature, and it feels superficial and materialistic. Career fairs make me feel bad about myself."

2.7 Major Overall Constructive to Personal Growth

Despite all of the negative mental impacts women experienced, 90% of the women we interviewed said that their time at Cal Poly was overall constructive to their personal growth. Every class at Cal Poly is a chance to learn a skill; whether it is learning to code and solve specific problems or learning patience and dealing with mental pressure. Many women stated that the major was constructive

because they built strength and learned to find balance within school work and the rest of life. In an interview, we were told:

"Getting through difficult classes, and difficult times in general has taught me that I can overcome challenges that I thought I would not be able to and persevere."

The women who expressed mental growth during their time at Cal Poly, felt more confident in their abilities and gained experience throughout the courses. One woman in an interview with us said:

"My major has been overall constructive. I learned a lot about myself like what I can handle, what I value, and how to stand up for myself. I have grown academically, and I've learned to deal with difficulties."

On the other hand, many women stated that even though they thought overall the major was constructive, there were many destructive parts. One woman summed up their experiences overall by saying:

"My major has been constructive - but also very destructive. Mentally, destructive, but in terms of growth and knowledge constructive".

So even though they believe they have grown in terms of overall knowledge, their mental health has suffered at the same time. For many of the interviewed women, if they described the major as constructive, they qualified their response by stating how they knew more than they did coming in, and they had learned to deal with workload better. Some students only found it constructive once it was in hindsight, but during times of great challenges they felt it was destructive to them.

3. Conclusion

To conclude, we want to state that during our interviews we discovered that many women within Computer Science at Cal Poly have had negative impacts on their mental health. The largest components of these negative impacts came from feelings of imposter syndrome, stress from placing high expectations on themselves, and lack of sleep and other forms of self-care due to projects or courses like CPE 357. Much of the pressure that many women felt stemmed from the competitive culture around doing well academically and starting a career. However, having friends within the major greatly lowered the pressure many women felt, and increased their sense of belonging. In addition, even though many women went through struggles during their time at Cal Poly, altogether they saw the major as being constructive to their overall growth. Their experiences at Cal Poly increased their life opportunities and their strength from enduring difficult classes. These positives should be kept in mind while looking for ways to decrease the negative mental impacts that many women have been struggling with.

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