Through the Looking-Glass: Barriers, Motivations, and Desires of Non-Traditional Students Learning Programming in an Online CS1 Course

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Abstract— **Student demographics have been changing on college campuses for many years, and to reflect the most efficient methods of teaching the current target population, many institutions are offering online introductory programming courses (CS1). Additionally, due to the increasing number of computing jobs and national demands, we are seeing a surge of non-traditional students (aged over 25), entering the online CS1 courses. We are at a large metropolitan public research university, Florida International University (FIU), where 30% of the students are non-traditional students. However, the online CS1 course usually consists of 70-75% of non-traditional students. We carried out a study in that course for the last 5 semesters where we interviewed non-traditional students to better understand their characteristics and how those are related to their learning goals and performance. This paper is just an attempt to identify the unique characteristics of non-traditional students that can help Computing-ED researchers and admins to design online CS1 courses with appropriate pedagogy, so a better learning experience can be provided to them and retention rates can be increased. Hence, in this paper, we report our preliminary findings on characteristics of non-traditional students who enroll in CS1 course, what their goals and expectations are-how that may differ based on their major (CS majors and non-majors), pre-CS1 programming experience, gender, and race/ethnicity.**

Keywords— non-traditional; CS1; online course; diversity

I. Introduction

The demographics on college campuses throughout the nation have been changing over the last decade, finding a more diverse group of students. Modern-day students look for academic programs that meet their needs with very full lives, time-dependent jobs, and family responsibilities. Many students cannot afford to take time away from their jobs or supporting their family to go to a brick and mortar classroom [1]. Online programs offer the flexibility that students are looking for while maintaining universities' academic commitment. Like many other STEM disciplines, computing programs throughout the nation have started to offer courses in online format [2].

Recently there is a surge in online introductory programming courses, also known as CS1 courses, where we see a surge of non-traditional students (aged over 25), who already have a degree in a different discipline and work either full-time or part-time, enter the CS1 course. We are at a large metropolitan public research university where we have a large number of non-traditional students, who prefer an option for a more flexible learning environment and schedule (e.g. online classes) than traditional students, and hence they tend to enroll in online CS1 course at large [2]. For non-traditional students, going back to school requires more planning and lifestyle reassessment and they may have families, full-time jobs, and/or mortgages they are responsible for. Similarly, when they enroll in the CS1 course, with or without the intention of getting a computing degree, we hypothesize that they tend to have differing goals, motivations, as well as expectations. Due to age differences, varying life experiences and constancy in an academic environment, we also hypothesize that traditional and non-traditional students have varying cognitive levels upon entering the online CS1 course. Finally, our observation finds that non-traditional students are more likely to leave school due to conflicting responsibilities (work, parenting, caring for an elderly parent), are less likely to complete their degree, and have lower retention rates compared to traditional students.

As online learning continues to see significant growth in computing fields, identifying the characteristics of these students will have important implications in diversity efforts. Computing departments are struggling to provide a good experience with limited resources and very little knowledge about these set of students. As departments seek to manage increasing enrollments in computing courses through online CS1 courses, as well as continue to attract and retain diverse students to the field, scholars and administrators will need to understand the unique characteristics of these students to deliver a better learning experience to them. To find answers to these questions, we conducted a study at a large metropolitan public research university classified as a Hispanic Serving Institution (HSI), where 30% of the students are non-traditional students. However, the online CS1 course, which took part in our study, usually consists of (70-75) % of non-traditional students with very low retention (less than 10%) and academic success rate.

This paper is just an attempt to identify the unique characteristics of non-traditional students that can help Computing-ED researchers and admins to design online CS1 courses with appropriate pedagogy, so a better learning experience can be provided to them and their retention rates can be increased. Hence, in this paper, we report our preliminary findings on characteristics of non-traditional students who enroll in CS1 course, why they enroll in CS1 course, what their goals and expectations are-how that may differ based on their major (CS majors and non-majors), pre-CS1 programming experience, gender, and race/ethnicity.

II. The Study

A. Research questions

This paper presents preliminary findings from a study conducted at FIU, on an online CS1 course largely taken by non-traditional students for 5 semesters. In total, 282 students (traditional and non-traditional combined) participated in this study, out of which 209 (i.e. 74%) were non-traditional students. This paper will explore the background, demographic characteristics, pre-course experiences, motivation, objective and mindset of non-traditional students who enrolled in the online CS1 courses between Spring 2018 and Summer 2019 semester (5 semesters including summer '18 and '19). The questions guiding the contribution of this paper are:

RQ1. What are the characteristics of non-traditional students enrolled in online introductory programming or CS1 courses?

RQ2. How do these characteristics differ between female and male students?

RQ3. How do these characteristics differ between CS majors and non-majors?

B. Preliminary Results and Discussion

In this section, we present a preliminary analysis of our study on what characteristics are unique for non-traditional students.

Gender: Even though female makes up close to 28% of the online CS1 course, non-traditional female students represent a much smaller share in online CS1 courses (12%). There is an even smaller representation of non-traditional female students among CS majors (21% female) than among those who are CS non-majors (51 % female).

Race/Ethnicity: Close to half (49%) of the students in the online CS1 course are Hispanic/Latino/Latino American, followed by 27% White/Caucasian, 11% Asian/Asian American, 7% Black/African American, 4% Multiracial, and 2% Other. Racial/ethnic diversity is greater among male students taking online CS1 relative to their female counterparts.

The academic and professional background of parents: A large portion of non-traditional students in CS1 courses reports that they are first-generation college students (62%). 28% of female students and 41% of male students had parents who went to college. However, as many as 8% of females and 18% of males report that at least one parent has a tech job.

Major: Contrary to our hypothesis, we found that only 18% of students enrolled in the online CS1 course were CS majors, and that varied significantly by gender. Only 8% of non-traditional females were CS majors and the rest were from very different academic majors ranging from education to IT. We found that males and females are equally likely to represent majors in engineering, business, and the physical sciences, math but female are more likely than men to report majors in biology, social sciences, and education.

Lack of belonging and community: These students report to often have multiple responsibilities that prevent the possibility of full-time enrollment and as a result, they (91%) reported a lack of belonging in academic circles and also lacking a sense of community with their peers. They can spend very little time on campus, which decreases their opportunities to seek support and build relationships with instructors and peers. Finally, enrollment status affects financial aid eligibility which can become a financial burden for the part-time student when compared to their full-time traditional counterparts.

Mindset: Our analysis indicates that non-traditional students who enroll in CS1 have more of an "outcome centered" mindset. Almost 64.6% of them expected to get into a better job with higher pay once they finish their CS major or minor requirements. 13.5% of them reported already working in IT or software developer position and they enrolled in the CS1 course to perform better in their current job.

Prior programming experience: Our study found that more than half of the non-traditional students enrolled in online CS1 already have little to moderate prior programming background. Many of them were already working part-time in development, IT, computer maintenance jobs, which required them to know programming or some computing logic. 41% students reported never taking a STEM course in college before.

Technology usage: A large population (close to 75%) of students expressed their comfort with computer usage as very high. However, in contrast, a large population (close to 45%) of students expressed they never installed software on their own. In a course like CS1, where students were required to set up JDK and an IDE, many students seemed to struggle with it even though they reported otherwise.

Reason for enrollment in an online CS1 course: Non-traditional students of online CS1 provide a range of reasons for enrolling in the class, with the most common reason being that it was convenient for them considering their lifestyle. More than half of the students reported they took the course out of curiosity or to make a career change. Only 32% of students reported that they took the course because it fulfilled their course requirement (close to 18% being CS major and a few others from engineering major). Few, 4.2% reported taking the class because they were encouraged by an advisor or a peer.

Environmental factor: Many (72%) students report that stress resulting from environmental factors poses one of the biggest challenges to success in the CS1 course. These factors include finances, domestic responsibilities, housing, childcare, family stability, employment demands, and transferring from a 2 to 4-year college. Close to 60% reported that despite putting required hours every week, online CS1 course, being a very technical and intensive programming course, required mental peace, time and dedication, self-study efforts from students' end, which resulted in more stress. Many (over 80%) reported that despite being dedicated, the pressure of balancing work, family responsibilities, and other circumstances adds a great deal of emotional strain to their daily life, that do not allow them to put enough effort to succeed.

References

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