Study Progression, Success and Program Component Selection

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This article evaluates some of the underlying assumptions of a data analytics initiative being undertaken at an Australian university, which provide student support staff with lists of students who have enrolled in program components (classes) different from the plan prescribed in the curriculum (e.g., out of sequence, not on the plan). This study was undertaken with the assumption that these 'inappropriate' enrolments might negatively impact student progression and success. The analysis suggests that student progression is significant negatively affected; in particular, students can be prevented from studying full-time, extending the time needed to complete their program. However, the impact on student success was found to be minimal. The findings help to demonstrate the impact of the data initiative, and the value of continuing and expanding its use into the future.

Keywords: Study success; course completion; data analytics; study support

Introduction

The role of universities, and of higher education in a global society is changing. Students are increasingly seeking higher education, and selecting programs of study as pathways to employment (Bhardwa, 2018). More and more students from a wide social economic spectrum are choosing to attend postsecondary education to prepare themselves for the global workforce. The growth in access and uptake of university education specifically, has conferred many benefits to growing numbers of students from a wide social spectrum, with data indicating that in Australia completion of a university degree increases the prospects of employability regardless of gender and level of achievement at entry to university (Marks, 2018). Students in greater diversity and numbers than ever before are seeking to enhance their global mobility, and to find and experience hands-on, authentic work placements integrated with their undergraduate study. They want to join an institution with a strong reputation and attendant opportunities to meet and work with creative business leaders, especially those who are the founders and executives of innovative companies and organizations that deliver positive social impacts via knowledge and innovation.

Students enter higher education institutions with a range of perceptions and expectations concerning university life, for example in terms of social aspects as well as in an institutional and educational context, including workload, access to academic staff, feedback, and support (Bailey, Gosper, Ifenthaler, Ware, & Kretzschmar, 2018). However, research shows a mismatch between students' perceptions and reality (Smith & Wertlieb, 2005). Furthermore, research indicates that many students do not know what is expected of them at university and that they are often academically unprepared (Mah & Ifenthaler, 2017; McCarthy & Kuh, 2006). Students' preparedness is particularly relevant with regard to generic skills such as academic competencies (e.g., time management, learning skills, technology proficiency, self-monitoring, and research skills), which they are supposed to already possess when entering university (Barrie, 2007). Students are also expected to follow a specific pathway in a program (i.e., degree) at a university. They will often have an amount of flexibility of what, when, and how to complete the courses (i.e., components, units, or subjects) that comprise the program. However, this freedom and flexibility of choice can also result in dropout (Tinto, 2005).

This paper aims to examine the impact of student choices of course enrolment on their success in the program (measured in terms of pass rate, grades/marks, and program retention/drop-out rate). Specifically, this study examined a selection of programs at an Australian university, for students who, in their first semester of study, selected courses which were not recommended to be studied until a subsequent semester.

Background

Literature Review

Research on study success has produced a broad conceptual understanding of the construct and related terms such as retention, persistence or graduation (Mah, 2016; Tinto, 1997). According to Sarrico (2018), study success can

be conceptualized as the successful completion of a program. Opposing terms for a lack of success include withdrawal, dropout, non-completion, attrition and failure. Hence, the essence of the construct 'study success' is to capture any positive learning satisfaction, improvement or experience during learning.

Educational data mining and analytics show promise to enhance study success in higher education (Berland, Baker, & Bilkstein, 2014; Pistilli & Arnold, 2010). For example, students often enter higher education academically unprepared and with unrealistic perceptions and expectations of academic competencies for their studies (Ifenthaler & Mah, 2017). Both, the inability to cope with academic requirements as well as unrealistic perceptions and expectations of university life, in particular with regard to academic competencies and management of following a specific study pathway, are important factors for leaving the institution prior to degree completion (Mah, 2016).

Context

Compared to many other institutions, most programs at the University typically have a relatively fixed structure, with not much choice between which courses students can select. Programs generally have only a handful of 'elective' courses (selected any course from the University they meet the pre-requisites for), or 'optional' or 'alternate core' courses (selected from a pre-defined list) available for selection in each program. The courses in each program are also typically designed to be done in a specified order, and where there are elective, optional, or alternate core courses available, these are generally intended to be selected at particular points in the program. Other institutions, with a less structured, or more flexible programs, may find less value in an initiative such as this one.

The Learning and Teaching Analytics team at the university have operationalised a dataset which includes a list of students with 'inappropriate enrolments', that is, students with at least one enrolled course that is not intended to be studied until a subsequent semester of study. This dataset is provided to directors of student engagement, program coordinators, and student services staff for review who contact students as appropriate, where there are concerns. The dataset was well received in the initial pilot in Semester 1, 2019, with several cases where, based on this list, students were advised to change their enrolments prior to the start of classes. One program coordinator stated that the dataset was "Very useful for identifying students incorrectly enrolled" and "all were incorrectly enrolled (so what a neat report that is!!)".

Due to the success of the initiative in 2019 Semester 1, it is being continued and expanded into 2019 Semester 2 and onwards. However, at present, there is only anecdotal evidence that students having 'inappropriate enrolments' negatively impacts their progress and success. This paper aimed to find empirical evidence of this claim, to help encourage the uptake and expansion in the initiative.

Inappropriate Enrolments

There are several reasons to suspect that students having 'inappropriate' enrolments at the university may negatively impact their success. Some of issues it can cause (which varies depending on individual circumstances) are:
- Students may not have the intended 'scaffolding' intended by the program designers, i.e. they may study a course without having the intended background knowledge on a subject.
- Students will be more likely to have class timetable clashes (tutorials, lecture, laboratories, workshops etc.) preventing them from attending all their classes.
- Students may require more time complete to their program, as not all courses are available every semester.

Methodology

Research questions

For this analysis, an 'inappropriate' enrolment is defined as occurring when a student in their first semester of study, attempts a course (unit) two or more semesters earlier than prescribed in their program's curriculum.

To formalise the objective of this paper, the following research questions have been formulated:
- **Research Question 1:** Are students with an inappropriate enrolment in their first semester of study, less likely to pass courses studied in their subsequent two semesters, compared to students with no inappropriate enrolments?

- **Research Question 2:** Do students with an inappropriate enrolment in their first semester of study, have lower marks on average, for courses studied in their subsequent two semesters of study, compared to students with no inappropriate enrolments?
- **Research Question 3:** Do students with an inappropriate enrolment in their first semester of study, attempt fewer credit points in their subsequent two semesters, compared to students with no inappropriate enrolments?

To summarise, research question 1 aims to determine whether inappropriate enrolments impacts pass rate, research question 2 to aims to determine whether inappropriate enrolments impact average marks, and research question 3 aims to determine whether inappropriate enrolments impact the number of credits attempted. For the purpose of this analysis, an 'early withdrawal' from a course counts as the student having not attempted it.

Scope

To control for potential confounding factors, the research questions were investigated only for students who met all the criteria in Table 1.

Table 1: Student Inclusion Criteria

Student Criteria	Rationale
Started their program attempt in semester one of: 2015, 2016, 2017, or 2018.	Four years of data increases the sample size. Students who start their program are more likely to have non-standard study plans, which could complicate the analysis.
Studied a full-time load (100 credit points) in their first semester of study.	Focusing on students who studied full-time, excludes students who might have withdrawn early from some of their subjects, which the researchers do not have data for at present.
Passed all courses attempted in their first semester of study.	Limiting to students who passed all their courses in their first semester of study, controls for the expectation that students who did not pass all their courses, may choose to study fewer courses in their subsequent semesters, not as a result of an inappropriate enrolment.
Studied one of four specific undergraduate programs known to have a relatively large number of students with inappropriate enrolments.	Programs can be very different from each other, and the impact of inappropriate enrolments could be very different in different programs. Focusing on four large programs which were found to have large numbers of inappropriate enrolments, helps to control for this.
Were new to program and have not been granted any exemptions from studying courses.	Students with exemption will have fewer credits to complete, which would skew the results.
Were only studying one program at the university in their first semester of study.	In the usual cases where students study more than one program, the number of credits studied in each program in each semester are likely to be non-standard and would skew results.

A total of 3930* students met the above criteria. Of these, 3713* had no inappropriate enrolment (control group) and 217* had at least one inappropriate enrolment. *Students who started multiple programs during 2015-2018 and met the criteria in Table for each program, can be counted multiple times.

Results

Research Question 1: Are students with an inappropriate enrolment in their first semester of study, less likely to pass courses studied in their subsequent two semesters, compared to students with no inappropriate enrolments?

An independent samples t-test was performed comparing the mean course pass rate of the control group students and the inappropriate enrolment students. As predicted, the inappropriate enrolment students ($M = 86.1\%$, $SD = 22.6$, $N = 180^*$) had a lower pass rate than the control group students ($M = 89.0\%$, SD = 21.8, $N = 3439^*$), $t(3617) = 1.668$, $p = 0.0841$, two tailed.

The difference in the mean pass rate of 2.9pp is not quite significant enough (at a 5% significance threshold) to support the prediction that students with an inappropriate enrolment are less likely to pass the courses they attempt.

*274 control group students and 37 inappropriate enrolment students did not attempt any credits in the subsequent two semesters and hence, were excluded from the calculation, as no pass rate can be determined.

Research Question 2: Do students with an inappropriate enrolment in their first semester of study, have lower marks on average, for courses studied in their subsequent two semesters of study, compared to students with no inappropriate enrolments?

An independent samples t-test was performed comparing the mean weighted mark of the control group students and the inappropriate enrolment students. Contrary to expectations, the inappropriate students ($M = 65.5$, $SD = 11.7$, $N = 179*$) had roughly the same average mark as the control group students ($M = 65.5$, $SD = 11.4$, $N = 3405*$), $t(3582) = 0.0024$, $p = 0.9980$, two tailed. The difference of 0.0 marks was not significant.

*308 control group students and 38 inappropriate enrolment students did not subsequently get any mark, hence are excluded from the analysis. An average mark cannot be calculated for these students.

Research Question 3: Do students with an inappropriate enrolment in their first semester of study, attempt fewer credit points in their subsequent two semesters, compared to students with no inappropriate enrolments?

An independent samples t-test was performed comparing the mean number of credits attempted by the control group students and the inappropriate enrolment students. As predicted, the inappropriate enrolment students ($M = 135.8$, $SD = 75.2$, $N = 217$) attempted fewer credits than the inappropriate students ($M = 168.2$, $SD = 58.8$, $N = 3713$), $t(3928) = 7.7418$, $p < 0.0001$, two tailed.

The difference of 32.4 credit points studied is highly statistically significant ($p <= 0.0001$) and supports the prediction that students with an inappropriate enrolment, attempt fewer credits in subsequent semesters. A typical course at the University is worth 25 credit points, meaning on average, students attempt at least one less unit. 32.4 credit points is 16.2% of the typical maximum number of credits that can be studied over two semesters (200 credits) and represents a significant negative impact to student progression and potential loss to the University.

Discussion and Conclusion

Student retention in higher education has been a global concern for years, as withdrawals from higher education remain at about 30% in the member countries of the Organisation for Economic Cooperation and Development (OECD, 2013). The first year of higher education is considered particularly crucial, as students often decide within this period to leave the institution, prior to degree completion (Mah & Ifenthaler, 2018). Recently, higher education institutions have gained interest in educational technologies, which have the potential to enhance student retention. Educational data mining and learning analytics show promise to support students throughout their higher education journey (Berland et al., 2014).

The most significant finding from this analysis is the fact that although there was not a significant difference in average marks, and only a small difference in pass rate, there was a highly significant difference in the number of credits that students attempted in subsequent semesters. This analysis does not conclude a causal link; however, it does suggest that inappropriate enrolments are preventing students from being able to study full-time and hence requiring them to take longer to complete their program. This is even more notable given the two groups of students performed similarly well in the courses they did attempt. This finding helps to demonstrate the value of the dataset provided by the analytics team to the university and quantifying it (avg. ~32 fewer credits studied in the subsequent two semesters), helps to measure its impact. The possible actions that could be taken on this this issue include providing clearer information/counselling to students in selecting courses, so they can make better informed choices about their learning pathways (Bailey et al., 2018).

Clearly, the current data analytics strategy can be considered as an advanced offering of academic support services. In addition to other study support, for example summer bridge programs, first-year seminars, or mentoring programs (Padgett, Keup, & Pascarella, 2013), the data analytic strategy can be expanded as an (semi-) automated student self-service feature and can be expanded into a larger data analytics initiative at the university.

One major aspect missing from this analysis is the rate of early withdrawals (students withdrawing before the cutoff date for fees). Due to limitations of the current data, this was not able to be investigated. Inclusion of early withdrawal data is planned for future analyses and is expected to further increase the significance of the findings.

Acknowledgements

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