Does the Sequencing of Major Courses Influence Students Success?

Proposal for Learning Analytics Fellowship (2019)

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Abstract

My 2018 LA Fellow research subject is about the impact of major course sequencing on student success. The study did not detect any connection between early start of major courses to student academic success (defined as higher overall GPA, more credits earned and shorter time to graduate). The study has several limitations:

1. Only student academic success was evaluated. The relationship between student recruiting success and when to start the major courses was not explored due to time limit.
2. Students graduated with a degree in one of the five majors and co-majors offered by the Operations and Decision Technologies (ODT) Department were treated as homogeneous groups. Combinations of ODT majors and other majors were ignored. However, 83% of graduates with ODT degrees also earned other degrees. Major requirements from other majors and the course should not be overlooked when examining course selection considerations of students.
3. Kelley admits undergraduate students from two channels: directly from high school (direct admit) and from other IU schools or colleges (standard admit). The numbers of terms the two types of students need to spend in Kelley are different. The number of credits they earned prior to Kelley, their expectations and planning behaviors might also distinct as two groups. Treating both groups of students as a uniform entity in the analysis might have hidden meaningful patterns if they are studied separately.
4. The studied group of students were admitted from fall 2006 to spring 2018. Over the 12 years, the market condition and Kelley undergraduate class size have changed dramatically. Time series research on this topic might reveal major preference changes, major combination changes and major course starting time changes.
5. The study focused on the students already graduated and the degrees they acquired. No attention has been paid to whether there is any time lag between the declaration of majors and the first term when the major course is taken. Neither was it explored on the number of students dropped the majors after any major courses were taken. Findings on these issues might help predict course enrollment for the next term or next year.
6. The study excluded current students since their success is harder to define. Include them or study them as a separate group might reveal patterns that no longer exist in students graduated already.

I would like to continue my study of this data set and further explore majors, major combos, major course requirement, course sequencing and their impact on student success. The title of my research stays the same but I hope to expand the scope of my exploration on majors, major combos, major course requirements and student success.

Scope

The research will focus on the two technology majors and three technology co-majors offered by the ODT department in Kelley School of Business. The majors/co-majors and related courses are listed in the following table:

Major/Co-Major	Prerequisites	Course Number	Course Title
	K303/K304	P320	Supply Chain Management: Sourcing

Supply Chain Management	I-Core	P421	Supply Chain Management
	P320/P421	P429	Operations Processes
	P320/P422	P431	Logistics and Distribution
	P320/P423	P481	Supply Chain Planning and Analytics
Operations Management	K303/K304	P320	Supply Chain Management: Sourcing
	I-Core	P421	Supply Chain Management
	P320/P421	P429	Operations Processes
Information Systems	K303/K304	S302	Management Information Systems
	K303/K304	S307	Database Design and Management
	K303/K304	S305	Technology Infrastructure
	S302/S307	S310	Systems Analysis and Project Management
	S302/S307	S308/S428	Business Application Development
Technology Management	K303/K304	S302	Management Information Systems
	K303/K304	S307	Database Design and Management
	S302/S307	S310	Systems Analysis and Project Management
Business Analytics	K303/K304	K327	Deterministic Models in Operations Research
	K327	K353	Business Analytics and Modeling
	K353	G350	Business Econometrics
	G350	G492	Predictive Analytics for Business Strategy

Prerequisite course in green background are recommended but not required.

Previous Findings

Of all 10987 students graduated from Kelley (admitted between fall 2006 and spring 2018) with at least one ODT degree, majority of them did not start to take the first major course until the senior year (late starters). The percentage of late starters varies across majors. There are higher percentages of early starters for the two majors, but the percentages of late starters are still 62.8% and 70.4% respectively. The percentages of later starters are even higher for the three co-majors: 78.4%, 84% and 87.2% respectively. It is also found that a significant number of students started with more than one major courses. Again, the percentage varies by majors and co-majors. Around 60% of students in the two majors started with at least two major courses. Lower percentage of students in the three co-majors started with at least two major courses.

No connection could be established between early start of major courses and academic success as defined at the beginning of the summary. However, the cause of late start is clearly linked with course sequencing. The difference of the early starter percentages across different majors and co-majors is affected by the variations of course sequencing in the majors. The study indicated that the number of required courses and sequencing of courses could influence students' decision on when to start the major courses.

Data Needed

I will continue to use the data collected for the 2018 study. The data include Kelley students enrolled between fall 2006 and spring 2018. The following data points were provided:

Demographic information:

a. Gender

b. Ethnicity

c. Domestic or international

Academic information:

a. IU Admit Term
b. Primary program – Assuming this value should be BUS since they are all Kelley students
c. Direct admit or standard admit
d. Whether a student is a transferred student
e. Admission SAT, ACT score or high school GPA, high school ranking
f. For all the courses listed in the table above, get the following information:
    a. The term the course was taken
    b. Class standing at the time when the course was taken (both IU class standing and Kelley class standing if possible)
    c. Course grade earned
    d. Program accumulative GPA and IU accumulative GPA at the term the course was taken
    e. Number of credits completed entering the course
    f. Number of credits taking in the same term of the course
    g. All majors declared at the time when the course was taken
g. If the students have graduated, the term of graduation
h. If the students have graduated, the majors at graduation

Major change information:

For all students included in the data set, collect the following major information:

1. Major when they got admitted in Kelley (Admit term, majors)
2. When majors are changed, list the term majors changed and the new set of majors

Career outcome information:

For all students included in the data set, gather their full time and internship information collected by Kelley Undergraduate Career Service Office including offer acceptance or report date, position or title name, category, employer, Industry, salary, etc.

Research Plan

Definition of student success

In the 2018 study, 3 dimensions were used to measure student success:

1. Program GPA and IU Cumulative GPA at the time of graduation
2. Total credit hours completed at the time of graduation
3. Number of years to graduate

The following dimension will be added:

1. Job outcome, whether a student received a job offer and the salary offered if data exist
2. Number of credits earned per year to graduate
3. Number of majors/co-majors acquired at graduation

Data Analysis

Since the academic data have been cleaned and prepared already in 2018, most of data preparation work will be spent on the career outcome data and the possible integration of the two datasets. More time will be spent to explore and look for insights. The following work is planned

1. Add the career success dimension to the 2018 research
2. Add the other two academic success dimensions: number of majors acquired at graduate and number of Number of credits earned per year to graduate
3. Find top major combinations (for example, Accounting and Business analytics) based on the number of students in each major combo. Explore whether there is any connection between when students started ODT major course and student success.
    a. Some single major graduates were identified in the 2018 research, if they did not receive degrees from outside of Kelley, they will be true single ODT major graduates. Their success and course scheduling behavior could be studied separately, and the results could be compared with those of the major combos.
4. Separate Direct Admit and Standard Admit students into two groups. Analyze their major selections, major course scheduling behavior and their success. Compare the results of the two groups
5. Study the change of major combos over time and the course scheduling behavior over time.
6. Find if there are any patterns in when students declare and drop majors
    a. When is the term they settle on their majors. This is defined as the term the majors are the same as those of the graduate term
    b. Find the percentage of students taking major courses before they declare the major
    c. Find the percentage of students took major courses and dropped the major later
    d. Check if there is any relationship between when students declare their final majors and how long it takes them to graduate
    e. Check if there is any relationship between when student declare their final majors and when they accept offers.
7. Perform the same study on current students

Additional Exploration

If time and data permits, I would also like to explore the following:

1. For graduated students, calculate the GPA of their major courses. Compare major GPA with program and IU GPA by major. See if there is any significant difference
2. Check if GPA of major courses has higher predicative power on whether students can graduate within 4 years and on whether students can get a full-time job.
3. Check if there is any relationship between when students take their major courses (and how many major courses they take) and when they accept full time offers.
4. Check if settling on majors early and taking major courses early has higher predicting power on students graduating early and their career outcome.
5. Explore popular majors and major combinations of international vs. domestic students, male vs. female students. And the trend changes over time.
6. Business Analytics co-major has two optional course sequence recommendations. If the recommendations are followed, the course sequence chain will be long and the co-major will take longer to complete. I want to find out how many students followed the recommendation, whether those followed the recommendation started the major courses earlier. In addition, whether the students followed the recommendation are more successful than others.