Where are the Computer Science Majors?

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ABSTRACT

In an effort to discern the cause for the lack of computer science majors in a society with an abundance of technical jobs, a survey was conducting among the non-computer science majors taking a computer science oriented class at Villanova University. The preliminary results pointed to the fact that while 75% of the non-majors stated they would take another computer science class, only 25% said they would consider switching to the major. This may be due to the fact that the same 75% of the students considered a computer science major to be difficult, or that they did not entirely understand the definition of a computer science major. The results of the survey suggest that in order to gain more computer science majors at the university level, schools at all levels should attempt to adequately educate students as to what a computer science major entails. With a more comprehensive understanding, more students might consider the major.

Categories and Subject Descriptors

K.3.2 [**Computers and Education**]: Computer and Information Science Education—*Computer Science Education*

Keywords

Computer Science Major, Declining Computer Science Enrollment, Definition of Computer Science

1. INTRODUCTION

In a world where the number of technical jobs is constantly growing[1], it would make sense that the number of technical majors would grow as well. However, this seems not to be true for the Computer Science Major, especially at Villanova University. With low graduation rates among the major, there seems to be a divide between the opportunities available and the number of students that are attempting to take advantage of those opportunities. In an effort to find out where the problem might lie, a survey was created and distributed to the computer science classes that are available for non-majors to take as part of their studies. The classes included CSC1020: Computing and the Web, CSC1040: Computing and Images, and CSC:1051 Algorithms and Data Structures 1. Of the survey results that were collected, only those responses from the non-computer science majors were considered. Based on previous research, it could be reasoned that those who took high level math or science courses in high school were more likely to consider a computer science major.[3] Others considered that their success might be based on high school GPA, or their high school ACT scores. [2] Another theory is that many students do not choose computer science because they have no idea what being a computer science major means in terms of the curriculum. Many suppose that they will sit at a computer all day, and could not explain what it means to have a career in computer science.[4] By conducting this survey which considered all of the above reasons, a determining factor became evident.

[1]The are expected to be 1.4 million total new computing-related jobs by 2018.[1]

2. THE SURVEY

The survey was distributed in class by the respective professors using a Google Docs form. This was the easiest distribution method that allowed easy and precise collection of data. The survey was anonymous, and asked all students to be honest in their responses. The responses were collected and represented in a table for use to gather the results. The basic layout of the survey is shown in Figure 1.

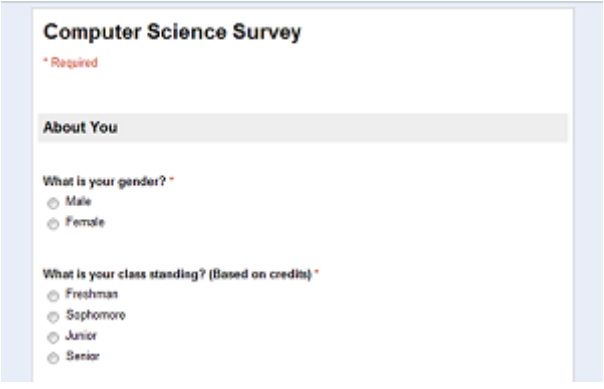

Figure 1: The beginning of the survey as the students saw it on the webpage.

Questions that were included in the survey were included in four large categories. The categories included: About You, Impressions About Computer Science, Computer Science at Your High School, and Computer Skills. In the first category, students were asked to provide some basic information about themselves, including their gender, class standing, major, and whether they might consider switching to a computer science major from their current major.

The second category's aim was to discern what sort of preconceptions a student had about computer science. The questions asked ranged from "What do you believe is the average starting salary for a Computer Science major out of college?" to "On a scale of 1 - 10, how hard do you think a Computer Science degree would be?". Also in this section were the questions "When you hear the words Computer Science, what are the first three words you think of?" and "What opportunities do you think Computer Science majors have after graduation?".

The third section of the survey tried to determine whether a student's high school experience determined their perceptions or willingness to pursue the major. Some of the questions that were considered were "Were Computer Science classes taught at your high school?", "Did you have the opportunity to take these classes?", "If so, what sort of classes were offered?".

The last section requested knowledge of the student's basic computer skills. The survey asked if they had ever taken a typing class, and also asked them to describe what they thought were their computer skills. The computer skills described could be anything from knowing how to use a web browser, knowing how to use Microsoft Office to knowledge of programming languages or anything else they might feel would be helpful.

Though there were a large variety of questions on the survey, it became evident that only some would be revealing as reason that students were not choosing computer science.

3. RESULTS

The most important result that was discovered from this survey was the number of non-majors that stated they might be persuaded to switch to a computer science major. Of the students that were surveyed, as shown in Figure 2 only about 25% stated that they might consider switching to computer science. There might be a number of underlying reasons for this result, including that they are happy with their current major, but the data shows that a majority of these students are undecided. Since most of the students taking these classes are also freshman, there is ample opportunity for them to declare computer science as their major, or easily switch to computer science.

Therefore, it must be considered that there is another reason why these students would not consider switching majors.

3.1 Computer Science and High School

Due to some former research, the first hypothesis considered was that a student's experiences in high school might determine their success or willingness to consider Computer Science as a major in college. The survey considered a variety

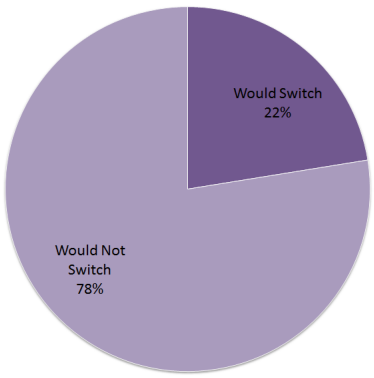

Figure 2: Percent of Non-Majors That Would Consider Switching.

of factors regarding the non-major's high school education. First, as shown in Figure 3 a majority of the high schools did offer computer science classes to the students. Therefore the preliminary hypothesis that the students were not exposed to computer science in high school does not hold. Many schools offered a web design course, or the AP Computer Science class. But, while many high schools conducted classes that fit the current description of computer science, many schools taught Microsoft Office and termed the class a computer science class.

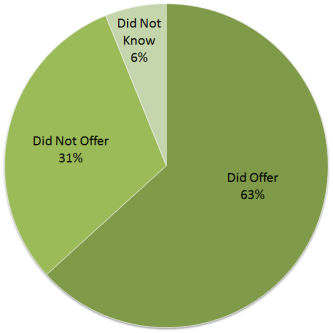

Figure 3: Percent of High Schools That Offered Computer Science Classes.

In an effort to determine whether or not these classes determined a student's willingness to switch, the field is limited to those students that would be willing to switch majors. With this smaller survey base, as shown in Figure 4 the number of high schools that had offered computer science classes increases to nearly 80%. The students were obviously exposed to computer science in high school and were given the opportunity to take computer science classes.

Though the high schools in question in teach various computer science classes, and the students were given the opportunity to take them does not necessarily mean that the students who would consider switching did actually take those classes. However, there are some researchers that consider

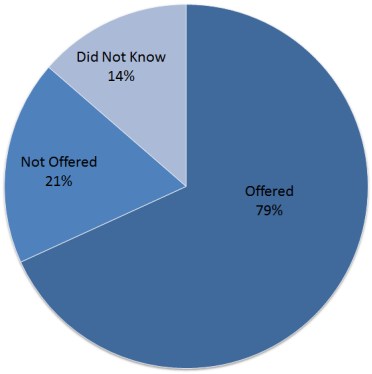

Figure 4: Of Those Who Would Consider Switching Majors, Percentage of High Schools that Offered Computer Science Classes.

a student's enrollment in an advanced math or science class in high school might predict their success, or willingness to consider the major.[3] The results of the survey as shown in Figure 5 were indicative of this thought, showing that more than 75% of those that would consider switching majors took an advanced science or math course in high school.

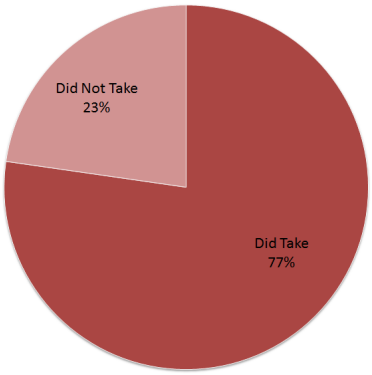

Figure 5: Of Those Who Would Consider Switching Majors, Those Who Took Advanced Science or Math courses.

This high number supports the notion that there is a relation between computer science and the concepts that are ingrained in advanced sciences and math. The logic and problem solving components that are involved in both of the high school subjects are influential is the decision to become a computer science major. If one excels at either one of these subjects in high school then they are likely to excel in computer science.

3.2 Computer Science and Non Majors

After some exploration into the previous hypothesis, two statistics became glaringly discordant. The number of non-majors that would consider switching their major to computer science was only 25% as shown in Figure 2. However, the number of students that would consider taking another computer science class is 75% as shown in Figure 6.

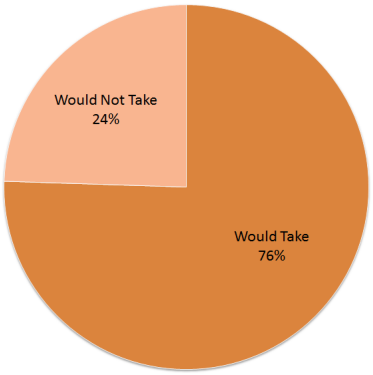

Figure 6: Number of Non-majors Who Would Take Another Computer Science Class.

The discrepancy between their desire to take another computer science class versus their willingness to switch to the major indicates that there is something about the major that is preventing their consideration of the career path. In an effort to determine why the students were put off from switching to the major, a second factor was considered. The students that were not willing to switch to computer science ranked on average the difficulty of the major to be a seven where ten was the most difficult. The perception that the major is hard might be preventing students from contemplating the major.

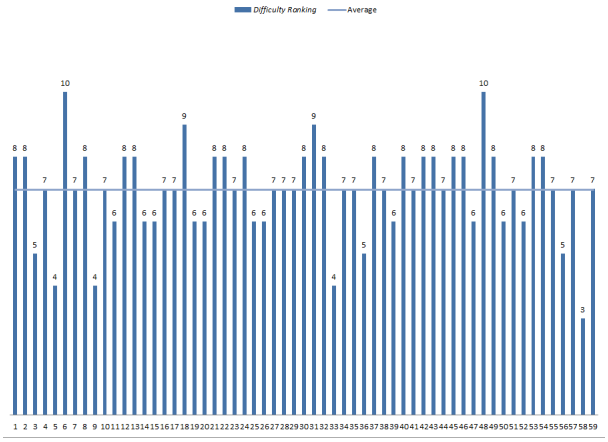

Figure 7: The Difficulty of a Computer Science Degree as Ranked by Those Students Who Would Not Switch Majors but Would Consdier Taking Another Computer Science Class.

Another reason that the students might not be considering the major is that they do not understand what a career as a computer science major might entail. The same group of students who ranked the computer science degree in difficulty were also asked what opportunities they thought a computer science major might have after graduation. The

major response showed that most students thought a computer science major would become a programmer, a video game creator or they would work in a store like Apple or Google. There are far more ways to use a computer science degree than to merely become a programmer and with more knowledge of the potential career paths, more students may wish to switch majors.

4. ANALYSIS

Based on the results, it would seem that if universities wanted to increase the number of computer science majors going into the future, they should make an effort to speak to advanced science and math classes in high school about the definition of computer science. Many of the students surveyed could not explain what a computer science major would do as part of their college curriculum. They could also not explain what type of job a computer science major could hope to achieve once they had graduated college. Many students equate computer science solely with programming and sitting behind a computer all day.[2] By providing the high school students that are most likely to consider switching majors with an actual definition of computer science and letting them know what they can expect from a life as a computer scientist, they might not see the major as daunting and difficult. With the perception that computer science is difficult, the students in the survey confirmed that even though they would take another computer science class, they would not consider switching to the major. The discrepancy must be addressed if universities want to gain more majors.

Additionally, if universities wish to increase their numbers, they also might want to consider trying to retain the number of students that actually take advanced math and science classes at the high school level. There has been some research that shows women especially decline to take more advanced classes in high school.[5] The author suggests that universities might want to outreach to high schools and expose the students to computer science in a co-curricular manner. By bringing computer science to the students outside of the classroom, they might gain a better knowledge of the definition of computer science and be more inclined to consider as a college path.

5. CONCLUSIONS AND FUTURE WORK

The inability for the amount of computer science majors today to fill the number of jobs that will pop up in the field in the next ten years is a very real issue. By pointing out the real cause of the issue, universities can make strides to help entice more students to consider the field. In the future, this work can be continued by distributing the survey to more students that are taking computer science classes at various universities that do not require the students to be a major. These non-majors have shown at least a minor interest in computer science by signing up for the one class, and it would be worthwhile to determine why this interest has not been expanded into a desire to switch to the major. By finding the source of this problem, universities can outreach to students and expand the number of computer science majors.

[2]This notion was supported by both this survey and previous research.[4]

6. ACKNOWLEDGEMENTS

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