Over the past few decades, the ratio of women to men in many traditionally male-dominated fields has become much more equal. However, in science, technology, engineering, and math (STEM) fields the ratio has not improved at the same rate. In computer science the ratio is still very uneven. Today women earn only 20% of the computer science degrees. Many recruitment programs try to attract more women to CS, but these efforts would be more successful if we had a better understanding of why many women are uninterested in CS. Our study uses a survey for high school students to reveal what females look for in a major and how they perceive computer science. Our results suggest that women are more influenced by the negative stereotypes of CS students and jobs as being lonely and boring, having a parent in a tech or engineering field increases interest in CS for women, and men are more influenced by a desire for financial security than women are.

Key Words: gender study, computer science, gender gap, STEM, high school

Corresponding e-mail address: ash.r.schneider@gmail.com
Reasons Behind the Low Enrollment of Women in Computer Science

by

Ashley R. Schneider

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APPROVED:

________________________________________________________________________
Mentor, representing Computer Science

________________________________________________________________________
Committee Member, representing Computer Science

________________________________________________________________________
Committee Member, representing Computer Science

________________________________________________________________________
Head, School of Electrical Engineering and Computer Science

________________________________________________________________________
Dean, University Honors College

I understand that my project will become part of the permanent collection of Oregon State University, University Honors College. My signature below authorizes release of my project to any reader upon request.

________________________________________________________________________
Ashley R. Schneider, Author
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According to the American Association of University Women (AAUW), historically males have outperformed females in math and science, but over the past few decades, the gap has narrowed [1]. Now females are earning credits in math and science high school courses at about the same rate as males and are earning higher grades in those classes on average. Figure 1 illustrates how females earned higher grades in high school math and science courses than males from 1990 to 2005 [1].

Figure 1. Grade Point Average in High School Mathematics and Science Courses by Gender, 1990 - 2005

However, fewer females than males take advanced placement (AP) exams for science, technology, engineering, and math (STEM) courses, and those who do take these exams perform worse on average than males [1]. To further this puzzle, studies show that 29% of male college freshmen as opposed to only 15% of female college freshmen plan on majoring in a STEM field,
even though they are, on average, equally prepared for such a major upon graduating high school.

Figure 2 shows how this disparity exists across all races and ethnicities [1].

Figure 2. Intent of First-Year College Students to Major in STEM Fields by Race-Ethnicity and Gender, 2006

Figure 2 illustrates that the percentage of women intending to major in CS is significantly less...
than the percentage of men across all races and ethnicities. In addition, the number of women in other previously male-dominated fields, such as business, law, and medicine, has increased much more than in the STEM fields.

The ratio of women to men earning bachelor degrees in physics, engineering, and computer science is particularly low, with women earning only 20% of the degrees [1]. In addition, computer science is an especially interesting case because the percentage of degrees earned by women in the field is actually declining. In the mid-1980s women earned 36% of the computer science degrees, but now that number has dropped to 20%. Furthermore, the retention rates for women and men in STEM at the college level are about equal; thus, in order to improve the ratio of women to men, the focus should be on students prior to entering the field.

In 2009 Michele Slattery, a consultant working with NCWIT Extension Services, collected and analyzed data on the undergraduate computer science program at Oregon State University in order to help the faculty attract and retain women in the program [2]. She collected data from three school years: 2006-2007, 2007-2008, and 2008-2009. Over these three years women made up 9% of the total students who applied to the Computer Science program. Even with this low percentage of applicants, a much higher percentage of male applicants enroll. Thus, women represented about 8% of the newly enrolled CS students over those three years. Slattery notes that “despite an impressive international reputation for Open Source, the Oregon State computer science department suffers from the classic pipeline issue of too few women entering the program” [2]. She reports that most women do not get computing exposure in high school, and so they do not consider the major. Our study aims to figure out what differences between men and women cause the ratio of women who consider the major to be so much lower than the ratio of men. If we can find these causes at the high school level, suggestions can be made for changing this reality.
THESIS STATEMENT

The low enrollment of women in computer science greatly reduces the diversity of the field as a whole, which inhibits the ability of computer scientists to provide the best technical solutions to as many people as possible. Improving recruitment techniques to attract more women to CS would improve the field, but it is important to understand what drives women’s choices of majors and why so many are uninterested in CS before the best recruitment techniques can be developed. This study aims to identify causes for the low number of women choosing computer science as a major. Our research is an exploratory study, but we do have a hypothesis we hope to support or refute. We hypothesize that females are more interested in majors that serve a social purpose and work with people, but they do not understand how computer science is applied to many fields and involves working on teams and with clients, which deters them from CS. More specifically, we hypothesize that the survey will show that more women than men rank dedication to a social purpose and the work environment as playing strong roles in their choice of major, and more females than males will describe the typical CS job as an isolated desk job.

BACKGROUND

Researchers have conducted many studies related to the low enrollment of women in CS, but many of them focus on the retention of students, testing possible solutions, or on a different target population. We will instead focus on the root causes of the discrepancy at the high school level with educated suggestions for decreasing the gap. The past studies suggest possible causes and solutions, and these helped frame how we set up our survey. If our results verify some of the suggested causes, the recommended solutions may help us form our propositions.
Retention Studies

Social scientist Jane Margolis and computer scientist and educator Allan Fisher explored many causes for the gender gap in CS [3]. They investigated causes from childhood to the workforce, but they focused at the college level by interviewing over 100 CS students from Carnegie Mellon University over four years. Their findings helped to increase the ratio of women enrolling in CS at Carnegie Mellon from 7% to 42%. They also spoke with hundreds of high school faculty and observed their classrooms. Their book *Unlocking the Clubhouse: Women in Computing* explains how the gap begins at a young age and continues to grow as time passes. They found that “in secondary schools across the nation, a repeated pattern plays out: a further increase in boys' confidence, status, and expertise in computing and a decline in the interest and confidence of girls” [3]. Margolis and Fisher identify many causes for this pattern including that “boys often formed friendship communities around shared experience and knowledge around the computer” and girls did not, assignments often reflected male interests, and males spent significantly more time playing video games than females [3]. They also found that “forty-four percent of the women [they] interviewed and nine percent of the men link their interest in computing to other arenas,” and they claim that “connecting computing to other fields and working within its human and social contexts make the study of computer science compelling and meaningful” for females [3]. The findings of Margolis and Fisher were very helpful in forming the ideas for our survey because we have focused on why students are interested in certain majors to try to reveal what women look for in a major that may differ from males. This may expose the reasons describing why they find CS to be unfulfilling and drive our suggestions for attracting more women to the major. Our study differs from theirs because we are surveying high school students and focusing on reform at that level, instead of the college level.

Another study by the National Center for Women & Information Technology (NCWIT) involves a program called Survey-in-a-Box: Student Experience of the Major (SEM) where they
use a survey to identify conditions that are helpful or harmful for student retention rates in computer science [4]. Undergraduate computing programs can distribute this survey to their students and send the results back to NCWIT. NCWIT will analyze the results for the program and send results back to the programs to make educated changes to higher retention rates. This survey and its goals stem from the same reasons why we are conducting our study: the low level of women in computing. However, it focuses on trying to keep women in the program; whereas, we are concentrating on identifying reasons why women do not choose the major in the first place. We are looking at the high school level for this reason, and our results will contribute something new to the results already found by NCWIT. NCWIT found the following reasons through research for the low participation. First off, most introductory computing courses are geared towards students with some programming experience. Also, women are less likely to have a background in programming, and women have a lower tolerance for what they consider low grades. These factors contribute to the low retention of women. Furthermore, it is important to link assignments to student’s existing knowledge and experiences to make it meaningful, and having faculty and student support systems are crucial to keeping women in computing programs. Collaborative learning environments are important for retaining both men and women. Finally, minorities in academic programs face a more difficult battle because they need to learn how to study with their peers and prove to faculty that they are capable of learning with their peers. All of these factors play a role in retaining students in undergraduate programs, and NCWIT’s survey helps undergraduate programs realize where they are lacking and what should be changed.

Our focus is on attracting more women to the major instead of retaining them, but these results are helpful in that they suggest one cause for the low enrollment of women in CS could be that many females do not know how CS relates to their existing interests. Our survey tries to capture this possible cause to confirm or deny it at the high school level. Judy Sheard, Angela Carbone, Selby Markham, A.J. Hurst, Des Casey, and Chris Avram from the Caulfield School of Information Technology and the Faculty of Information Technology at Monash University in
Australia combined efforts to explore the severe drop in students applying for Information and Communication Technology (ICT) degree programs [5]. The study focused on college students already in an ICT program with the hope of determining the perceptions ICT students have when they enter the program and investigate how these perceptions play a role in risk factors for students who end up failing or leaving the program. They chose to survey the students in a course taken by the majority of first year ICT students. They found that interest level in ICT did not show any significant correlation with performance. Students with past experience with programming, who had English as their first language, or who started the course directly from school were more likely to succeed in programming. However, students with unclear expectations were more likely to drop the program. Students’ interest or expectations do not help predict whether a student would complete a course, and females were more likely to drop the more technical courses. These findings focus on retention of students, but it shows that past experience with programming and clear expectations of the course helped students succeed. This may help with our study. If we find that students are generally not interested in CS because they do not understand the major and have little experience, integrating CS into high school curriculum could be a suggestion since this study shows it helps students succeed.

**Methods for Generating Interest**

Female software engineers at Google’s Israel R&D Center in collaboration with the Israeli National Center gave high school females the opportunity to visit Google in 2011 [6]. Presenting female role models during the visit and the visits themselves influenced female students’ perception of computer science and their desire to study computer science or work in a high-tech field. A survey asked the students if they would be interested in continuing their communication with Google, and many responded with face-to-face ways they would like to
continue their connection with the females they met. These results suggest one method of generating more interest in CS for females could be presenting them with more female role models in the field. The study also suggests face-to-face forms of contact with people may be important to females, and the idea of using computers extensively may be deterring more females than males for this reason. Our study hopes to find the root causes for women’s lack of interest in CS and may be able to confirm or deny the possible causes suggested through this study: lack of female role models in the field and perceived lack of face-to-face communication on the job.

Casey Alt, Owen Astrachan, Jeffrey Forbes, Richard Lucic, and Susan Rodger from Duke University developed modules for changing high school introductory computer science classes to study topics from social networks instead of just programming [7]. This stemmed from the way examples in these courses have not changed in forty years despite the huge leaps in computational power. Also, these courses fail to attract students interested in other subjects such as biology, economics, public policy, mathematics, chemistry, and other sciences. By using materials more based on mathematics than programming, it is possible the teachers will be able to keep ahead of the students, and the courses may be able to attract more students from diverse interests outside of programming. This proposal also hopes to attract more women specifically to computer science. These researchers reviewed literature that suggests that “women often form long-term attitudes about computer science at the high school level,” and “women tend to respond more favorably to computer science when it is demonstrated that the field is not just about programming, but rather is deeply interconnected to other already familiar academic areas and can be concretely applied to help solve important ‘real-world’ problems” [7]. These ideas and the development of this new curriculum seem promising, but the researchers have not been able to yet test if their ideas will increase participation in computer science or not. Our study attempts to address the same issues as these researchers, but we are searching for the root of the problem before we attempt to fix the issue.
Similar Studies with Different Target Population

Lori Carter from Point Loma Nazarene University conducted another study in 2006 to try to determine why the number of students majoring in computer science was declining [8]. She surveyed 836 high school students and determined that the students seriously lacked experience with computer science and did not have an understanding of the major. Figure 3 illustrates that the vast majority of the students surveyed did not know what CS majors study [8].

![Student Impression of What CS Majors Learn](image)

Figure 3. High School Students in Advanced Mathematics Courses Understanding of What Computer Science Majors Learn, 2006

Her study also revealed that, among those who had chosen to major in computer science, the males and females had different reasons. The males primarily chose computer science because of an interest in computer games. The females, however, chose it because they wanted to use the skills in a different field. This study helps reveal a key difference between males and females but was not meant to be a gender study. It also only surveyed students in advanced math classes.
Our study aims to identify differences in goals and interests between males and females from all subject areas.

Larisa Eidelman and Orit Hazzan from the Department of Education in Technology & Science in Technion - Israel Institute of Technology in Haifa, Israel conducted a gender study in the Israeli high school system [9]. While their gender study did focus on the underrepresentation of women in CS, it examined the differences in the Jewish majority sector and the Arab minority sector. More women choose to study computer science in the Arab sector, and the study explored many possibilities for this discrepancy, one of which is that the teachers in the Arab sector encourage their female students more to pursue CS. This reveals that one method to help improve the number of females who choose CS is more encouragement from teachers, but the study does not focus on the root causes for women to be less interested than men in the first place, which differs greatly from our study.

In 1990 Karen A. Frenkel from ACM Headquarters in New York, NY did a lot of research regarding the dropping number of women graduating with a CS degree or going on to an advanced education in CS [10]. Her paper references statistics revealing that girls in grade school show less interest in computer science than boys, and she suggests this may be due to the software used in the classroom, which was exciting for males but caused anxiety for the girls. This suggests that changing the software used in classrooms to appeal to girls and boys could help interest more girls at a young age. Our study hopes to find causes at the high school level so that changes can be made at that level, but it is possible that the software used in computer classes is less interesting to the females than the males.

Thomas Zimmerman from IBM Research, David Johnson, Cynthia Wambsgans from the National Hispanic University, and Antonio Fuentes analyzed the Latino College Preparatory Academy (LCPA), a small charter high school that aims to encourage Latino students to attend college, to see what the school is doing to encourage its students to pursue a college degree in CS [11]. Latino students are very underrepresented in CS, but this high school is succeeding in
encouraging its students to pursue a college degree in CS. Using surveys and test scores, they analyzed which characteristics make students likely to choose to major in CS. The researchers used questions from a past study and used the past results as a baseline. The survey results showed that the LCPA students were more influenced towards CS and less influenced away from it than the control group, especially for the females. The LCPA females were also more influenced by the money they could make, as well as the desire to use a CS degree to complement another field. In addition, knowing someone in the CS field had a higher positive influence on LCPA females than the control group. The results for males at LCPA were very similar to the results for the control group, except the males at LCPA were more influenced by a desire to program. These results show that the methods being used at LCPA work very well to attract the students, especially females, to CS. The school introduces students to professionals in the field, discusses salary potentials with students, and exposes them to the possible fields that CS can be applied to. The methods worked to attract Latino women and could also be effective for women of other ethnic backgrounds. Our focus group is high school students in the Willamette Valley of Oregon, and we hope to reveal the causes for a lack of interest in CS. We may suggest some of the approaches LCPA uses, if any of the causes we find seem as if these approaches could help address them.

Another study performed in 2012 by Sandy Muspratt and Thomas Apperley analyzed high school students in two schools in Australia and looked for patterns involving video game play [12]. The goal was to gain an understanding of students’ gaming practices and how they feel it affected their lives. This is slightly related to our study because many students claim that their interest in computer science stems from playing video games as children. The researchers performed cluster analysis on three dimensions: Competition, Creation, and Socialization. This revealed five main clusters. The largest group regarded all three dimensions as unimportant to game play. This group contained a majority of females, and its members played games less frequently than most of the other groups and mostly played single-player games. The second
largest cluster only valued competition out of the three elements and were disproportionately males. This group spent the most time playing games out of the five clusters. The third largest group regarded all three dimensions as important. This group also had more males than females. The fourth largest group regarded the creative element as the only one important to their gameplay. This group was disproportionately female, played casual single-player games, and played the least out of all the groups. The final group was the smallest and only thought the social element was important. This group was fairly balanced in gender compared to the sample and played multiplayer games the most. This study provides some insights into the motivation to play video games and the differences in motivation between males and females. If video games prove to play a role in the results of our study, then this information could be useful to us.

Paul J. Will from the Department of Computer Science SUNY College at Oswego, New York did an analysis of responses to a survey given to non-majors in an introductory general education course to explore their perceptions of computers [13]. The results showed that students recognized the importance of computer technology but felt uneasy about its effects. Also, those who had taken a high school computer science course did not have an improved view of computers. Males tended to have a more positive view than females, and older students tended to have a better attitude towards computers than younger students. These results provide some insights into the view of computers for students who are not majoring in computer. They suggest that one reason females could be less inclined to major in CS than males is that they are more uneasy about technology. This research study surveyed students who had not yet decided their major, and we hope to focus instead on the reasons students choose one major over another, as well as their perceptions about computer science.

Many studies have been conducted around the subject of the lack of women in computer science, but none of them seek to find the root causes at the high school level as we do. Many studies tried various methods of sparking more interest for women or focused on increasing the retention of women in the major. Instead, we are trying to increase the number of women
entering the pipeline by finding the root causes before trying a recruitment method. However, many of these studies suggest possible causes and solutions that we will keep in mind as we analyze our results.
METHODOLOGY

Conducting this study involved a lot of communication between our team, the Institutional Review Board (IRB), and various school districts, due to surveying high school students. Our first concern was making sure everyone on the team was IRB-certified to conduct human studies on minors in Oregon. I took the online training course and gained the certification during the spring of 2012. We then developed the survey with a variety of questions to identify what leads students to choose one major over another and what predispositions students have towards computer science.

We then researched the procedure for asking the districts for permission to conduct the study at their high schools. We contacted eight total districts in Oregon and submitted proposals to each district that requested them. In the end, four high schools agreed to participate: Corvallis High School, Crescent Valley High School, Philomath High School, and Lebanon High School. While we communicated with the districts, we also prepared the documents for the IRB, and so once we had permission from the districts themselves, we were able to submit our proposal to the IRB right away.

We submitted our documents to the IRB on November 12, 2012. After multiple revisions the IRB approved our study on February 4, 2013. We printed enough flyers for all of the students at each school, and on February 7th, we delivered survey flyers to Corvallis High School and Crescent Valley High School. On February 8th, we delivered the rest of the flyers to Philomath High School and Lebanon High school. The total number of surveys distributed was between 4000 and 5000.

The results of the surveys trickled in slowly, and at first we only got 18 responses. We then followed up with the schools to see if they had all distributed the surveys. One of the schools had only given the surveys to a subset of students, and another school was not sure what happened to the surveys. After following up and clearing up our instructions, we received 15
more responses, bringing our total to 33. We then proceeded to analyze the data. Because we obtained so few responses, we were not able to do real statistical analysis. Instead, we grouped the responses into four categories according to gender and interest in CS. We classified participants who listed at least one of their major choices as an engineering field or technology as interested in computer science. By going through the different groups, we identified some trends that stood out within them. We examined each factor in the students’ choice of major, and we classified the role as being a strong influence if it received an average score of 3.5 or higher, where 3 meant it played a moderately important role and 4 meant it played a very important role. Using this technique we found a few correlations in the data.
RESULTS

From the 33 responses we received, 14 were from females and 19 were from males. Twenty-five of the responses were from freshman, 6 from sophomores, and 1 from a junior. One participant did not indicate his or her grade level. Six Corvallis High School students, 11 Lebanon High School students, and 16 Crescent Valley High School students participated. We did not get any responses from Philomath High School. We then divided the responses into four groups based on sex and interest in computer science. This left 2 females interested in CS, 12 females uninterested in CS, 5 males interested in CS, and 14 males uninterested in CS.

The surveys show that the two interested females have both parents in engineering careers. They both also said that most of their family members are engineers. Their responses about what plays a role in their interest in majors show that for both females a personal interest in the major plays a strong role in their choice. One of the females also noted that a dedication to a social purpose, a want for financial security, and a desire for a prestigious career path all play a strong role in her interests in majors. Neither one listed work environment as a strong factor.

Of the five interested males, only one has a parent in an engineering or tech-related field. Only one listed dedication to a social purpose as playing a strong role, but four of the five males, or 80%, said that personal interest plays a strong role in their major selections. Three out of five, or 60%, of them responded that a want for financial security strongly influences their choices. Three out of five also listed a desire for a prestigious career path as a strong role in their selections. Two out of five, or 40%, said work environment greatly influences their choices.

Only 1 of the 12 uninterested females has a parent in an engineering or tech-related field. Five of the 12, or 41.7%, said dedication to a social purpose plays a strong role in their choices. Five of the 12 also listed a personal interest in the major as greatly influencing their selections. Four out of 12, or 33.3%, said a desire for financial security plays a strong role, and 3 of the 12, or 25%, responded that a desire for a prestigious career path is a strong influence on their
decisions. Also, 4 out of 12 answered that work environment plays a strong role. Besides the influences on their major choices, there were some trends in their thoughts about typical CS students and careers. Three out of 12, or 25%, mentioned at least once that they thought computer science was boring. Five out of 12, or 41.7%, said the typical CS student is nerdy, and 2 out of 12, or 16.7%, said the typical CS student is socially awkward.

Of the 14 uninterested males, only 2 have a parent in an engineering or tech-related field. Eight out of 14, or 57.1%, reported that a desire for financial security plays a strong role in their major choice. Seven out of 14, or 50%, said their wish for a prestigious career path plays a strong role in their selections, and another 7 listed work environment as a powerful factor. Six out of 14, or 42.9%, said personal interest greatly influences them, and another 42.9% said dedication to a social purpose plays a strong role. Two out of 14, or 14.3%, associated CS with a desk job, and only one student mentioned that a typical CS student is a nerd.
DISCUSSION

Our main obstacle in this study was a lack of data. It was very difficult to get high schools and their students to participate in a study like this. We gave enough flyers to the high schools for every student to receive one. This should be four to five thousand students, yet we only received thirty-three responses. This suggests that the schools did not fully distribute the flyers. We should have gotten much higher participation if every student had gotten one. In the future, in order for a study like this to be successful, a grant may be needed to inspire participation.

Although the sample size of our results is small, some notable trends still stand out from this data. The two students from the interested females group both have a strong family influence. Both parents of these students are engineers; whereas in the uninterested females group only one student, 8.3% of the group, has a single parent in an engineering or technology field. The males in both groups similarly had a very small percentage with at least one parent in an engineering or technology field. Figure 4 shows the percentage of each group with at least one parent in a technical or engineering field.

![Figure 4. Percentage of Students from Four Groupings by Sex and Interest in CS with At Least One Parent in an Engineering or Technical Career](image-url)
The findings shown in Figure 4 support the study where female high school students visited Google’s Israel R&D Center. That study found that introducing the students to female role models in tech influenced their interest in Google and CS [6]. In addition, this trend supports Eidelman and Hazzan’s study in the Israeli high school system because their results suggested that encouragement from teachers can influence female students and make them more interested in CS [9]. Both of these studies suggest that role models who encourage females to try a career in a high-tech field can make a big difference. Our results suggest that parents can serve as that encouraging factor that interests women in CS or another technological career.

In addition, the uninterested females seem to be more affected by the stereotypes of CS students and careers. When asked to describe a typical CS job, one female student from this group said “that you just sit in the office all day working with computers.” Another uninterested female commented that “it just seems so boring.” This group is the only one to use the word boring, and 25% of the females in this group used it. Furthermore, one student in this group described a typical CS student as “social awkward…sits at home on computer all day doesn’t have a life,” and she continues on to say that this discourages her from studying CS because she “wouldn’t want to hang out or be around people like that all day…it would get depressing.” These findings suggest that negative stereotypes of CS students and jobs influence females more than males. The uninterested males only had 1 in 14, or 7.1%, mention the nerd stereotype, but among the uninterested females, 5 in 12, or 41.6%, described the typical CS student as nerdy. Many of the previous studies we reviewed, such as Margolis and Fisher’s, Carter’s, and Zimmerman, Johnson, Wambsgans, and Fuentes’s, suggested that females who do choose to study CS do so because of a desire to use CS in other fields. Our findings support this claim because they suggest that many females are uninterested in CS because they view it as a solitary desk job lacking interaction with socially adept people.

Another trend that stands out from the data is the male preoccupation with a desire for financial security. Eleven of the 19, or 57.9%, of the males and only 5 of the 14, or 35.7% of the
females listed financial security as a strong role in their major choices. This discrepancy was unexpected. The previous studies we reviewed did not contain any financial findings. The results also show that 42.9% of the females and 36.8% of the males listed dedication to a social purpose as strongly influencing their choice of major. While this is slightly more females than males, it does not stand out as a trend, and we do not have enough data for that small difference to be significant. Thus, we cannot support our hypothesis that dedication to a social purpose is more important in choice of major for women than men. However, 47.5% of the males and only 28.6% of the females said work environment plays a strong role in their selections. This refutes our hypothesis that more women would put work environment as a strong factor in their choices.

Figure 5 shows these factors and the percentages by gender of whose major selections are strongly influenced by these factors.

![Percentage of Gender Strongly Influenced by Each Factor](image)

Figure 5. Percentage of Males and Females Who Listed Each Factor as Playing a Strong Role in Their Choice of Major

Figure 5 reveals the unexpected results of the study. However, part of our hypothesis was supported. More women than men described CS students and jobs negatively as solitary and
boring. This supports our hypothesis that more women would describe CS jobs as isolated desk jobs that do not deal with people.

In conclusion, our results suggest that while females’ major choices are not significantly more influenced by a dedication to a social purpose or work environment than males’ selections are, they are more negatively influenced by stereotypes of CS students and jobs. Also, our results suggest that having a role model in a technical or engineering field positively influences females to try CS. Finally, males seem to be more driven by a desire for financial security than females are. These findings can be used as suggestions for female recruitment programs. For instance, our findings suggest that it would help to explain how there are very many inter-disciplinary, social, team-oriented jobs for CS graduates. Also, focusing on the financial opportunities will help recruit males but probably not females. Recruiting more women into CS is very important for the field, and clearing up misconceptions and stereotypes about the major may really help even out the ratios.
BIBLIOGRAPHY


Few Women in CS High School Survey Questions

1. **Sex**: Male Female

2. **Age (in years)**: ______________

3. **Ethnicity**: Hispanic or Latino Not Hispanic or Latino
   - **Race**: White Black or African America American Indian or Alaska Native
   - Asian Native Hawaiian or Other Pacific Islander

4. **High School**: ____________________________

5. **Student Status**: Freshman Sophomore Junior Senior

6. **Overall G.P.A.**: ____________

7. **Scholastic Aptitude Test Score (if taken/known)**:
   - OVERALL: ______________
   - WRITING: ______________
   - CRITICAL READING: ______________
   - MATH: ______________

8. **Father’s Occupation**: ______________

9. **Mother’s Occupation**: ______________

10. **What is the combined salary range of your parents?**
    - a. Less than $10,000
    - b. $10,000 to $19,999
    - c. $20,000 to $29,999
    - d. $30,000 to $39,999
    - e. $40,000 to $49,999
    - f. $50,000 to $59,999
    - g. $60,000 to $69,999
    - h. $70,000 to $79,999
    - i. $80,000 to $89,999
    - j. $90,000 to $99,999
    - k. $100,000 to $149,999
    - l. $150,000 or more

11. **What is the highest level of education your father has completed?**
    - a. Less than High School
    - b. High School/GED
    - c. Some College
    - d. 2-Year College Degree (Associates)
    - e. 4-Year College Degree (BA,BS)
    - f. Master's Degree
    - g. Doctoral Degree
h. Professional Degree (MD, JD)

12. **What is the highest level of education your mother has completed?**
   a. Less than High School
   b. High School/GED
   c. Some College
   d. 2-Year College Degree (Associates)
   e. 4-Year College Degree (BA, BS)
   f. Master's Degree
   g. Doctoral Degree
   h. Professional Degree (MD, JD)

13. **Do you plan on going to college after you graduate:**
    Yes  No

14. **Are your parents going to finance your college education?**
    No  Yes  Partially (please provide percentage they are paying): ___________________

15-17. **Please list your top 3 predictions of the major you will choose when you begin college, #1 being your most likely choice:**
    1.
    2.
    3.

**How committed are you to each of the three areas of study?** (Mark a “1”, “2”, and “3” anywhere along the line corresponding to your commitment for each major listed above)

:________________:________________:________________:________________:
Not at all  Slightly  Moderately  Very  Extremely
18. **Using the scale provided please indicate how strong a role each of the following play in your prediction of the major you will choose once you start college:**

   1 = Played no role in my decision  
   2 = Played a slight role in my decision  
   3 = Played a moderately important role in my decision  
   4 = Played a very important role  
   5 = Played an extremely important role

Then, below each question, please comment in 1-2 sentences on the specific role that this factor played in your prediction.

1._____  2. _____  3. _____ Intrinsic (e.g., personal) interest in the topic

1._____  2. _____  3. _____ Scholarship money available for study in this field

1._____  2. _____  3. _____ Means to a desired (career) end

1._____  2. _____  3. _____ Following family tradition (e.g., parents or other relatives work in this field)

1._____  2. _____  3. _____ Recruited by the school for study in this area

1._____  2. _____  3. _____ Reputation of this major at university of interest

1._____  2. _____  3. _____ A commitment to a wider social purpose (e.g., helping others, protecting the environment)

1._____  2. _____  3. _____ Uninformed choice
1. _____  2. _____  3. _____ Active influence, pressure, or persuasion of others (e.g., parents or other family members)

1. _____  2. _____  3. _____ One of several viable major options.

1. _____  2. _____  3. _____ Compromise between what I want to major in and what others want me to major in

1. _____  2. _____  3. _____ Financially-secure future

1. _____  2. _____  3. _____ Prestigious career path

1. _____  2. _____  3. _____ Type of work environment I want (e.g., desk job vs. lots of human interaction, outdoor vs. indoor, etc.)

19. **How would you rate how well you understand the career options available to those who graduate college with a bachelor's degree in Computer Science?** (Mark an “X” anywhere along the line)

Not at all  Slightly  Moderately  Very  Extremely

20. **Have you taken a high school computer science programming course?**

Yes  No

21. **Have you taken the AP Computer Science A exam? If so, what score did you receive?**

Yes  Score: _____________  No

22. **Please rank how interested you are in majoring in Computer Science.** (Mark an “X” anywhere along the line)

Not at all  Slightly  Moderately  Very  Extremely
23. Please explain the roles and/or circumstances that either positively or negatively impacted your interests in computer science (Use the roles from #15 as examples).

24. Please describe your perception of a “typical” computer science student.

25. Do you feel you fit in with this perceived student?  Yes   No

26. Does your answer to #22 influence your desire to major in computer science?  Please comment in 1-2 sentences on your choice.

    _____ Yes, it encourages me  _____ No

    _____ Yes, it discourages me

Explanation:

27. Please describe your perception of a “typical” job opportunity for a computer science major and the work environment of this opportunity.

28. Do the opportunities you named in #24 influence your desire to major in computer science?  Please comment in 1-2 sentences on your choice.

    _____ Yes, it encourages me  _____ No

    _____ Yes, it discourages me

Explanation:
APPENDIX B
## Project Title:
Reasons behind the Low Enrollment of Women in Computer Science

### Principal Investigator:
Dr. Carlos Jensen, cjensen@eecs.orst.edu

### Student Researcher:
Ashley R. Schneider, schneias@onid.orst.edu

### Co-Investigator(s):
Dr. Jennifer Parham-Mocello, parhammj@eecs.orst.edu
Dr. Ronald Metoyer, metoyer@eecs.orst.edu

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Hello,

We are conducting a study for the completion of Ashley Schneider’s honors thesis. This study is about the low ratio of women to men who choose to study computer science in college. We are asking you if you want to be in this study because this study’s focus is on how high school students choose what they are going to study in college and how they perceive computer science as a major.

If you take part in this study, we will ask you to fill out an online survey, which will help us find some of the reasons why so few women choose to major in computer science. These reasons might help other students someday. If you have any questions about this research project, please contact: Dr. Carlos Jensen at cjensen@eecs.oregonstate.edu or Ashley Schneider at schneias@onid.orst.edu.

For more information and to take the online survey, please visit


Thank you!
CONSENT FORM

Project Title: Reasons behind the Low Enrollment of Women in Computer Science
Principal Investigator: Dr. Carlos Jensen
Student Researcher: Ashley R. Schneider
Co-Investigator(s): Dr. Jennifer Parham-Mocello  
Dr. Ronald Metoyer
Sponsor: Unfunded
Version Date: September 10, 2012

1. WHAT IS THE PURPOSE OF THIS FORM?

This form contains information you will need to help you decide whether to allow your child to be in this study or not. Please read the form carefully and ask the study team member(s) questions about anything that is not clear.

2. WHY IS THIS STUDY BEING DONE?

The purpose of this study is to determine some of the reasons why the ratio of women to men earning bachelor degrees in computer science is so low. This study is being conducted by Ashley Schneider for the completion of her undergraduate thesis. Up to 5,000 may be invited to take part in this study.

3. WHY IS MY CHILD BEING INVITED TO TAKE PART IN THIS STUDY?

Your child is being invited to take part in this study because he/she is a high school student in Oregon.

4. WHAT WILL HAPPEN IF MY CHILD TAKES PART IN THIS RESEARCH STUDY?

The study activities include an online survey. The survey will take about 20 minutes.

______ You may contact my child if you wish to conduct a follow up interview during future studies at: ____________________________
    Initials Email address

5. WHAT ARE THE RISKS AND POSSIBLE DISCOMFORTS OF THIS STUDY?

While we will keep your child’s survey responses confidential, there is always a risk that we could accidentally disclose information that identifies him/her. Furthermore, both the security
and confidentiality of information collected from your child online through the survey cannot be guaranteed. Information collected online or sent by email can be intercepted, corrupted, lost, destroyed, arrive late or incomplete, or contain viruses.

6. WHAT ARE THE BENEFITS OF THIS STUDY?

We hope that the results can help us understand why there are so few women choosing to study computer science in college and that they can be built upon in future research to develop a strategy for bringing more women into the major.

7. WILL MY CHILD BE PAID FOR BEING IN THIS STUDY?

Your child will not be paid for being in this research study.

8. WHO WILL SEE THE INFORMATION I GIVE?

The information you and your child provide during this research study will be kept confidential to the extent permitted by law. Research records will be stored securely and only researchers will have access to the records. Federal regulatory agencies and the Oregon State University Institutional Review Board (a committee that reviews and approves research studies) may inspect and copy records pertaining to this research. To help protect your child’s confidentiality, his/her data will be identified by a code number, not by his/her name. If the results of this project are published his/her identity will not be made public.

9. WHAT OTHER CHOICES DO I HAVE IF I DO NOT TAKE PART IN THIS STUDY?

Participation in this study is voluntary. If your child decides to participate, he/she is free to withdraw at any time without penalty. He/she will not be treated differently if he/she decides to stop taking part in the study. If he/she chooses to withdraw from this project before it ends, the researchers may keep information collected about your child and this information may be included in study reports.

10. WHO DO I CONTACT IF I HAVE QUESTIONS?

If you have any questions about this research project, please contact: Dr. Carlos Jensen at jensenca@eecs.oregonstate.edu or Ashley Schneider at (503) 944-9115 or by email at schneias@onid.orst.edu.

If you have questions about your child’s rights or welfare as a participant, please contact the Oregon State University Institutional Review Board (IRB) Office, at (541) 737-8008 or by email at IRB@oregonstate.edu

11. ASSENT STATEMENT
This research study has been explained to my child in my presence in language my child can understand. He/she has been encouraged to ask questions about the study now and at any time in the future. INITIAL: _______

12. WHAT DOES MY SIGNATURE ON THIS CONSENT FORM MEAN?

Your signature indicates that this study has been explained to you, that your questions have been answered, and that you agree for your child to take part in this study. You will receive a copy of this form.

Participant's Name (printed): _____________________________________________________________

(Signature of Participant’s Legal Guardian) __________________________________________________________________ (Date)

(Signature of Person Obtaining Consent) __________________________________________________________________ (Date)
1. **In one paragraph, state your primary research question or purpose:** The number of women in previously male-dominated fields such as business, law, and medicine has increased much more than in the science, technology, engineering, and math (STEM) fields. The ratio of women to men earning bachelor degrees in physics, engineering, and computer science is particularly low, with women earning only 20 percent of the degrees. Computer science is an especially interesting case because the percentage of degrees earned by women in the field is actually declining. Our goal is to discover possible reasons behind the low ratio of women to men majoring in computer science today.

2. **Anticipated Level of Review – Complete the Selection of Review Level form**

   - [ ] Exempt  
   - [x] Expedited  
   - [ ] Full Board

3. **Research is: awarded**

   - [ ] Funded  
   - [x] internal  
   - [x] external  
   - [ ] pending  
   - [ ] Unfunded

4. **Ethics and Compliance Training**

   All study team members involved in this project must complete training in the ethical use of human participants in research prior to submitting an IRB application. Please refer to the Education Requirement Policy at: [http://oregonstate.edu/research/ori/hrh/edreq.htm](http://oregonstate.edu/research/ori/hrh/edreq.htm)

   If you have additional study team members, please submit the information on a separate sheet.
<table>
<thead>
<tr>
<th>Study Team Member(s)</th>
<th>Role in Project</th>
<th>OSU email Address*</th>
<th>Ethics Training Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Carlos Jensen</td>
<td>Principal Investigator</td>
<td><a href="mailto:jensenca@eecs.oregonstate.edu">jensenca@eecs.oregonstate.edu</a></td>
<td>☑ Yes ☐ No</td>
</tr>
<tr>
<td>Dr. Jennifer Parhem-Mocello</td>
<td>Co-Investigator</td>
<td><a href="mailto:parhammj@eecs.orst.edu">parhammj@eecs.orst.edu</a></td>
<td>☑ Yes ☐ No</td>
</tr>
<tr>
<td>Ashley Schneider</td>
<td>Student Researcher</td>
<td><a href="mailto:schneias@onid.orst.edu">schneias@onid.orst.edu</a></td>
<td>☑ Yes ☐ No</td>
</tr>
<tr>
<td>Dr. Ronald Metoyer</td>
<td>Co-Investigator</td>
<td><a href="mailto:metoyer@eecs.oregonstate.edu">metoyer@eecs.oregonstate.edu</a></td>
<td>☑ Yes ☐ No</td>
</tr>
</tbody>
</table>

*Do not use personal email addresses (gmail, hotmail, yahoo, etc.) unless no secure address exists.

5. Risk/Benefit Assessment for adults and/or children

**Minimal risk**: The probability and magnitude of harm or discomfort anticipated in the research are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests.

<table>
<thead>
<tr>
<th>Adults</th>
<th>Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>☑ Not enrolling adults</td>
<td>☑ Not enrolling children</td>
</tr>
<tr>
<td>☑ Minimal risk</td>
<td>☑ Minimal risk</td>
</tr>
<tr>
<td>☐ Greater than minimal risk</td>
<td>☐ Greater than minimal risk, but holds prospect of direct benefit to subjects</td>
</tr>
<tr>
<td>☐ Greater than minimal risk; no prospect of direct benefit to subjects but likely to yield generalizable knowledge about the subject’s disorder or condition</td>
<td>☐ Research not otherwise approvable but presents an opportunity to understand, prevent, or alleviate a serious problem affecting the health or welfare of the subjects</td>
</tr>
</tbody>
</table>
6. **Total number of subjects** *(not a range)* that will be enrolled over the course of the study: 5,000
   
   *Enrollment must not exceed this number without prior IRB approval. See Protocol Template for additional details.*

7. **Participant age range** (check all that apply):
   
   - 0-7: include parental consent form (unless seeking waiver) and description of oral assent process
   - [X] 8-17: include assent form and parental consent (unless seeking waiver)
   - [X] ≥18: include consent document or oral consent guide (unless seeking waiver)

8. **Target population(s)**

<table>
<thead>
<tr>
<th>Targeted</th>
<th>Permitted</th>
<th>Excluded</th>
<th>Populations</th>
<th>For targeted population(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>Adults lacking capacity to consent</td>
<td>Protocol must include additional safeguards</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>Children in foster care or wards of the state</td>
<td>Research must be (1) related to their status as wards; or (2) conducted in schools, camps, hospitals, institutions, or similar settings in which the majority of children involved as subjects are not wards. IRB must appoint an advocate for each child who is a ward.</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>Prisoners</td>
<td>Ineligible for exempt review</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>Pregnant women</td>
<td></td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>OSU Students or employees</td>
<td>See IRB Website for guidance: <a href="http://oregonstate.edu/research/ori/recruit_students.html">http://oregonstate.edu/research/ori/recruit_students.html</a></td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>Non-English speakers</td>
<td>Protocol must include qualifications of the translator(s) and of the research staff or student(s) obtaining consent in a language other than English</td>
</tr>
</tbody>
</table>

9. **If the research involves any of the following, check the appropriate box**

| [ ] | Study of existing data | Data must be “on the shelf” prior to conception of current study in order to be considered existing |
Audio or video recording

Consent document must indicate whether recording is optional or a required study activity. If optional, include an opt-in/opt-out section for subjects to initial.

Radiation

Complete attachment A. IRB will forward submission to Radiation Safety.

Human biological materials

Complete attachment B. IRB will forward submission to Biosafety.

Microorganisms or Recombinant DNA

IRB will forward submission to Biosafety.

Sending or receiving biological materials

Contact the Office for Commercialization and Corporate Development regarding the potential need for a Material Transfer Agreement (541) 737-4437.

Using Chemical Carcinogens

List of applicable chemicals: http://oregonstate.edu/ehs/carclist

IRB will forward to Chemical Safety.

Waiver of documentation (signature) of informed consent

If you do not think that the requirement for a signed consent document is appropriate for this study, include justification in protocol. See IRB website for guidance on a verbal or alternative consent process.

Waiver of informed consent

If you do not think that the requirement for obtaining consent to research is appropriate for this study, include justification in protocol.

Translated documents

Include material in English and translated into a language spoken by participants.

Multiple institutions

Complete relevant section of the protocol.

External research sites

Complete relevant section of the protocol.

10. Attachments (check all that apply):

- Protocol (required)
- Consent Document(s)
- Assent Document(s)
- Attachment A: Radiation
- Attachment B: Human Materials
- Grant application or funding contract
- Recruiting tools (e.g., ad copy, flyers, letters)
- Test instruments (e.g., questionnaires, surveys)
- Material(s) in other languages
- External IRB Approvals
Letters of support from external research sites

☐ Other: _____

11. Does the study need to be registered with ClinicalTrials.gov?

☐ Yes  Applicable* Clinical Trials:

Trials of Drugs and Biologics: Controlled clinical investigations of a product subject to FDA regulation, other than Phase I investigations

Trials of Devices: Controlled trials with health outcomes of devices subject to FDA regulation, other than small feasibility studies and pediatric postmarket surveillance

*NH encourages registration of ALL trials whether required under the law or not. [http://grants.nih.gov/grants/guide/notice-files/NOT-OD-08-014.html](http://grants.nih.gov/grants/guide/notice-files/NOT-OD-08-014.html)

☐ No

12. Conflict of Interest

Federal Guidelines require assurances that there are no conflicts of interest in research projects that could affect the welfare of human subjects. If this study presents a potential conflict of interest, additional information will need to be provided to the IRB.

Examples of potential conflicts of interest in research involving human subjects may include, but are not limited to:

- A researcher or family member participates in research on a technology, process or product owned by a business in which the faculty member holds a financial interest.
- A researcher participates in research on a technology, process or product developed by that researcher.
- A researcher or family member has a financial or other business interest in an entity which is supplying funding, materials, products, or equipment for the current research project.
- A researcher or family member serves on the Board of Directors of a business which is supplying funding, materials, products, or equipment for the current research project.
- A researcher receives consulting income from an entity that is funding the current research project.

Do any members of the study team, or any of their family members, have a financial or other business interest in the source(s) of funding, materials, or equipment related to this research study?

☐ No

☐ Yes – Please describe: _____
PRINCIPAL INVESTIGATOR’S ASSURANCE STATEMENT

I understand Oregon State University’s policies concerning research involving human subjects and I attest:

☒ that the information contained in this application is accurate and complete;
☒ that research involving humans, including recruitment, will not begin until IRB approval has been granted;
☒ to the scientific merit and importance of this study;
☒ to the competency of the study team member(s) to conduct the project and their time available for the project;
☒ that facilities, equipment, and personnel are adequate to conduct the research.

Furthermore, I agree to:

☒ comply with all IRB policies, decisions, conditions, and requirements;
☒ accept responsibility for the scientific and ethical conduct of this research study;
☒ obtain prior approval from the IRB before amending or altering the study and/or study documents;
☒ report to the IRB in accord with current policy, any adverse event(s) and/or unanticipated problem(s);
☒ complete and submit continuing review documentation or a final report prior to the expiration date;
☒ notify the IRB immediately of the development of any potential conflict of interest not already disclosed.

<table>
<thead>
<tr>
<th>Study Title:</th>
<th>Reasons behind the Low Enrollment of Women in Computer Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principal Investigator:</td>
<td>Carlos Jensen</td>
</tr>
<tr>
<td>Date:</td>
<td>10/15/2012</td>
</tr>
</tbody>
</table>

Applications will only be accepted if submitted by the Principal Investigator

PI should email completed application and all relevant attachments to IRB@oregonstate.edu
> File names for all attachments should include the last name of the Principal Investigator, document title, and version date. For example: Smith_Protocol_10272009.doc

> All attachments should include the last name of the Principal Investigator, document title, version date, and page numbers.
1. **Protocol Title:** Reasons Behind the Low Enrollment of Women in Computer Science

**PERSONNEL**

2. **Principal Investigator:** Dr. Carlos Jensen

3. **Student Researcher(s):** Ashley R. Schneider

4. **Co-investigator(s):** Dr. Jennifer Parham-Mocello and Dr. Ronald Metoyer

5. **Study Staff:** None

6. **Investigator Qualifications:** PI and co-investigators all have PhD’s in computer science and experience in human studies. The student researcher has experience working with the target population. All researchers in this study have completed their CITI training.

7. **Student Training and Oversight:** Carlos Jensen and Jennifer Parham-Mocello will work together with the student researcher to ensure that she follows the proper processes that comply with IRB standards.

**FUNDING**

8. **Sources of Support for this project (unfunded, pending, or awarded)**
   This project is unfunded.

**DESCRIPTION OF RESEARCH**

9. **Description of Research:** The purpose of this study is to determine some of the reasons why the ratio of women to men earning bachelor degrees in computer science is so low. Women are only earning 20 percent of the degrees, and that number has been declining. In this study we will be collecting data from high school students through a survey that aims to identify whether or not they have considered pursuing a career in computer science, their level of knowledge about computer science, their skills in science, technology, engineering, and math (STEM) subjects thus far, and their perceptions of computer science students and jobs. All the survey responses will be confidential but include the option of leaving an email address for follow up interviews in possible future studies. The surveys include a field for the participant to indicate gender, age, and their student status. This allows the results to be analyzed and compared by gender and status, with the hope of revealing some key differences. This study is being conducted by Ashley Schneider for the completion of her undergraduate thesis.

10. **Background Justification:** According to the American Association of University Women (AAUW), historically males have outperformed females in math and science, but over the past few decades the gap has narrowed and now females are earning credits in math and science high school courses at about the same rate as males and are earning higher grades in those classes on average. However, fewer females than males take advanced placement (AP) exams for science, technology, engineering, and math (STEM) courses, and those that
do take these exams perform worse on average than males [1]. To further this puzzle, studies show that 29 percent of male college freshmen as opposed to only 15 percent of female college freshmen plan on majoring in a STEM field even though they are, on average, equally prepared for such a major upon graduating high school [1]. In addition, the number of women in other previously male-dominated fields such as business, law, and medicine has increased much more than in the STEM fields [1].

The ratio of women to men earning bachelor degrees in physics, engineering, and computer science is particularly low, with women earning only 20 percent of the degrees [1]. In addition, computer science is an especially interesting case because the percentage of degrees earned by women in the field is actually declining. In the mid-1980s women earned 36 percent of the computer science degrees, but now that number has dropped to 20 percent [1]. Furthermore, the retention rates for women and men in STEM at the college level are about equal; thus, to improve the ratio of women to men the focus should be on students prior to entering the field [1].


11. External Research or Recruitment Site(s)

a) Name or description of each research site:
Oregon State University

b) Name and role of appropriate authority from each site providing a letter of support or permission (when applicable):
Carlos Jensen – PI (overseeing project completion) cjensen@eecs.orst.edu

Jennifer Parham-Mocello – Co-PI (overseeing recruitment, data collection, and data analysis) parhammj@eecs.orst.edu

Ron Metoyer – CoPI (overseeing data analysis and final report) metoyer@eecs.orst.edu

Ashley Schneider – Student Researcher (conducting the research study for honors thesis) schneias@onid.orst.edu

c) Name of each recruitment site:
Corvallis High School, Corvallis, 509J
Cresent Valley High School, Corvallis, 509J
Philomath, 17J
Lebannon Community School District

d) If recruitment method involves more than an advertisement (newspaper classified, flier, listserv email), name and role of appropriate authority from each site providing a letter of support:

e) Attach or include ad copy or correspondence to be used for recruitment

12. Subject Population

The target population for this study consists of high school students in grades 9 through 12, whose ages can range from 12 – 19. The total target enrollment number is 5,000.

Arrangements will be made with the Corvallis, Philomath, and Lebanon school districts. The student researcher will provide district personnel with the appropriate materials for advertising the study with the web location of the parental consent and survey. These materials will be sent home with the students, and the students and their parents can visit the website for more information and consent/decline to take the survey. Survey responses will be automatically entered into the database. The student researcher will give district personnel directions as to how to access the survey online, and they will then communicate this to the study participants.

See the attached informational letter and consent/assent forms. The consent and assent is one form for those students under age 18, as well as those age 18 and older.

13. Consent Process

The research team will obtain consent from the participants prior to involving the participants in any study activities. A consent form will be provided as the initial screen for participation in the online survey, and the consent form is tailored for students 18 and older or the parents of students under 18. Since the research team will not be present when the form is completed, the form contains information on how to obtain further information regarding the study via email and phone. Signatures on the consent form will unlock the ability to participate in the survey.

14. Assent Process

The assent will be provided online at the time of consent for those students under the age of 18. The students and their parents will have time to read and ask questions before giving assent. Giving assent will unlock the ability to participate in the study.

15. Eligibility Screening: This study does not include a screening process.
16. Methods and Procedures

This study consists of an online survey that will be located on the web. This allows students to complete the survey on their own time, and the answers can be stored securely in a database. It will take about 20 minutes for participants to complete. They will do so at a location of their choosing. Once this phase of the study is complete the answers will be analyzed and compared by gender with the hope of revealing some differences.

17. Compensation: Participants will not receive any compensation for participating in this study.

18. Cost: There is no cost to participants for participating in this study.

19. Anonymity or Confidentiality

The data collected from the survey will be stored securely on OSU servers. It will be password protected and will not include any direct identifiers. Each participant’s responses will be kept confidential, and consent/assent will be kept as part of the database. The survey data will be stored for a minimum of 3 years after the study termination.

20. Risks

There are no major risks involved in participating in this study. While the research team will keep the participants’ survey responses confidential without names or other identifiers on the survey, there is always a risk that they could accidentally disclose information that identifies participants. Furthermore, both the security and confidentiality of information collected online through the survey cannot be guaranteed. Information collected online or sent by email can be intercepted, corrupted, lost, destroyed, arrive late or incomplete, or contain viruses. The research team will do its best to keep data secure and confidential.

21. Benefits

There are no direct benefits for the participants in this study. However, they will confront their assumptions about and notions of computer science, which could lead to some learning about the subject. Also, the results will help with the understanding of why there are so few women choosing to study computer science in college, and these results could be built upon in future research to develop a strategy for bringing more women into the major. This will help diversify the field.

22. Assessment of Risk:

Benefit ratio: Since the survey does not contain sensitive data, the most risk associated with this study is being identified with responses about choosing a major and overall GPA. A possible detriment is that the data might not yield results about gender and its role in choosing computer science as a major and/or that the survey doesn’t enhance gender awareness in computer science.
Lebanon District confirmation:

Ashley,

Dr. Hess forwarded your email to me. Our district is happy to support the research you described. Please contact me with the details of what you need first to get this organized. It may be best to just connect you with our high school principal. Let me know, and we'll get started.

Rynda

Rynda Gregory  
Director of Federal Programs  
(541)-451-8511  
rynda.gregory@lebanon.k12.or.us
Philomath District confirmation:

Jennifer,

Yes, this is okay. When you come by please refresh my memory and our office staff as to why you are there and what procedures you will be conducting. Ken :-)

Ken Ball, Principal/A.D.
Philomath High School
"Home of the Warriors"
2054 Applegate Street
Philomath, OR 97370
(541) 929-3211 ext. 4124
e-mail: ken.ball@philomath.k12.or.us
"Success Happens Every Day for Everyone"

Jennifer Parham-Mocello
10/4/2012 3:12 PM

Hi Ken,

I know you are extremely busy, but I have an honors student, Ashley Schneider, who is really interested in conducting a gender study among high school students to see what why females are not going into computer science. Part of her study is to compare demographically different high schools, and she would like to include Philomath High School in her study.

Do we have your approval to conduct this minimal risk research, which would not even take class time from the teachers? We want to visit the school to deliver the informational letters for the students to take home to their parents, and they would participate in the study through a webpage.

Thank you for your cooperation,
Jennifer

Jennifer Parham-Mocello, PhD Instructor, CS MECOP Advisor
School of Electrical Engineering and Computer Science
Oregon State University
2101 Kelley Engineering Center
Corvallis, OR 97333
Phone (541) 737-8895
CORVALLIS SCHOOL DISTRICT 509J

Research Projects

Board policy regarding requests for permission to conduct research projects in the District will be based on the following considerations. Please respond to these considerations either on this sheet or attach your responses. Forward the completed form to the building principal(s) of the school(s) where you desire to conduct the research project.

1) Describe the purpose of the project, give an estimate of the timeline, and indicate the school(s) and class level(s) to be involved.

My project "Reasons behind the Low Enrollment of Women in Computer Science" aims to identify some of the causes of the low ratio of women to men majoring in computer science at the undergraduate level. I expect to collect data for this project between October and December 2012. The data collected will then be analyzed and the project completed by June 2013. I would like to include College Hill Alternative High School, Corvallis High School, and Crescent Valley High School in the Corvallis School District. Within these schools I would like grade levels 9 – 12 to be involved.

2) Describe the time, resources, and energies of District personnel who may be involved in the project.

To collect data for this project I have created a survey for high school students with the purpose of exploring whether or not the participants have considered pursuing a career in computer science, their level of knowledge about computer science, and their skills in the field thus far. This requires very little time for District personnel. The survey will be online, so the personnel would simply need to hand out an informational flyer to the students. The consent form will also be online, so students can go over the consent form with their parents and fill out the survey on their own time.

Describe the value of the research project to the educational goals of the District in particular.

This research project aims to identify reasons behind the low ratio of women in computer science so that with further research a strategy can be created to attract more high school women to consider studying computer science during college. This is imperative nationally because not only do women only earn 20 percent of the computer science degrees, but also this number has decreased since the mid-1980s when women earned 36 percent of the computer science degrees. It is important that we figure out why fewer women are interested in the field so that we can address the issue, increase the numbers, and diversify the field as a whole. This is very valuable to the District's educational goals because computer science is a growing field and plays a large role in our world's future. This study can help direct more women from the Corvallis School District towards becoming leaders in the world through the field of computer science.
4) Describe how the project may serve the needs of the district, particularly in the areas of learning, instruction, leadership, and school facilities.

This project lays the groundwork for discovering changes that need to be made at the high school level for attracting women to computer science. You will be able to view the results of the study and decide if there are any changes you would like to make in the way your students are introduced and exposed the computer science. In the future the results of this study may be used to develop a direct strategy for your school facilities to implement to address this issue.

5) Describe the degree to which such project would interfere with normal classroom operations.

This project would have minimal interference in the classroom. All it requires is that teachers distribute informational flyers about the study. The students can fill out the survey on their own time.

Name of person(s) Requesting Research Project: Ashley Schneider

Mailing Address: 209 NW 12th St, Corvallis, OR 97330

Phone Number(s): (503) 944-9115

Date: August 21, 2012

1) Applicant completes form and forwards to building principal.
2) Building principal will sign below indicating acceptance or non-acceptance of project.
3) Building principal forwards signed form to Assistant Superintendent for final approval.

****************************************

Building Principal Signature: [Signature] Date 08/21/12

Project is accepted

Project is not accepted

Approved by Assistant Superintendents: [Signature] Date 08/28/12

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Administration Office • 1555 SW 35th Street • P.O. Box 3509 • Corvallis, OR 97339 • (541) 757-5724 • Fax (541) 757-5726
CORVALLIS SCHOOL DISTRICT 509J

Research Projects

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2) Describe the time, resources, and energies of District personnel who may be involved in the project.

   To collect data for this project I have created a survey for high school students with the purpose of exploring whether or not the participants have considered pursuing a career in computer science, their level of knowledge about computer science, and their skills in the field thus far. This requires very little time for District personnel. The survey will be online, so the personnel would simply need to hand out informational flyers to the students. The students who agree to participate can then take the 20 minute survey on their own time.

3) Describe the value of the research project to the educational goals in general and those of the District in particular.

   This research project aims to identify reasons behind the low ratio of women in computer science so that with further research a strategy can be created to attract more high school women to consider studying computer science during college. This is imperative nationally because not only do women only earn 20 percent of the computer science degrees, but also this number has decreased since the mid-1980s when women earned 36 percent of the computer science degrees. It is important that we figure out why fewer women are interested in the field so that we can address the issue, increase the numbers, and diversify the field as a whole. This is very valuable to the District’s educational goals because computer science is a growing field and plays a large role in our world’s future. This study can help direct more women from the Corvallis School District towards becoming leaders in the world through the field of computer science.
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Name of person(s) Requesting Research Project: Ashley Schneider

Mailing Address: 209 NW 12th St, Corvallis, OR 97330

Phone Number(s): (503) 944-9115

Date: August 21, 2012

1) Applicant completes form and forwards to building principal.
2) Building principal will sign below indicating acceptance or non-acceptance of project.
3) Building principal forwards signed form to Assistant Superintendent for final approval.

Building Principal Signature: [Signature] Date 10/15/12

Approved by Assistant Superintendent: [Signature] Date 11/26/12

Project is accepted

Project is not accepted

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