A Study on Students' Change of Majors, What they Choose and Why

Sampling Survey and Society
36-303

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Abstract:

Selecting a major is an important decision for an undergraduate. What a student chooses to study often determines their future career by providing them with a knowledge base that will enable them to succeed in that field. At Carnegie Mellon University (CMU), students are allowed to change majors as they wish in accordance to certain influences in their life, including but not limited to perceived academic success, future job prospects, personal interests, and social pressures. This study aims to determine the retention rates of each major at CMU, which majors are most popular to switch to, and the prevailing factors that influence a students decision to change or not to change their major. Our results indicates(to be filled out later), which lend insight to what CMU departments can do to affect the popularity and retention rates of their majors by identifying what influences an undergraduate's decision on changing majors the most.

Section 1: Introduction

1.1 Research Question and Motivation

College major plays an important role in determining one's career and life after graduation. As upperclassmen at CMU, we ourselves and other students alike have encountered decisions in switching majors, in which many claim to be a problem for various reasons. We believe that some majors may be better at retaining students, and some majors have high turnover rates. We would hope to understand why some majors have better retention rates. We would also like to know if classes have an effect on major changing and choosing. In situations that students don't switch majors even if they have originally thought so, we are interested in the reasons. This study would be most beneficial and significant for prospective students as they are able to make their decisions more carefully when they know reasons behind switching majors. This study is also important for the university itself letting them make inference on how or why people change their majors. By conducting this survey, we would hope to be able to make inferences on specific majors on CMU campus, and obtain data regarding why people choose the majors they chose to pursue.

Our survey set out to assess the main motivations that drive students to change majors, what keeps students stay in their current majors, what are the factors that have possibly stopped students from changing majors even though they have thought about it, and the type of

majors people are likely to have switched to. The results of this survey are based on students' responses about their opinions of their current majors, and their thoughts about what affected them the most when they changed or thought about changing major if they ever have done so. We sampled students from each class level and compared the results. We expected to see different reasons from students in different departments for the field and characteristics of the majors within the department is similar.

1.2 Citations to Literature on This Topic

A survey called "Survey of Major Changers" presented by Dr. Judy Shoemaker of UC Irvine Survey was conducted to determine why students change majors and how easy the process is. The results of the survey shows how the major-change process is perceived and what can be done to improve the process. Another survey "Freshmen Keen to Switch Majors" conducted by Jia Jianyu in December 27, 2010 focused on the high volume Chinese University students wishing to change majors and the reasons behind it. The survey covered in the article has similar motivations to our proposed study, and can serve to compare our data with theirs.

1.3 Quick Summary of Results

After assessing our responses and results, we find that a majority of students in Carnegie Mellon stay in their major because they want to, and those who switch their majors do so primarily because of interest in major, opposed to external factors such as jobs or workload. Students who want to switch but can't stay in their current major primarily because they don't have enough time to complete the work. Many students complain about lack of knowledge information and advising, as well as the inability to transfer credits between some majors.

Section 2: Methods

2.1 Target Population and Sampling Frame

The target population is the Carnegie Mellon undergraduate student population. We wish to make inferences on this population regarding our proposal topic.

For our sampling frame we will use the Carnegie Mellon C-book email list to avoid any unbiased collection of data. An unbiased random selection of individuals is important so that the sample represents the population. Since C-book lists email addresses of all currently enrolled Carnegie Mellon students, a random sample selected from the C-book email list excluding graduate students gives us an appropriate sample frame.

2.2 Sample Size

Considering that the total undergraduate population of CMU is 5619, assuming that students are evenly distributed across the four grade levels, the sample target will be 75% of this population (sophomores, juniors, seniors) which is 4214 students.

Simple random sample without replacement
n0=(z2)SD2ME2= (1.9622)0.520.052 = 384.16384
n>(Nn0)N+n0;
n>(4214384)4214+384=352.06353
So our sample size is 353.

According to our calculations, assuming a standard deviation of ½ with 95% confidence interval and 5% margin of error, we would need to sample at least 353 students. We decided on restricting the margin to 5% because this is recommended in the context of the book, and here our inference about the target population with 5% margin will be convincing enough.

Assuming we use as our medium of distribution, which has a maximum 20% response rate, we would need to sample 353*5=1765 students in order to account for this low percentage. Just to simplify we need to sample 1800 students.

2.3 Sample Design and Methods

We have decided that sending out questionnaires from the C-book is the most unbiased and error-free procedure in conducting this survey. Since we feel that the questions asked in the survey are only adequate to persons in grades sophomore and up, we have excluded any responses from freshmen. This does decrease our effective sample size, but we were not conservative in increasing sample size to account for non-response and believe this should cover the potential unused observations of freshmen. We will assume that simple random sample will distribute the population evenly in each grade automatically making this plan a stratified one.

Since we have the complete sampling frame, simple random sampling (SRS) is the simplest sampling technique and data collection can be efficiently conducted on randomly distributed items. SRS is free of classification error, and it requires minimum advance knowledge of the population other than the frame. Its simplicity also makes it relatively easy to interpret data collected via SRS. By using sampling without replacement (as opposed to sampling with replacement), we avoid any choosing any member of the population more than once, which could skew our results.

Although we would like to rely on a respondent naturally not taking the survey twice to ensure sampling without replacement, we could not be sure that each respondent only took the survey once. Alternatively, we gave the respondent the chance to provide us with their Andrew ID so that we do not contact them when we send out follow-up emails, which will ensure to a greater degree that our final sample was taken using sampling without replacement.

2.4 Response/Non-response

Sampling1800 students resulted from a calculated sample size of 353 and the assumption of the maximum response rate of 20%, which is fairly low. Our calculation was done assuming worst case scenario, therefore we expect to not encounter any problems regarding non-response rates. We had concerns regarding distribution of responses across different grade sub-groups, fearing one class may be over or under represented. To account for this issue, we took some adjustment measures described in 2.6 Post-survey Processing section below.

2.5 A few Questions From the Questionnaire

What department is the major you are considering to declare?
(List of every CMU department)

What attracts you to these majors? (check all that apply)
Future Job conditions Interested in the Subject provide a well rounded education
Recommendations from others (i.e parents) Ease of coursework
Did well in subject in high school CMU program is well-known Other

What led you to choose your current major? (Check all that apply)
Future Job conditions Interested in the Subject provide a well rounded education
Recommendations from others Ease of coursework
Did well in subject in high school CMU program is well-known Other

What factors influenced your choice to change majors? (Check all that apply)
Future Job conditions Sounded interesting provide a well rounded education
Recommendations from others Ease of coursework Prepare for graduate school
Other

Why did you consider changing majors? (Check all that apply)
Future Job conditions Interested in the Subject
provide a well rounded education Recommendations from others
Ease of coursework Did well in subject in high school

Current major is harder than expected CMU program is well-known Other

Why didn't you change? (Check all that apply)

Not enough time to complete Financial Issues Parents don't agree Other

2.6 Post-Survey Processing

We did not need to code the answers to our questions. Because the questions we asked were multiple choice, we were able to simply count the number of responses for each answer. For people who answered "other", we manually read each response and combined similar answers.

We gathered the data into excel for data processing. Our post-survey processing includes data collection, data entry, edit-checks and build weights. We had a significant population of respondents that classified themselves as master or PhD students, which had to be removed before analysis.

Section 3: Results

Firstly, we present the demographic facts of the respondents and ensure that our analysis based on the response will lead us to make appropriate inference about our target population. Since our data is mostly categorical, graph representation is the best way to exhibit the distributions we are interested in. Each graph displays the relationship between either two categorical variables or a categorical variable and a quantitative variable.

Figure 1

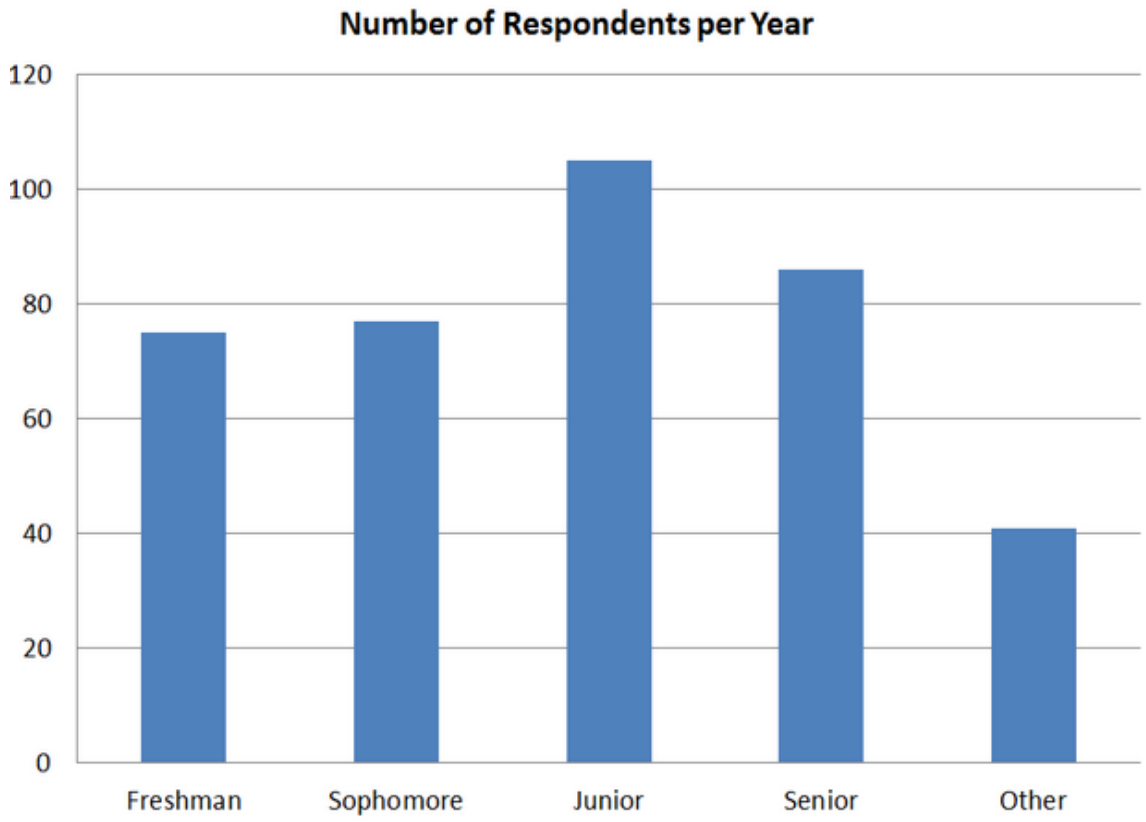


Figure 1. This is a bar plot of respondents categorized by class. There are the largest number of Junior respondents and the smallest number of other (5th year or more) undergraduate respondents. The average is about 70 respondents per class. The respondents are almost evenly distributed overall.

Figure 2

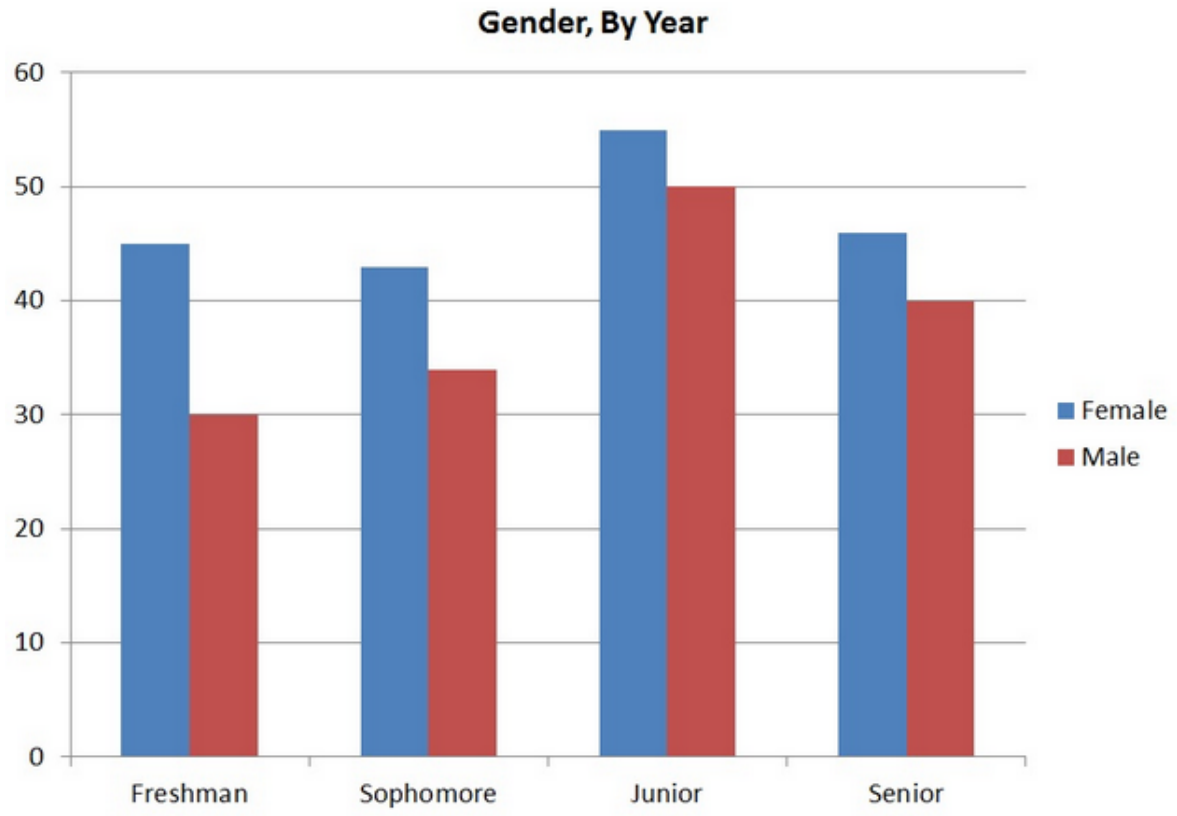


Figure 2. This is a bar plot of respondents categorized by gender and class excluding other (5th year or more). We are only focusing on Freshman, Sophomore, Junior and Senior. Gender is indicated by color. We can see from the graph that in each class, there are more female respondents than male respondents. The overall distribution of respondents over class is similar to the previous graph.

Figure 3

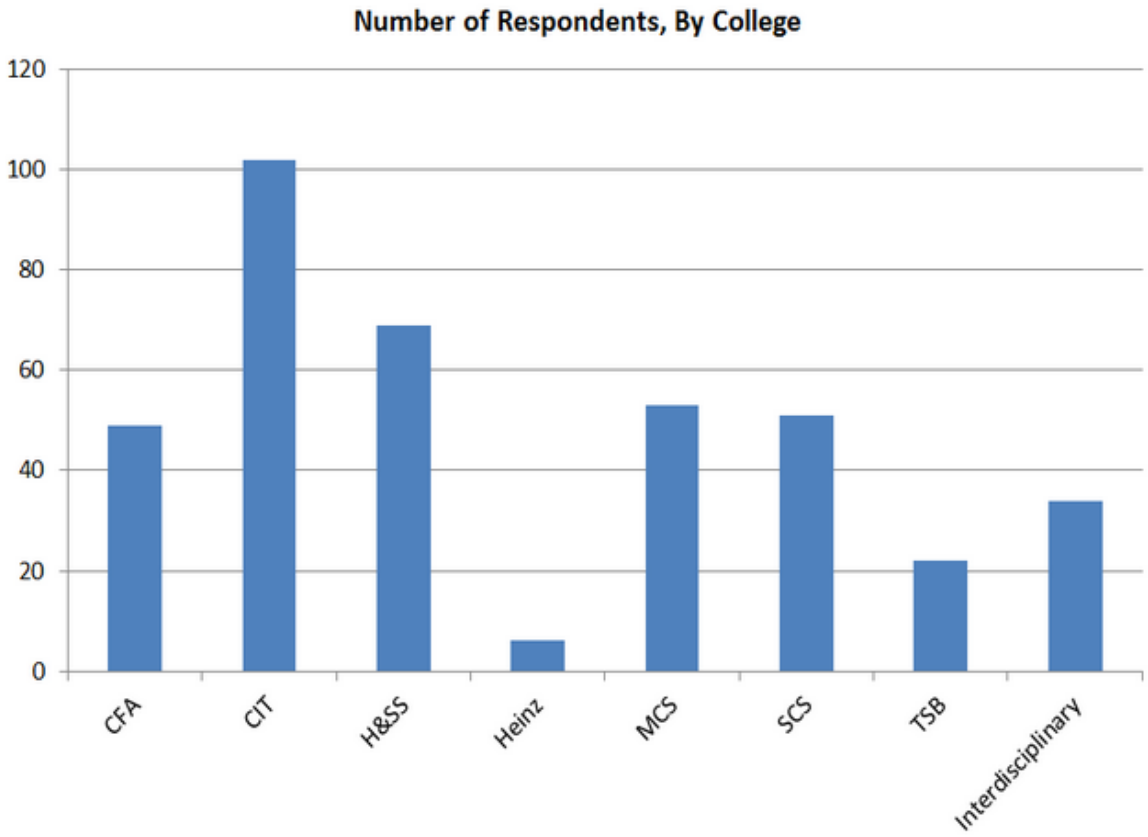


Figure 3. This is a plot of respondents categorized by college. The distribution is uneven among different colleges. There are the largest number of CIT college respondents and the smallest number of Heinz college respondents, this correlates to the size of each college in CMU. The Heinz respondents are confusing, because they don't have an undergraduate program. This may be due to invalid input or invalid coding.

Figure 4

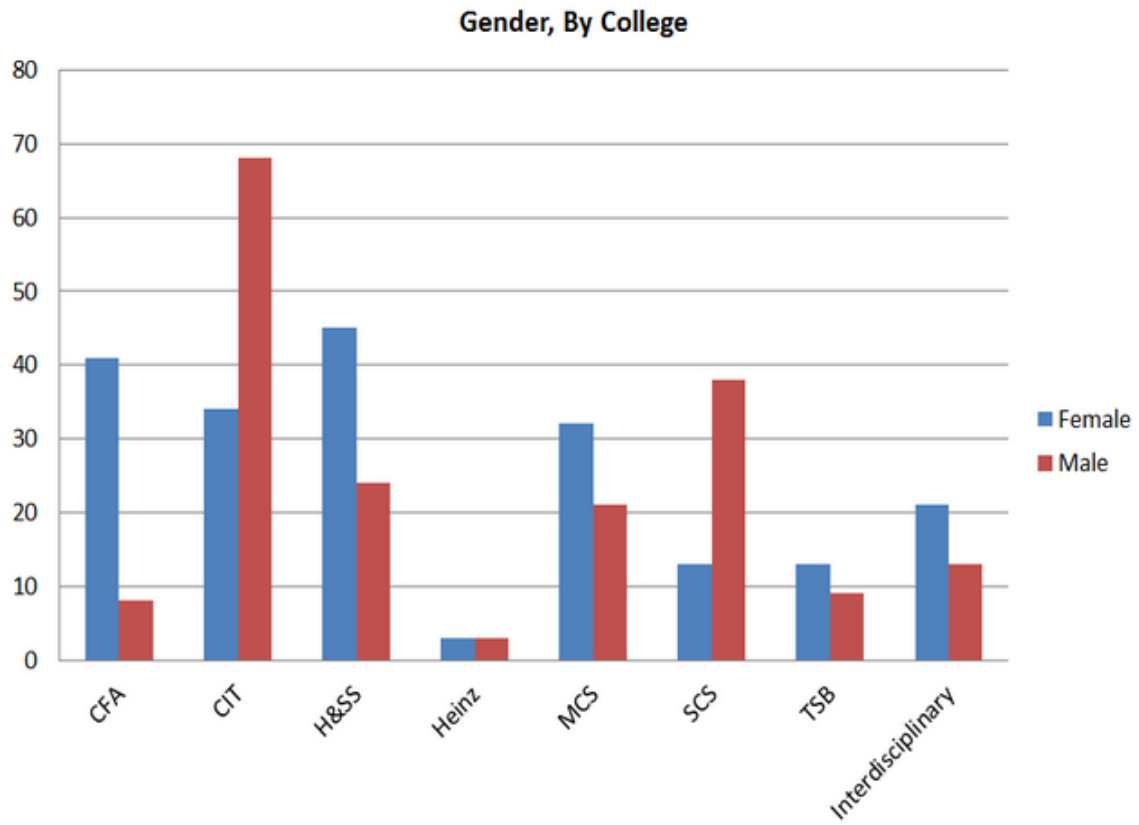


Figure 4. This is a bar plot of respondents categorized by gender and college. The distribution of overall distribution of respondents over class is similar to the previous graph. In most colleges, there are more female respondents than male respondents, especially in CFA, the number of female respondents is about five times of the male respondents. However, in CIT and SCS, the number of male respondents is about two and three times of the female respondents respectively.

Figure 5

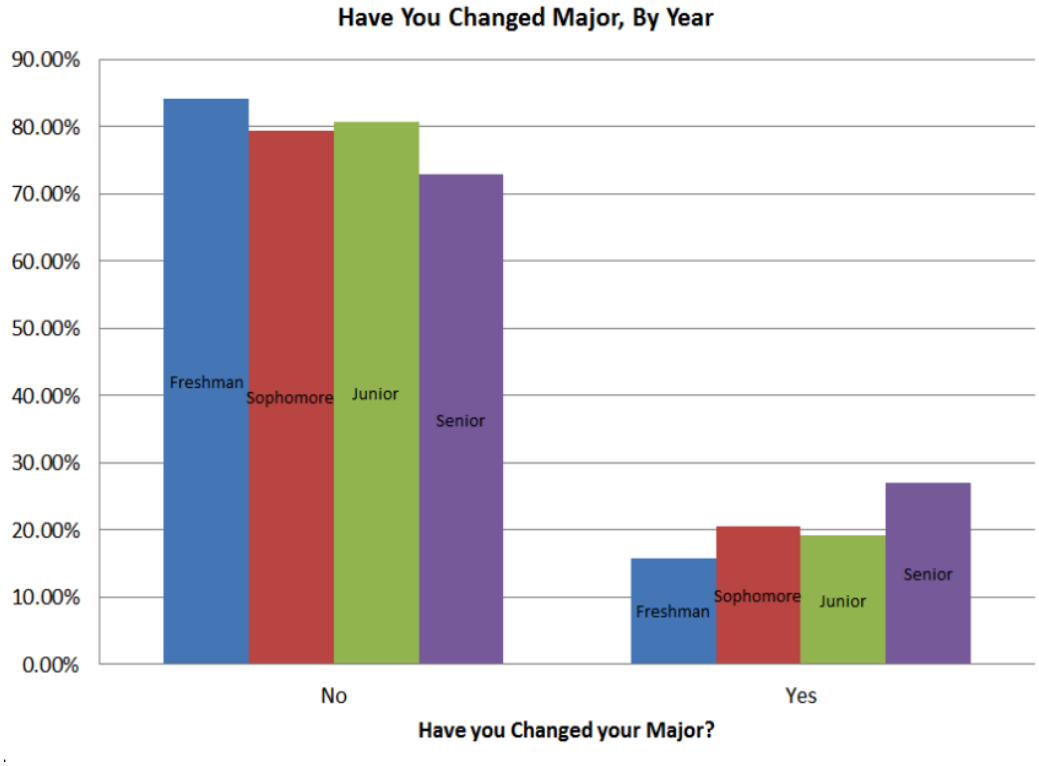


Figure 5. As a way to check that participants did answer the questions the way we intended them to, this chart showing the percentage of students in each year who have changed majors was created. As expected, freshmen had the highest percentage of No's while the Seniors had the highest percentage of Yes's. This is expected because Seniors, having had the most time to actually change their majors should have more people who have changed than any younger year. Strangely enough, a higher percentage of Sophomores have changed than Juniors, although there may be extraneous factors that have affected the decision of the sophomores (i.e. more students admitted into harder majors, change of curriculum, etc.)

Figure 6

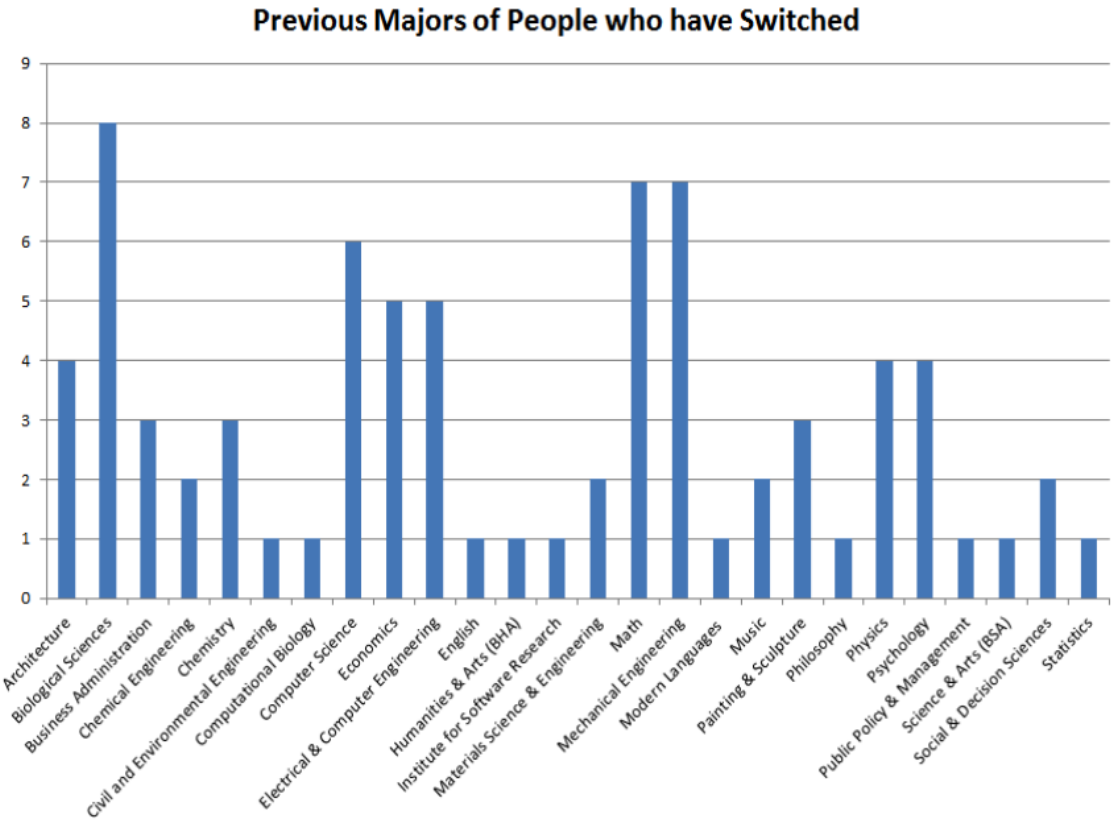


Figure 6. In order to determine what majors have the lowest retentions we simply looked which majors had the highest count of leavers. This was done by counting the departments selected indicated as a previous major by the participants who have switched majors. As can be seen, Biological Sciences, math, Mechanical engineering, and computer science have the lowest retention, followed closely by Economics, ECE, Architecture Physics and Psychology.

Figure 7

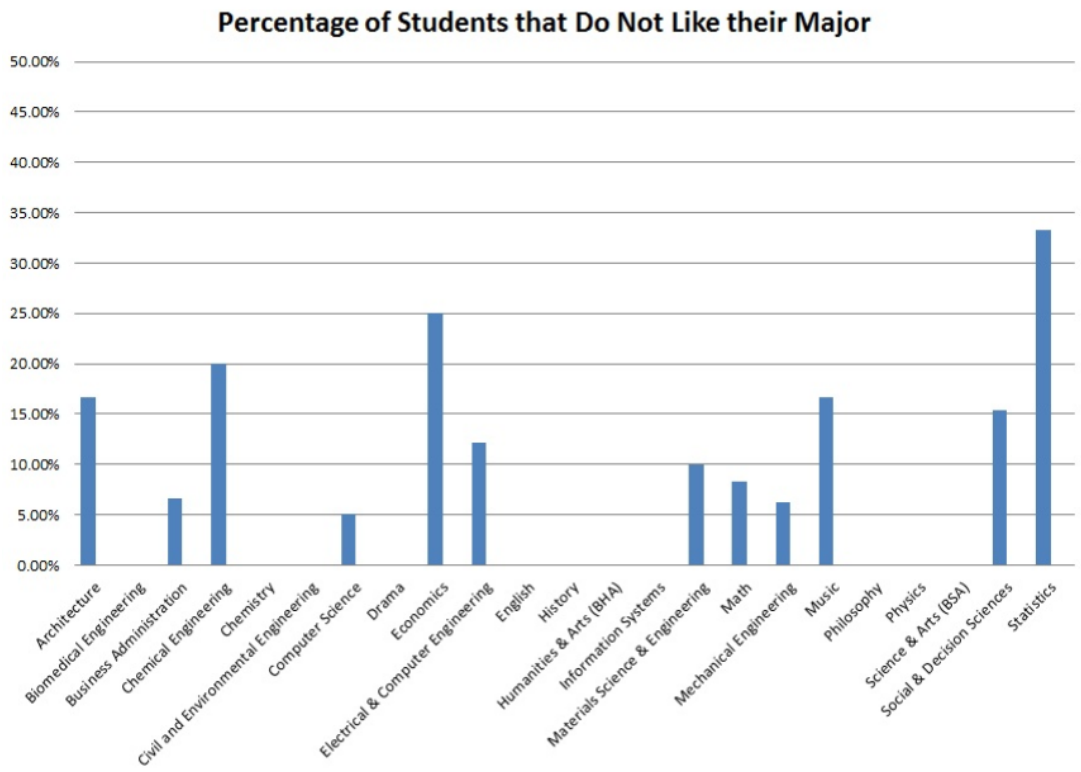


Figure 7. This is a visual representation of the percentage of students who do not like their major. The chart was generated by combining department counts for each question that asked participants to identify their current major and the responses to the question asking about whether or not participants liked their current major.

As can be seen from the chart, the highest percentage of Statistics students reported that they were unhappy with their major, followed by Economics, Chemical Engineering, Architecture, Music, and Social & Decision Students (in that order). It must be noted that the large number of empty categories does not necessarily indicate that all students in those majors are happy, but perhaps that there are no students currently in those majors due to people switching out.

Figure 8

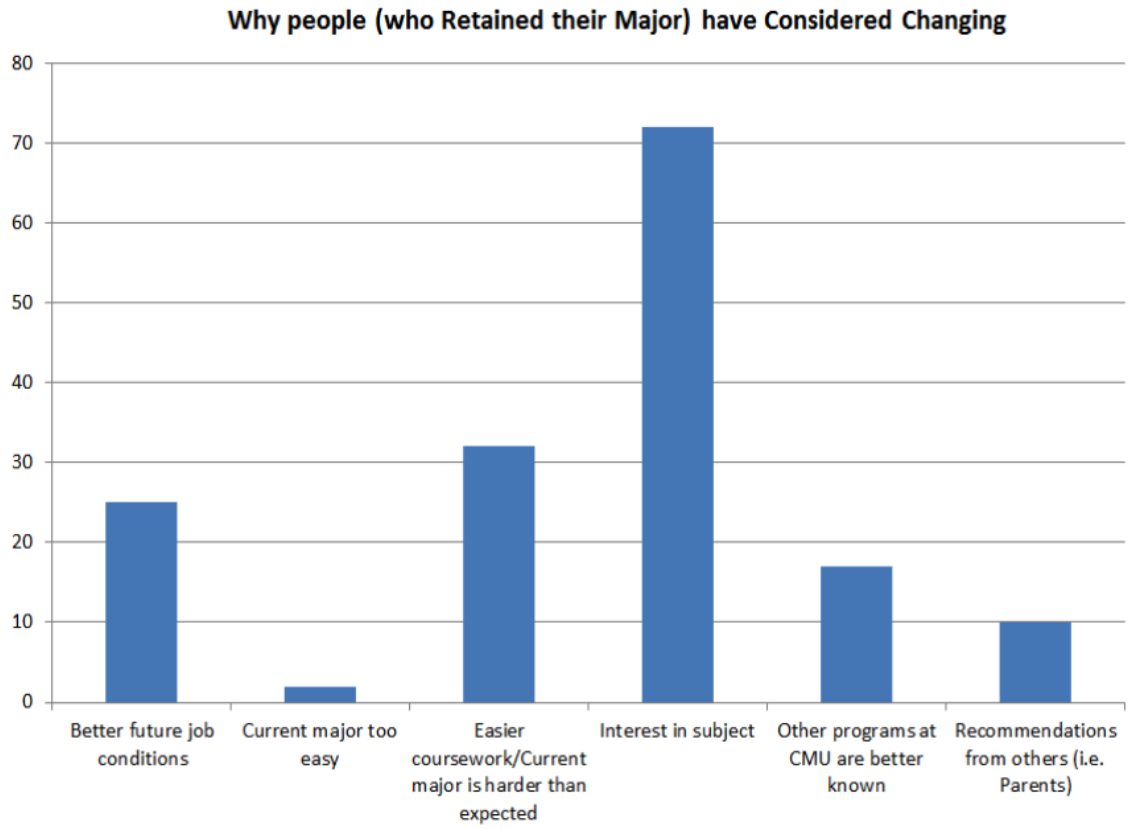


Figure 8 shows the reasons why students consider switching majors. The y-axis represents number of respondents per reason given on the x-axis. The graph only depicts the reasons that received more than one response, meaning other reasons not shown here only received one or no response.

It is evident that number one reason for those who have considered switching majors is having interest in other subjects. This reason is more than twice as much as the second reason which is the reason of seeking easier course work for current major is more difficult than expected. Other reasons include other majors possessing better future job conditions, renowned status in CMU, and high recommendation from peers. It was interesting to see that some students considered transferring because they felt that their current majors are too easy. This tells us that some are not satisfied with easy work and seeking difficult tasks and challenges.

Figure 9

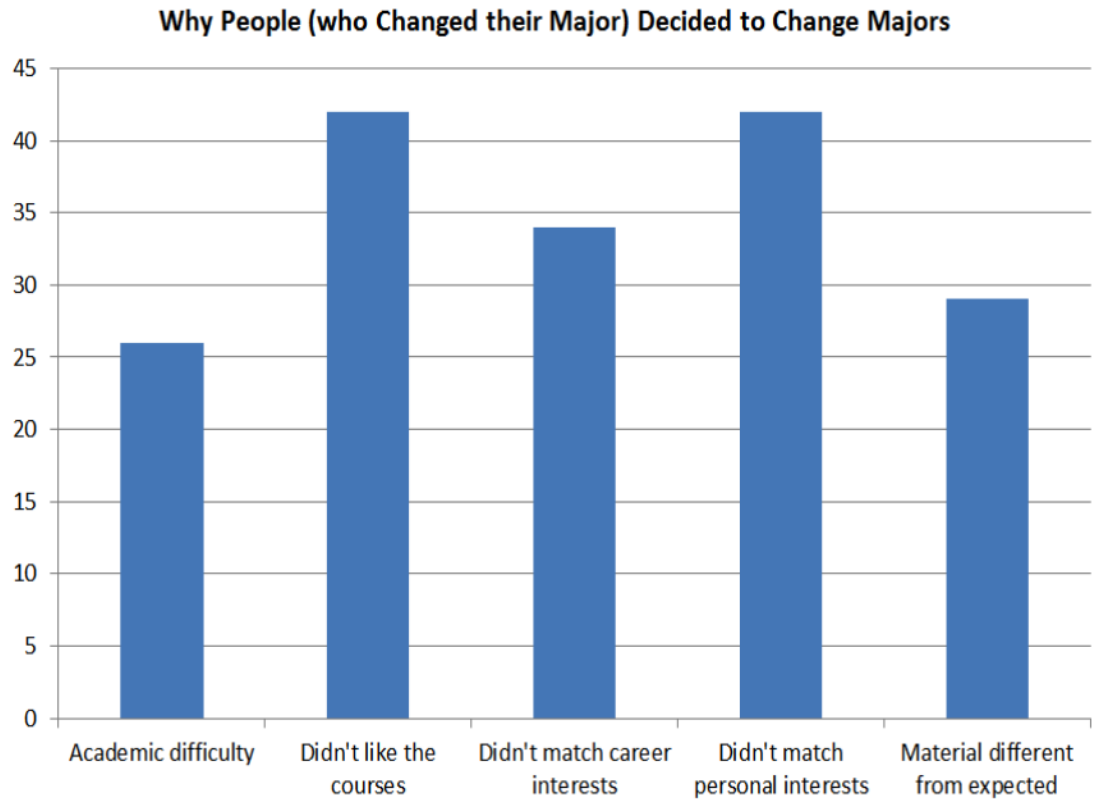
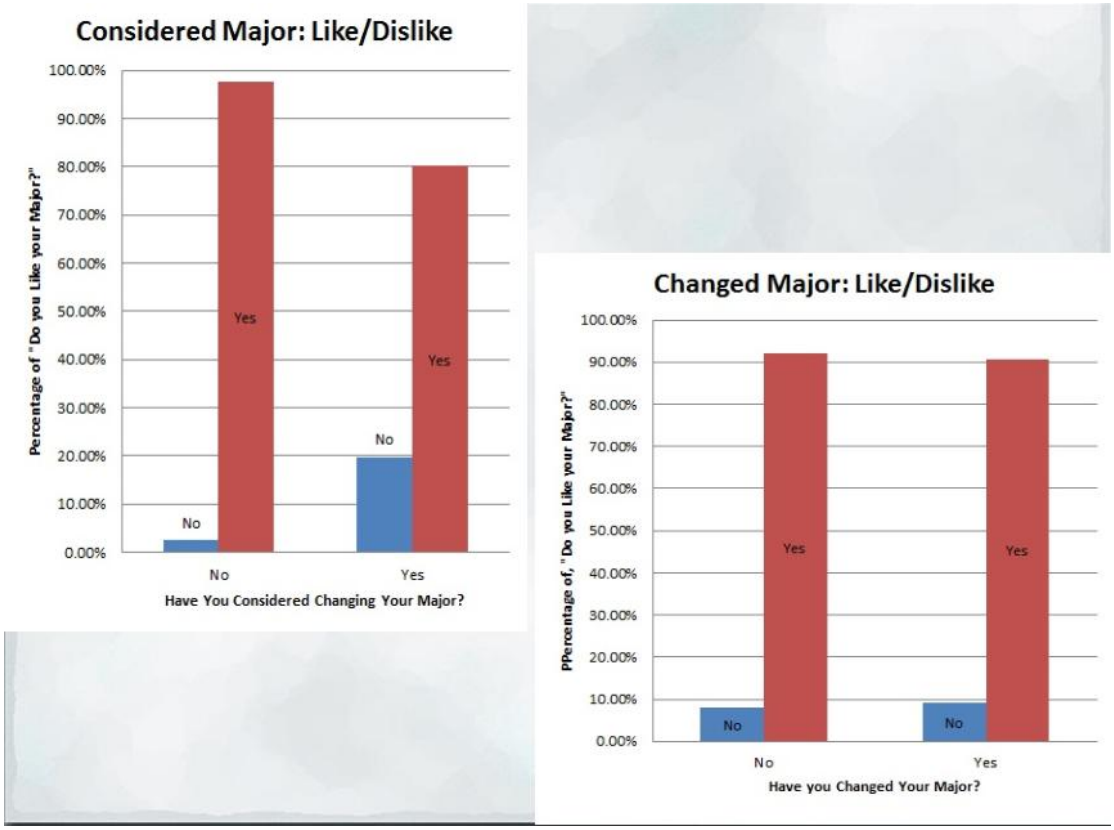


Figure 9 is a similar graph to Figure 8. The axis is kept the same with number of respondents on the y-axis and reasons on the x-axis, however the respondents were students who have switched majors. Again the graph only contains reasons that received more than one response.

Compared to figure 8, the distribution of responses between reasons shown in figure 9 is spread more evenly. It is shown that top reasons are that in previous majors, students either did not like the courses or did not feel that it matched their personal interests. With 34 responses the reasons of "didn't match career interests" came in third followed by "material (of previous major) different from expected" and difficulty of previous majors.

Looking at reasons for both figure 8 and 9, it is evident that main reasons are all regarding students' interest and difficultly of the majors rather than personal reasons such as social influences or future job conditions.

Figure 10a & 10b

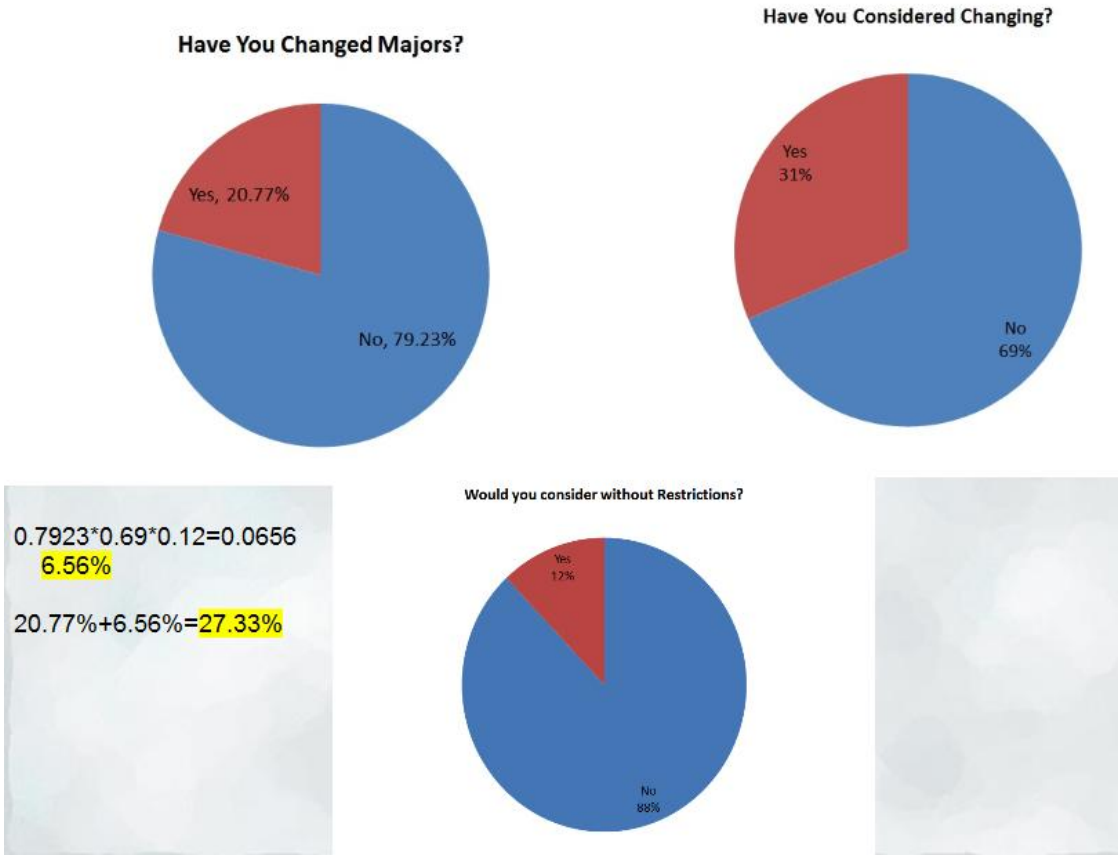


On the x-axis of the figure 10a answers the questions of weather or not students (who didn't change major) considered switching majors. The bars show the percentage of the respondents between answer to the question on whether or not the student like their majors.

As predicted figure 10a shows that there is a higher percentage of respondents that like their current majors that have not considered changing than those that have. The inverse relationship between yes and no applies here as well.

A more interesting graph is figure 10b which has the same parameters as figure 10a, but on the x-axis, it answers the question "have you changed majors?" Here our prediction was that the percentage of "yes" would be much higher for those who have switched than those that have not. However the graph depicts that the distribution of "yes" and "no" for each category is about equal. This leads to the conclusion that assuming that for those that have switched did not like their previous majors, although transferring to another major seeking for something the students are interested in, there will always be same percentage of people that will not like what they are studying.

Figure 11a, 11b & 11c



We asked the whole sample population if they have changed their majors; the distribution of the answer to this questions is shown in figure 11a. Respondents who answered “no” to this question (79.23%) were asked if they have ever considered changing majors; 31% answered yes and 69% answered no to this question. Of the 69% that answered “no”, 12% answered “yes” to the question “would you consider without any restrictions?”. This means that, if there were no restrictions such as time and financial concerns, we predict that proportion of students who changes major will increase 6.56% to 27.33%. With this we conclude that for 6.56% of the population cannot transfer because of some restrictions that prohibits them from doing so regardless of wanting to switch.

Figure 12

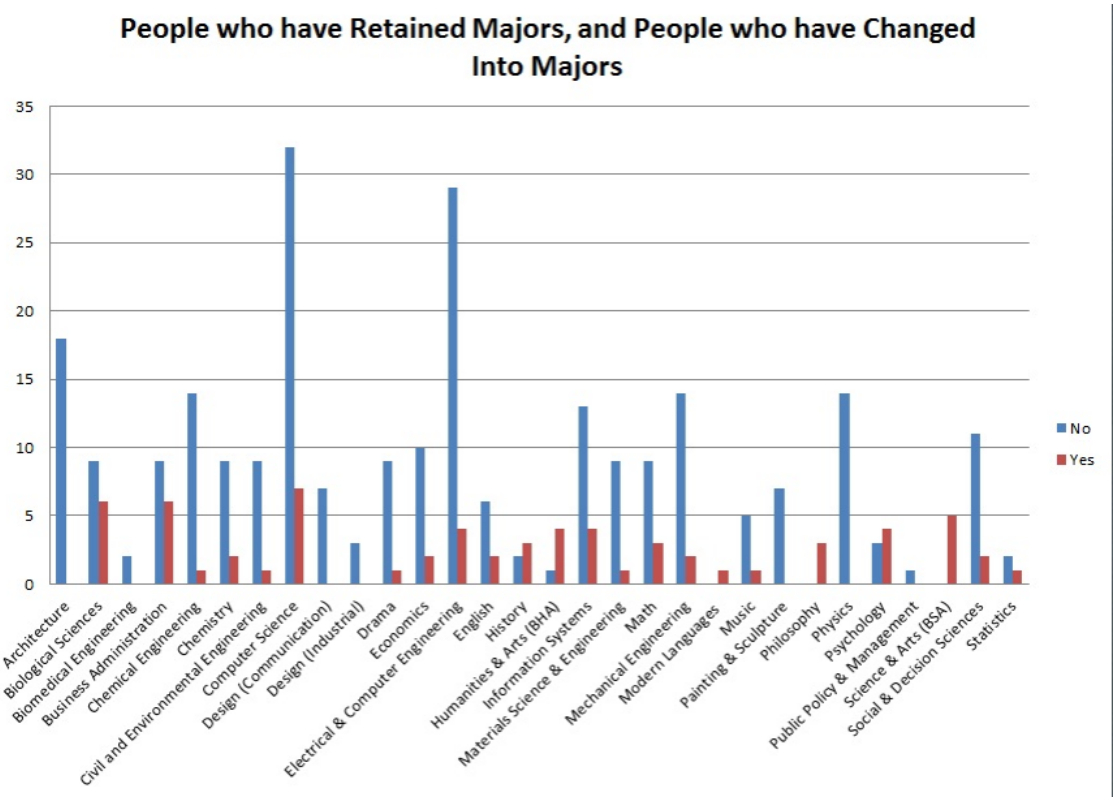


Figure 12. Some interesting features about this graph :

- Architecture has a large number of students retaining, but zero observation switched in.
- Many students switched into Science & Arts major, the one that originally doesn't have any retaining students.
- Computer Science has the largest number of retaining students, and also a large number of students switching in. ECE also has a large number of retaining students, but this might because it has a large number of students.
- Design departments (Communication/Industrial Design, Architecture, Painting & Sculpture) have few if any students switching in. This means that it must be very hard or impossible to switch into design.

Figure 13

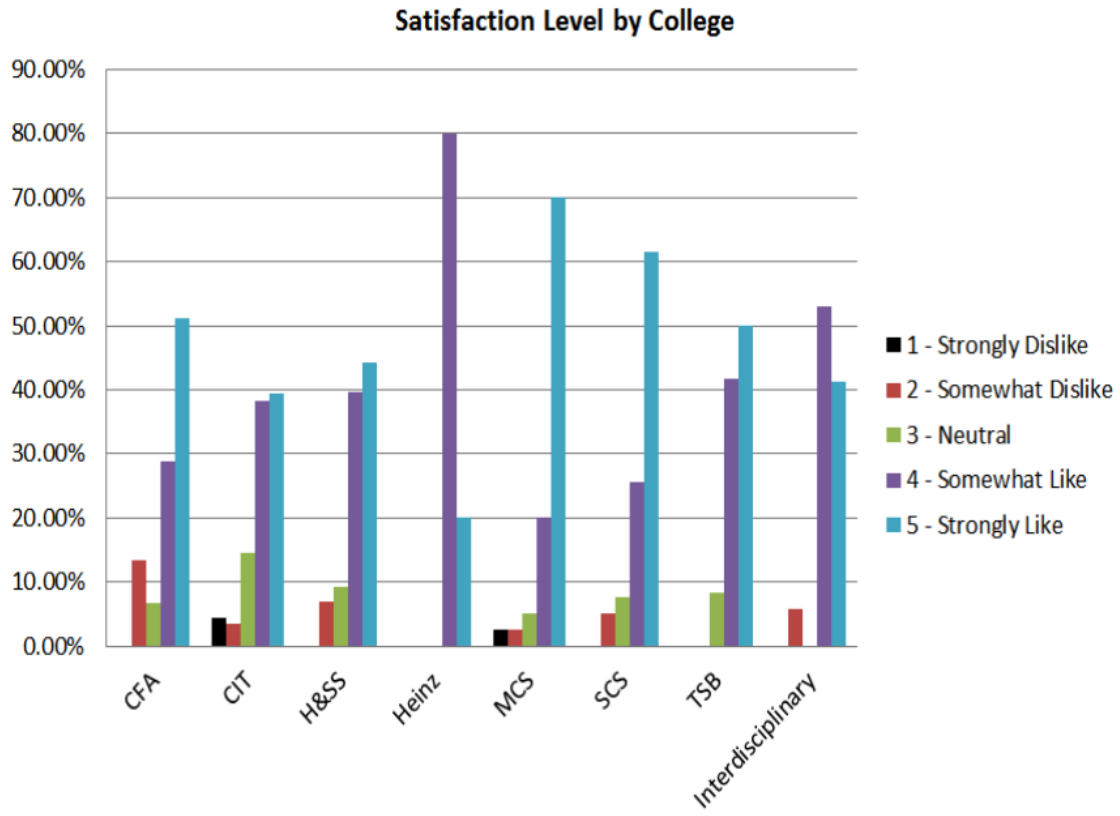


Figure 13 shows students' satisfaction level with their current major by colleges. In the questionnaire the respondents are asked to indicate their satisfaction level (1 strongly dislike to 5 strongly like) with their current college. Looking at each college's satisfaction level distribution, we conclude that College of Fine Arts has the highest dislike rate, while Mellon College of Sciences has highest percentage of students who strongly like their current major, 70% of the MCS students surveyed absolutely enjoy their current major. Overall, the majority of our respondents like their current major. In Heinz College and Tepper School of Business, none or only a few of the respondents indicate any dissatisfaction with their current major.

Figure 14

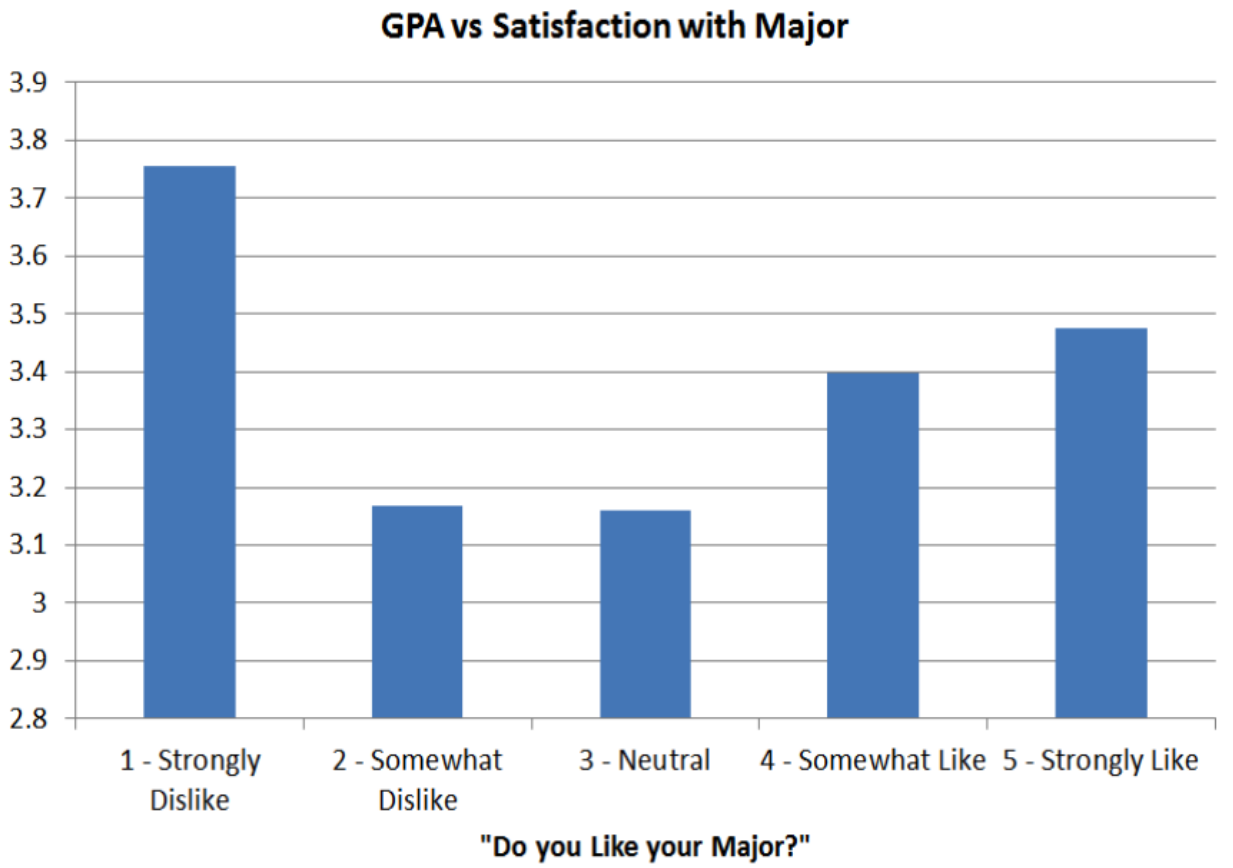


Figure 14 displays the GPA distribution among different level of students' satisfaction with their current major. This graph shows a surprising result that the students who strongly dislike their current major are doing extraordinarily well academically, and students having an ambiguous attitude about their current major tend to have lower GPA than students showing clear preferences. The fact that many students who strongly dislike their current major are obtaining the highest GPA explains a major factor that might have stopped students from changing majors--some students would rather keep their high GPA than take the risk to switch majors.

Figure 15

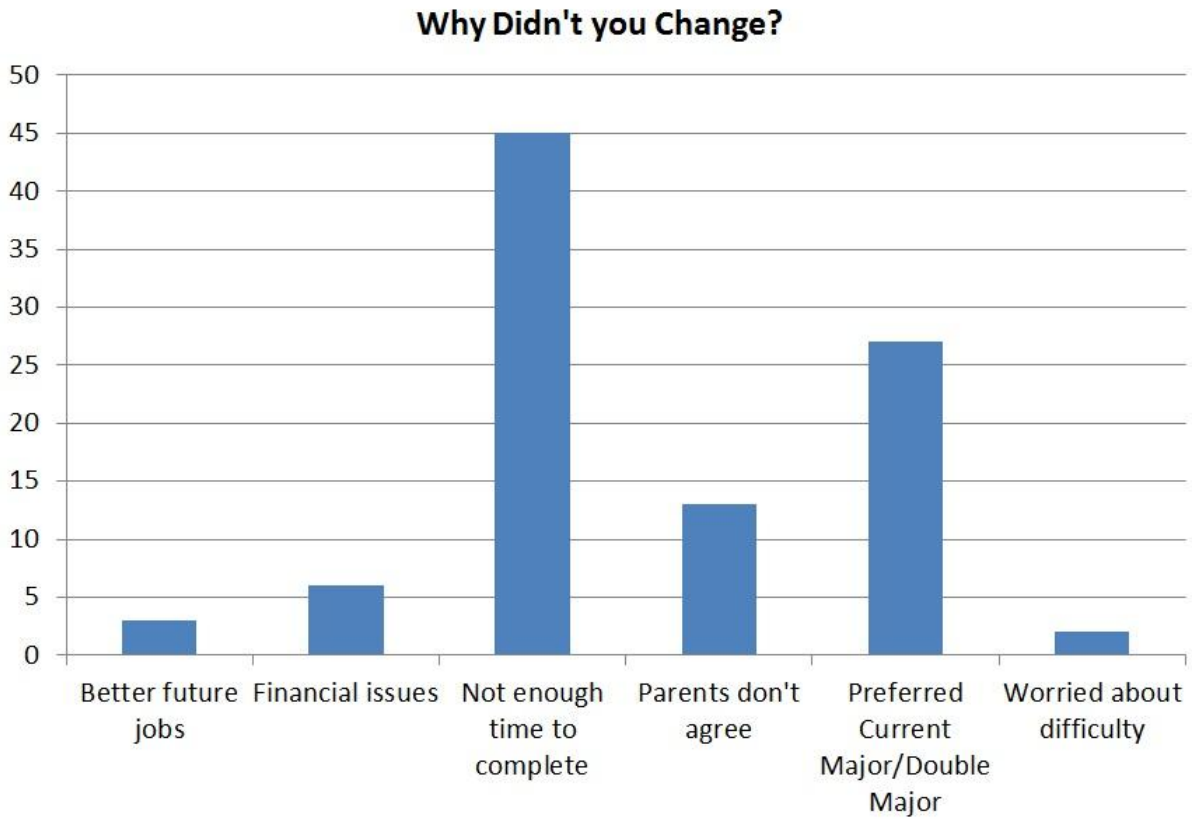


Figure 15 One of the research questions in our study is what factors can possibly stop students from changing majors when they are considering changing. It turns out that among the respondents, the majority of students who have thought about changing to another major didn't do so due to time restrictions. A large portion of others indicate that after careful consideration, they still prefer to stay in their current major or declare a second major. Some answered that they concerned about parents' opinion and financial issues, thus have decided to stay. Only a minority of students' decisions are influenced by future job conditions and concerns about course difficulty.

3.2 Statistical Analysis of Our Results

The first analysis step is coding--translating non-quantitative/non-categorical data into quantities and categories. In our survey, most of the data are in categorical form. Even though there are some originally open-ended questions, we have converted them into multiple choice questions in order to make the coding process simpler. We made sure that the multiple choices we provide cover a wide range of possible answers if the question is open-ended, and if a students' answer doesn't fall into any of the multiple choices, he/she can always answer "other" and specify. However, we only encountered few such cases and decided to ignore them because they are not significantly meaningful for the purpose of our research, and taking out several responses wouldn't affect much since our sample size is large enough for our study.

Since we are only interested in the pattern and distributions of various categorical and a few quantitative variables, graph would be the best way to show the resulting distribution. Among all the data collected, we chose combinations of two variables that are relevant to our research questions and performed graphical analysis which is shown in the section above. We have performed numerical analysis as well.. For example, in figure 11, we calculated the percentage of students that have changed major, have considered changing and would have change if there is no restrictions. After obtaining these percentages, we calculated the percentage of students who are held back because of restrictions on major switching.

3.3 Conclusion of our Results

Expected results: The demographic distribution of our respondents ensures that our random sample size is appropriate for our target population, and the study is done correctly throughout the process. We got responses from close number of males and females evenly distributed among all grade levels and colleges except Heinz, we will elaborate on this later. Some colleges such as CIT and SCS have higher male response rates than female, and other humanity based colleges shows the opposite pattern. However, this does not indicate any shortness in our procedures, because based on the CMU Common Data Set, engineering colleges have higher enrollment rates for female than male. The uneven distribution between gender by colleges shown in figure 4 does represent the overall enrollment trend at CMU.

Each graph displays a pattern of interest. Combining figures 8 and 9, it is evident that main reasons behind students who have decided/considered to change majors are regarding students' interest and difficultly of the majors rather than personal reasons such as social influences or future job conditions.

Anther predictions verified in our results is that there is a higher percentage of students who like their current majors that have not considered changing than those that have.

Unexpected results: In fact, a much smaller percentage of students have considered changing majors than we expected.

There is still about 10% of the students who have switched major indicating they don't like their current major.

Interesting facts: Science/Engineering students are more likely to switch out to other majors than humanity students.
Students indicating they strongly dislike their current major have an average of close to 3.8 GPA.
A number of respondents answered that they want to switch out of their current major because their current coursework is too easy.

Section 4: Discussion

4.1 Research Questions and Answers

We explored the factors that affect a student's decision to change or retain their majors and how prevalent these factors are in the decision making process.
1. What percentage of the students like their current major?
Prediction: We expect to see about >50% of students to like their current majors.
Result: The result on figure 10 indeed shows that our prediction was correct. The distribution of "like" of each category is shown below.
Not considered switching majors: 97%
Considered switching majors: 80%
Have not switched: 92%
About 90% of our sample expressed that they liked their major. Many of the academic humanities such as English, History, and philosophy majors all express zero dislike of their major. Departments that had relatively high dislike included economics, statistics, and chemical engineering.

2. What percentage of the students thought about switching majors?
Prediction: More than 75% of students considered switching majors.
Result: Figure 11 tells us that 20.77% have actually switched, and (0.7923*0.31)=24% of the whole population have considered switching(excluding those that have actually switched). Combination of the two gives us 20.77+24=44.77%, which is much lower than our predicted value.

3. What percentage of the students have changed or are going to change their major?
Prediction: Actual percentage students switching majors: <50% for restrictions regarding switching majors.
Result: Figure 11 explains the percentage of students who have changed major and would change major without restrictions. If we assume there are no restrictions, about 27.33% of the respondents have changed or are going to change their major. This is also much lower than what we expected.

4. What are the reasons behind students who decided to change their majors?

Prediction: We hope to see a significant difference in number of respondents in each reason given in the multiple choice question.

Result: According to Figures 8 and 9, the top reasons are that in previous majors, students either did not like the courses or did not feel that it matched their personal interests. Most students' decision to change major are driven by personal interests rather than the course materials.

5. What are the reasons that stopped students from switching majors.

Most students indicate that they ended up not switching to their desired major because they're concerned about the time restriction. Switching to a new major means having to complete the four-year curriculum in less time and wasting most of the units they have already completed. Considering this, many students prefer double majoring or minoring in their desired major. Future job conditions and concerns about academic difficulty are just minor hold-backs in our case.

4.2 Surprising or Unexpected Results

Surprisingly, less than 25% of respondents said they thought about changing majors, while we originally noticed the major changing phenomena is prevalent in college.

Another surprising result comes from comparison between GPA and satisfaction level of major. We noticed that students who strongly dislike their current major are doing extraordinarily well academically, and students having an ambiguous attitude about their current major tend to have lower GPA than students showing clear preferences. The fact that many students who strongly dislike their current major are obtaining the highest GPA explains a major factor that might have stopped students from changing majors--some students would rather keep their high GPA than take the risk to switch majors.

4.4 Strengths and Weaknesses

Strengths:

We hope to find some significant distribution or percentage through our responses. This would add meaning to our study, and allow us to make strong conclusions on questions listed above. However if the distributions of responses are spread evenly with no significant results, it is hard to make inferences.

4.5 Take-home Messages

From Figure 11 we conclude and predict that with no restrictions in switching majors, there will be an increase in number of people that will transfer to another major. Specifically the

percentage will increase from 20.77% to 27.33%. This number is significant enough for the University to consider designing a more flexible constraint free policies that will give more freedom to students in changing their majors.

Also, our result will tell what influences students to change major/retain the most. This will help perspective students to think carefully before declaring majors. For example, if heavy workload is a common reason why people decides to quit their current major, incoming students or freshmen should take a second thought on whether or not they could manage to complete the coursework if they declare their desired major. Our result will also indicate the majors students are most likely to switch to, and this will give perspective students some ideas about the most popular majors at CMU.

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Dr. Judy Shoemaker. "Survey of Major Changers". Oct. 15, 2007. <http://www.assessment.uci.edu/reports/documents/SurveyofMajorChangers.ppt>

Jia Jianyu. "Freshmen Keen to Switch Majors". Dec. 27, 2010. <http://life.globaltimes.cn/life/2010-12/604400.html>

Women in Computer Science, *Stanford Survey Results*. "Whether Students Have Considered Switching Majors, and Why" <http://www.cs.washington.edu/homes/letchner/classwork/cs201/survey.html#switchingmajors>

CMU website, retention rates

Appendix 1: Survey

Major Changer Questionnaire

What is your gender?

Male Female

What year are you?

Freshman Sophomore Junior Senior 5th year Undergraduate Other

What school are you in?

CIT CFA H&SS TSB Heinz MCS SCS

Interdisciplinary(BHA, BHS, etc.)

What is your current cumulative GPA?

What is your current primary major?

Have you declared your major yet? Yes No

If Undeclared:

What department(s) are the major(s) you are considering to declare (check all that apply)?

(Checklist of every CMU department)

Is the major you're thinking about in your current college?

Yes No

What major(s) are you considering to declare? (List all that apply)

What attracts you to these majors? (check all that apply)

Future Job conditions Interested in the Subject provide a well rounded education

Recommendations from others (i.e parents) Ease of coursework

Did well in subject in high school CMU program is well-known Other

If Declared:

Which department does your current primary major belong to?

(List of every CMU department)

Do you like your primary major?

Yes No

What led you to choose your current major? (Check all that apply)

Future Job conditions Interested in the Subject provide a well rounded education
Recommendations from others Ease of coursework
Did well in subject in high school CMU program is well-known Other

Would you pursue the field of your major in future professional career?

Yes No

Have you changed majors?

If Changed Majors:

From which school was your previous major?

CIT CFA H&SS TSB Heinz MCS SCS Interdisciplinary(BHA, BHS, etc.)

Which department was your previou major within?

(List of every CMU department)

Why did you choose your previous major? (Check all that apply)

Future Job conditions Sounded interesting provide a well rounded education
Recommendations from others Ease of coursework
Did well in subject in high school CMU program is well-known Other

Why did you leave your previous major? (Check all that apply)

Didn't like the courses had academic difficulties didn't match career interests
Materials different from what expected Didn't match personal interests Other

What factors influenced your choice to change majors? (Check all that apply)

Future Job conditions Sounded interesting provide a well rounded education
Recommendations from others Ease of coursework Prepare for graduate school
Other

How soon did you start thinking about another major?

Before College Freshman Sophomore Junior
Senior

What year did you change your major?

Freshman Sophomore Junior Senior 5th year Other

If Have Not Changed Majors:

Have you considered changing majors? Yes No

Please indicate your level of satisfaction with your current major from 1-5 (1-strongly dislike, 5-strongly like).

1 2 3 4 5

If Considered changing majors:

Why did you consider changing majors? (Check all that apply)

Future Job conditions Interested in the Subject
provide a well rounded education Recommendations from others
Ease of coursework Did well in subject in high school
Current major is harder than expected CMU program is well-known Other

What department is the major you were thinking about switching to (check all that apply)?

(Checklist of all CMU departments)

Why didn't you change? (Check all that apply)

Not enough time to complete Financial Issues Parents don't agree Other

If Not Considered changing majors:

What possible changes in your current major will lead you to reconsider? (Check all that apply)

More difficult curriculum Poor Professor/Instructor/Faculty Bad future job prospects Less school support for program/related research

Would you consider changing majors if there are no restrictions.

Yes No

Do you think the University should put more emphasis on major selection counseling?

Yes No

If you have any other comments regarding what the school can do to help you in exploring your interests please list them here:

If you do not wish to be contacted with further emails reminding non-respondents to take our survey, please provide us with your Andrew ID so we can place you on our do-not-contact list.