



Obstacles Faced by Underrepresented Groups when Pursuing Degrees in Computer Science

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ABSTRACT

In recent years, an increasing number of International Asian Students (IASs) have come to the United States to pursue undergraduate degrees in Computer Science (CS). The percentage of students who receive a grade of D or F or who withdraw (DFW rate) among all undergraduate CS students is 59%. Anecdotal evidence observed by the authors suggests that there are unique obstacles faced by the IAS sub-population within the DFW group. The primary factors that contribute to the general DFW rate vary, but issues such as language barriers and cultural differences may significantly impact IASs in CS. To measure the impact of these issues, a survey of undergraduate students at a four-year university will be conducted. The sub-populations of interest are IASs and non-IASs who are currently taking or have taken a CS course as a requirement for their major or intended major. Data ascertained from the survey will be used to fit an ANOVA model to test the impact of different issues among and within groups. The results are expected to show that some obstacles exist that uniquely impact the academic performance of IASs pursuing degrees in CS. This study will lead to a better understanding of the obstacles faced by IASs, thus providing potential insight into how to decrease the overall DFW rate and broaden overall participation in CS.



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INTRODUCTION

IASs: In this study, International Asian Students (IASs) are defined as students who spend 80% or more their elementary and middle school education (or equivalent) in the country below: Afghanistan, Armenia, Azerbaijan, Bahrain, Bangladesh, Bhutan, Brunei, Cambodia, China, Georgia, India, Indonesia, Iran, Iraq, Israel, Japan, Jordan, Kazakhstan, Kuwait, Kyrgyzstan, Laos, Lebanon, Malaysia, Maldives, Mongolia, Myanmar (Burma), Nepal, North Korea, Oman, Pakistan, Philippines, Qatar, Saudi Arabia, Singapore, South Korea, Sri Lanka, Syria, Tajikistan, Thailand, Timor-Leste (East Timor), Turkey, Turkmenistan, United Arab Emirates, Uzbekistan, Vietnam, and Yemen

There is no doubt that the United States is known for its powerful level of higher education. There are more and more IASs choose to pursue their higher degrees in the US. As displayed on UGA factbook of year 2019, 745 out of 786 international students are IASs, which makes up the large proportion of international students [1]. According to the Open Door Report done by the Institute of International Education, Computer Science is one of the most famous major choices[2]. The variety of career options, the seven of top ten computer science schools(refer to U.S. News), the high starting salaries, and the high quality of education that all can be the reason for choosing to leave their warm hometown and go to a totally different country by themselves. Throughout college education, a lot of obstacles IASs encounter as well as hardships caused by various factors. IASs in all majors have to overcome these challenges to succeed but it becomes more challenging when they are pursuing a major with a high DWF rate such as Computer Science. To help IASs succeed and accomplish more, this research will focus on measuring how significant language barriers and cultural differences are impacting academic performance of IASs if the influences exist. Another purpose of this research is to give some insights on future researches if factors that are uniquely impacting IASs are explored.

METHODS AND DESIGN

In this research, a survey will be designed and conducted to students who enrolled at UGA. Students who currently enrolled at UGA's Main Campus is the target population of this survey. Data ascertained from the survey will be used to fit an ANCOVA model to test the impact of the language barrier and culture differences among and within groups. Students' academic performance is the dependent variable of the survey while the independent variables are selected based on the specific model being analyzed such as language background, question-asking behavior, and attendance status. Also, obstacles that are unique to IASs will be one of the emphasis of the analysis which can be accomplished by comparing the IASs with other groups of students major in CS. Additionally, data retrieved will be displayed in the form of different charts so differences can be better visualized.

RESULTS

By feeding the cleaned survey results into ANCOVA model, two groups of results as displayed in Figure 1.1 and 1.2 show us how significant language barriers and culture difference affect IASs specifically. None of the significant values of all four groups of data is less than 0.01; however IASs has both a lower Culture_diff and a Understand_diff sig. value of 0.027 and 0.245, respectively, compared to NIASS groups who have sig. value being 0.385 and 0.973.

Tests of Between-Subjects Effects						
NIASS						
Dependent Variable: AVG_Grade						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	.866 ^a	2	.433	1.723	.188	.057
Intercept	7.815	1	7.815	31.094	.000	.353
Years	.604	1	.604	2.405	.127	.040
Understand_Diff	.193	1	.193	.770	.384	.013
Error	14.327	57	.251			
Total	154.222	60				
Corrected Total	15.193	59				

a. R Squared = .057 (Adjusted R Squared = .024)
→Result: P1=0.384

Tests of Between-Subjects Effects						
IASs						
Dependent Variable: AVG_Grade						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	
Corrected Model	.620 ^a	2	.310	2.888	.082	
Intercept	.439	1	.439	4.091	.058	
Years	.101	1	.101	.942	.345	
Understand_Diff	.619	1	.619	5.772	.027	
Error	1.931	18	.107			
Total	40.778	21				
Corrected Total	2.550	20				

a. R Squared = .243 (Adjusted R Squared = .159)

Figure 1.1: ANCOVA result from analyzing how language barriers affect CS IASs' & CS Non-IASs' academic performance

Tests of Between-Subjects Effects						
NIASS						
Dependent Variable: Average_Grade						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	
Corrected Model	.127 ^a	2	.063	.288	.751	
Intercept	8.685	1	8.685	39.483	.000	
Years	.122	1	.122	.554	.460	
Culture_Diff	.000	1	.000	.001	.973	
Error	10.118	46	.220			
Total	119.000	49				
Corrected Total	10.245	48				

a. R Squared = .012 (Adjusted R Squared = -.031)

Tests of Between-Subjects Effects						
IASs						
Dependent Variable: Average_Grade						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	
Corrected Model	.193 ^a	2	.096	.734	.495	
Intercept	.888	1	.888	6.767	.019	
Year	.004	1	.004	.029	.868	
Culture_Diff	.190	1	.190	1.448	.245	
Error	2.230	17	.131			
Total	39.778	20				
Corrected Total	2.422	19				

a. R Squared = .079 (Adjusted R Squared = -.029)

Figure 1.2: ANCOVA result from analyzing how culture differences affect CS IASs' & CS Non-IASs' academic performance

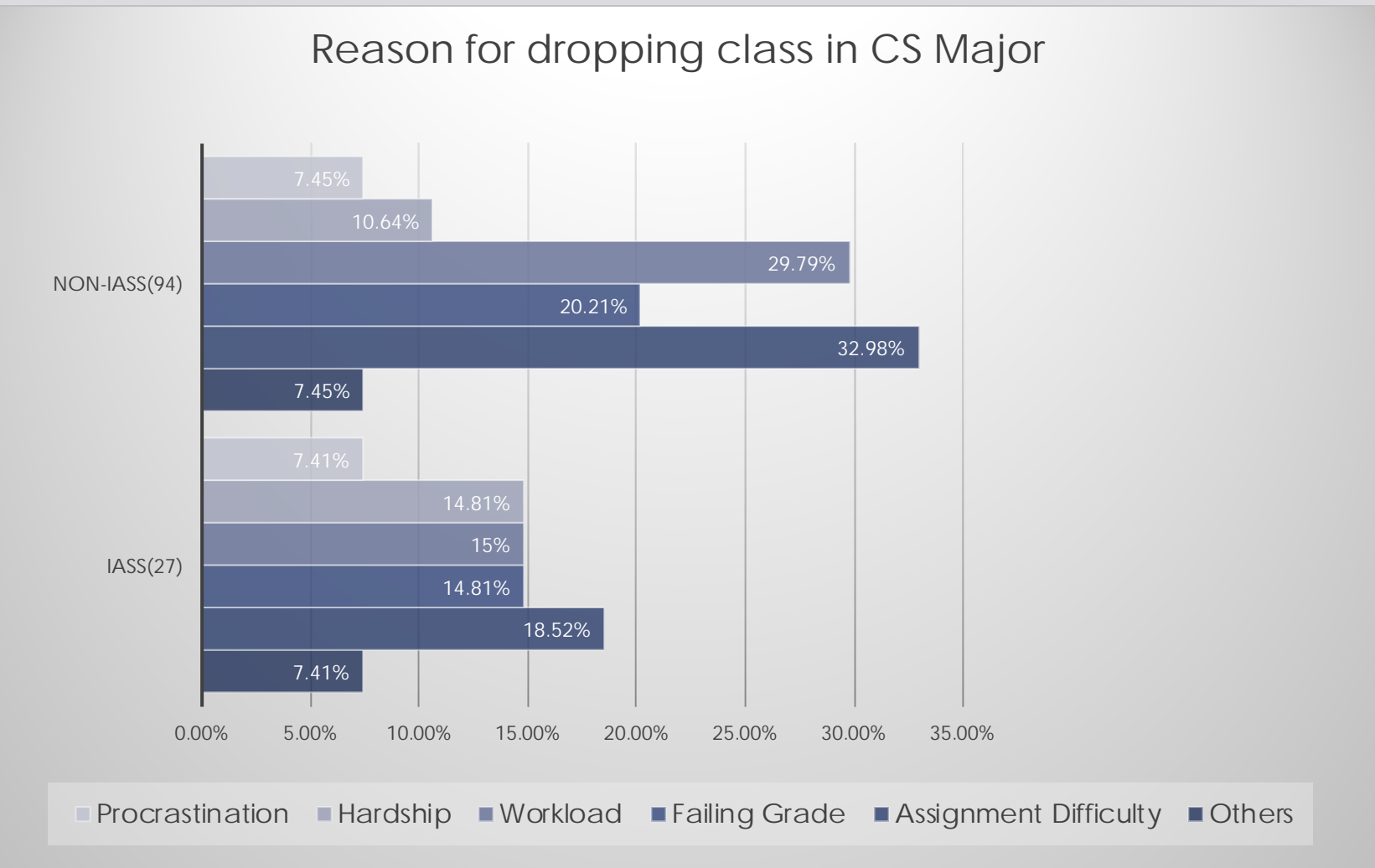


Figure 2.0: Reasons for dropping CS Major classes

DISCUSSION

As shown in the results, language barriers which cause having difficulty with readings and culture differences which may be the reason that cause IASs not going to office hours, asking questions in class etc. are some of the obstacles IASs are encountering. While the survey collected reasons why students drop Computer Science classes, more efforts can be devoted in the future by researchers to figuring out how other factors are impacting IASs population besides language and culture related reasons. As reasons of dropping Computer Science classes are displayed in Figure 2.0, a clustered bar chart, in the format of percentages, more emphasis of future researches and investigations can be put on those weigh more on the chart and can possibly lead to more and faster feedback.

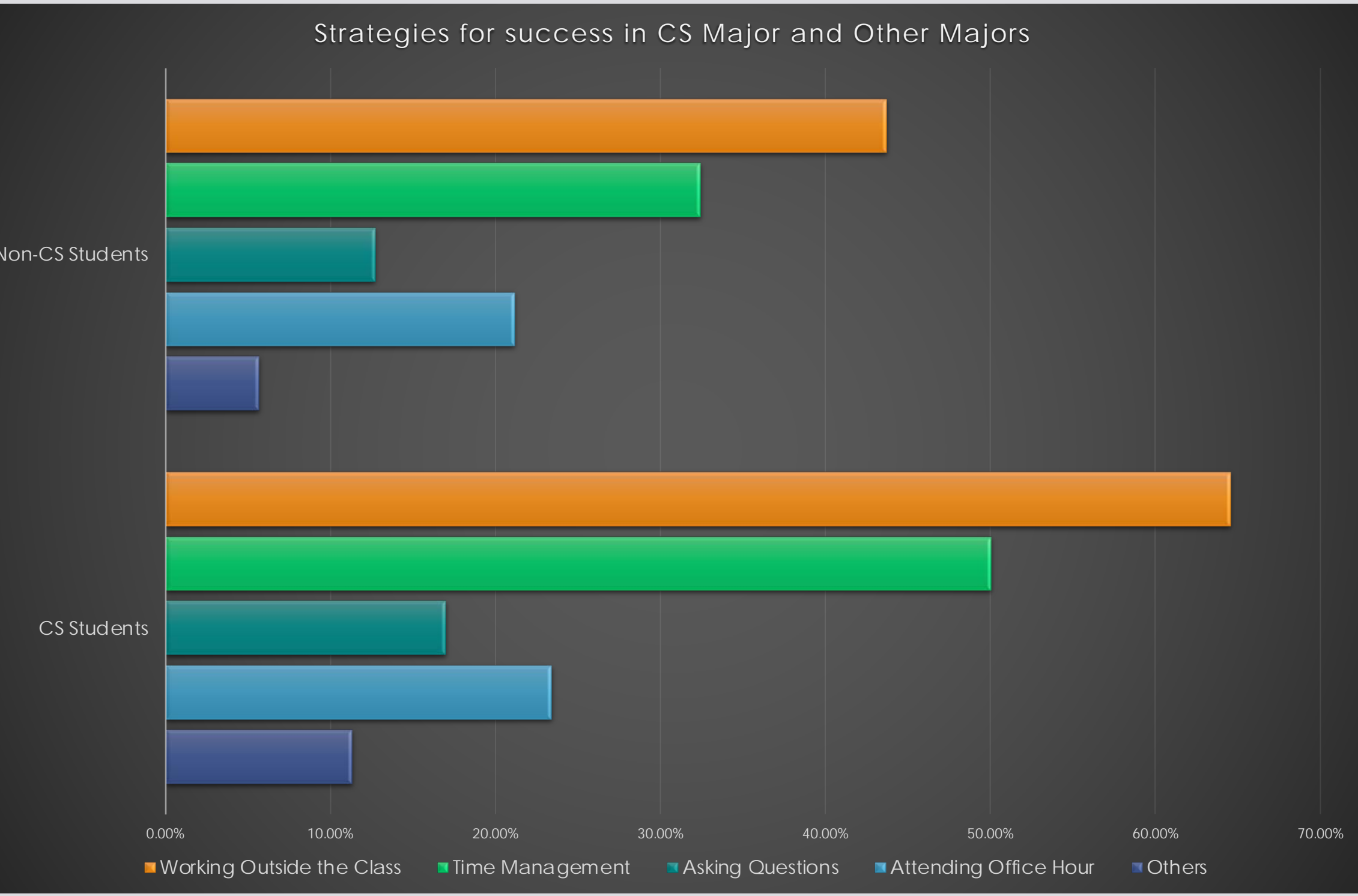


Figure 3.0: Strategies for success in CS Major and Other Majors

DISCUSSION

After analyzing the data resulting from ANCOVA models and visualizing numbers in the form of cluster column charts etc., a conclusion can be made that language barriers and culture difference are factors that have bigger impact on IASs groups. The fact that IASs has both a lower Culture_diff and a Understand_diff sig. value also indicates that having difficulty understanding course related readings and culture differences impact more on populations of IASs. As obstacles need to be exposed, propositions of potential solutions are at the same level of importance. Another clustered bar chart, Figure 3.0, also created from survey responses, showed us what strategies those students applied to succeed in CS classes. Extended from this chart, actions such as providing translate class materials, holding events that encourage IASs to embrace different culture, can be taken to help IASs tackle those obstacles and succeed.

REFERENCES

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[2] International students U.S. study. (n.d.). Retrieved from <https://www.ije.org/Research-and-Insights/Open-Doors/Data/International-Students/Fields-of-Study>