Work in Progress: Comparing Metrics of Student Success Across Academic Fields

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Abstract* — Multiple stakeholders are interested in measuring undergraduate student success in college across academic fields. Different metrics might appeal to different stakeholders. Some metrics such as the fraction of first-time, full-time students who start in the fall who graduate within six years, the graduation rate, are federally mandated by the U.S. Department of Education, Integrated Postsecondary Education Data System (IPEDS). We argue that this calculation of graduation rate is inherently problematic because it excludes up to 60% of students who transfer into an institution, enroll part-time, or enroll in terms other than the fall. By expanding the starters definition, we propose a graduation rate definition that includes conventionally excluded students and provides information on progression in a specific program. Stickiness is an even more-inclusive alternative, measuring a program's success in graduating all undergraduates ever enrolled in the program. In this work, programs are grouped into six academic fields: Arts and Humanities, Business, Engineering, Other, Social Sciences, and STM (Science, Technology, and Mathematics. Stickiness is the percentage of students who ever enroll in an academic field that graduate in the same field. We use the Multiple Institution Dataset for Investigating Engineering Longitudinal Development (MIDFIELD) 2023 which contains unit-record data for over 2 million individual students at 19 institutions. For the academic fields studied, Engineering has the highest graduation rate and third highest stickiness. Social Sciences and Business also have higher graduation rates and stickiness than the other fields. We also track the relative fraction of students migrating to and from each academic field. This paper continues our work to derive better metrics for understanding student success.

Keywords— graduation rate; stickiness; student outcomes; diversity; MIDFIELD

I. Introduction

When comparing metrics of student success across academic fields, it is important to consider that success can be defined and measured in various ways. Some common metrics that are often used to evaluate student success include retention, graduation rate, and stickiness. College retention rates refer to the percentage of students who continue their education at specific time frames, such as the first year or the first semester. These rates are tied to specific cohorts of students and usually only include first-time in college (FTIC), full-time students.

Graduation rates measure the percentage of degree-seeking students who complete their degree programs within a specified time frame. They provide an indication of a field's ability to retain and graduate students. Graduation rates can be measured based on different time frames. Some rates consider the completion of a bachelor's degree within four years, while others include a longer period, such as six years [1]. The standard period defined by the US Department of Education's Integrated Postsecondary Education Data System for a four-year degree is 6-years [2].

We argue that typical first-year retention rates and six-year graduation rates are problematic because they only include cohorts of students who started college as first-time, full-time students, excluding up to 60% of students who transfer into the institution or migrate between majors [3]. Many of the IPEDS exclusions relate to how starters are defined. By expanding the starters definition, we propose a graduation rate definition that includes all conventionally excluded students except migrators.

Stickiness [4,5] is a more-inclusive alternative to six-year graduation rate as a measure of a program's success in attracting, keeping, and graduating their undergraduates. All students excluded by a conventional graduation rate metric—including migrators and transfers—are included in the stickiness metric.

A. Prior Research on Student Success

The study of college student success has a long history, with research efforts dating back decades. The focus on graduation rates emerged as an important area of study due to its relevance to educational attainment, workforce development, and social mobility. Researchers began examining college completion rates and their implications. These studies primarily focused on descriptive analyses, providing basic statistics on graduation rates [6, 7, 8, 9], and identifying factors that influenced student success, such as socioeconomic background, race, student attitudes, and academic preparation [10, 11]. In the 1980s, the U.S. federal government began to take a more active interest in college graduation rates. The National Center for Education Statistics (NCES) started collecting and reporting data on graduation rates at the institutional level through the Integrated Postsecondary Education Data System (IPEDS) [12, 13].

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Longitudinal studies allow for a deeper understanding of the factors that contribute to college completion, including academic performance, financial aid, student engagement, and institutional characteristics. Studies of student success are best performed using longitudinal datasets, but these are rarely available. Most studies rely on cross-sectional data or on the construction of synthetic cohorts to model outcomes over time, yielding results that can be challenging to interpret. These approximations are not necessary in research using MIDFIELD.

B. Our Research Question

This work-in-progress is a descriptive longitudinal study. Our research question is: "How do six-year graduation rates, stickiness, and migration to other fields compare between academic fields?"

II. Methods

A. MIDFIELD Data

We use the Multiple Institution Dataset for Investigating Engineering Longitudinal Development (MIDFIELD) for this research. Specifically, this study uses MIDFIELD 2023, which contains unit-record data for 2,135,484 individual students at 19 institutions across the USA providing up to 35 years of student records. MIDFIELD 2023 is less engineering-centered than the original MIDFIELD making it better suited to study non-engineering disciplines. This rich longitudinal dataset is large enough to permit disaggregation by multiple categories such as race/ethnicity, sex, and program. Such disaggregation is particularly important for conducting intersectional analyses and investigating small, underrepresented populations. Research with MIDFIELD has enabled impactful and award-winning research. For examples, see [16, 17].

B. Definitions

Academic majors in MIDFIELD are divided into six academic fields: (Arts and Humanities, Business, Engineering, Other, Social Sciences, and Science, Technology, and Mathematics) as seen in Table I. This avoids the complexity of comparing all possible majors and facilitates a wide comparison.

Six-year graduation rate is a ratio of degree-seeking undergraduates who complete their program in a timely manner (typically 6 years). The American Council on Education estimates that the conventional definition of graduation rate may exclude up to 60% of students at 4-year institutions [18]. MIDFIELD includes students who attend college part-time, who transfer between institutions, and who start in any term. students who transferred or migrated into the field, and full- and part-time students. Those students are included in this study.

Stickiness is a more-inclusive alternative to graduation rate as a measure of a program's success in attracting, keeping, and graduating their undergraduates. All students excluded by a conventional graduation rate metric—including migrators—are included in the stickiness metric [4]. Stickiness is the ratio of the number of graduates of a program to the number ever enrolled in the program.

TABLE I. Majors in Academic Fields

Academic Field	Majors in Field
Arts & Humanities	History; Communications, Journalism and Related Programs; Communication Technologies and Support Services; Foreign Languages, Literature and Linguistics; Law, Legal Services and Legal Studies; Liberal Arts and Sciences; General Studies and Humanities; Multi/Interdisciplinary Studies; Philosophy and religion; Theological Studies and Religious Vocations; Visual and Performing Arts.
Business	Business, Economics, Management, Marketing and Related Support Services.
Engineering	Engineering.
Other	Natural Resources and Conservation; Engineering Technology; Family and Consumer Sciences/Human Studies; Library Science; Military Technologies; Parks, Recreation, Leisure, and Fitness Studies; Science Technologies/Technicians; Construction Trades; Mechanic and Repair Technology; Precision Production Trades; Health Professions and Related Clinical Sciences.
Science, Technology, Mathematics	Agriculture, Agricultural Operations and Related Sciences; Architecture and related Services; Biological and Biomedical Sciences; Mathematics and Statistics; Computer Sciences; Physical Sciences.
Social Sciences	Area, Ethnic, Cultural and Gender Studies; Education; Political Science; Psychology; Protective Services; Public Administration and Services; Social Sciences.
Not included	Basic Skills; Citizenship Activities; Health-related Knowledge and Skills; Interpersonal and Social Skills; Leisure and Recreation Activities; Personal Awareness and Self-improvement; Dental, Medical and Veterinary Residency Programs

C. Procedure

The time span (or range) of MIDFIELD data varies by institution. At the upper and lower limits of a data range, a potential for false counts exists when a metric (such as graduation rate) requires knowledge of timely degree completion. For such metrics, student records that produce problematic results due to insufficient data are excluded from this study.

Only students with timely completion are included in this study. Six-year graduation rates and stickiness were calculated. The first field a student declared and the field in which a student graduated were captured. Those variables complete the data necessary for this analysis.

III. Findings

A. Six-year graduation rates

Fig. 1 shows the six-year graduation rates of the academic fields as open circles. Engineering has the highest 6-year graduation rate. Of the students who started in engineering, 53%. graduated in six years. Social Sciences is second with a six-year graduation rate of 51%. Business graduated 49% of students who started in Business within six years. Other and Science, Technology and Math graduated students who started in those fields at 43% and 47%. Only 29% of students who start in Arts & Humanities graduated in Arts & Humanities in six years.

B. Stickiness

Fig. 1 also shows stickiness in the field as filled circles. Social Sciences has the highest rate of stickiness at 59% and is clustered with Business and Engineering at 58% and 57%, respectively. Arts & Humanities has the lowest stickiness at 34%, meaning, that of the students who ever declare Arts & Humanities, 66% did not graduate in Arts & Humanities. Note that these students could have graduated in another field.

C. In what fields did students who graduate within six years start?

Table II shows in which fields students who graduated within six yeas started. This table only includes students who graduated within six years. The shaded boxes indicate students who started in a field and graduated in that field. The bottom line (All) indicates the percentage of students who graduated in that field divided by the total number of students who grated within six years. Reading down the column, Arts & Humanities gained 48.3% of its graduates from other fields, since only 51.7% of students who started in Arts & Humanities started in Arts & Humanities. Fields with higher percentages were more restrictive for students entering the field since they graduated more students who started in the field. 78.3% of engineering graduates started in engineering.

D. In what fields did students who started in a field graduate within six years?

Table III shows in which field did students who started in a field graduate within six years. This table only includes students who graduated within six years. The shaded boxes indicate students who graduated within six years in a field and started in that field. The right column (Total) indicates the percentage of students who started in that field divided by the total number of students who grated within six years. Reading across the rows, only 50.8% who graduated in Social Sciences started in Social Sciences. Social Sciences pulls 23.0% of their graduates from Arts & Humanities. Engineering graduates the fewest students who started in other fields. 87.2% of students who graduate in engineering started in engineering.

Earlier research has shown that engineering is particularly distinct from other groups of majors in that it attracts very few students after matriculation [19]. Other research [20] suggests that the most likely explanation is that the structure of engineering curricula generally requires a commitment prior to enrolling in college including targeted high school preparation.

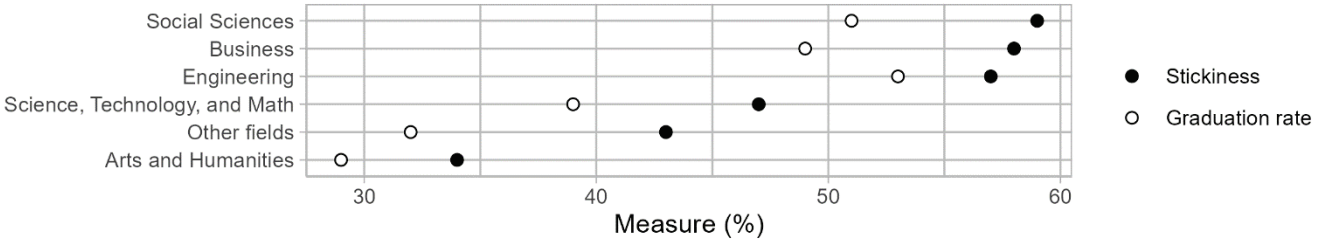

Fig. 1. Six-year graduation and stickiness by field

TABLE II. In what fields did students who graduate within six years start? Read down the column.

Starting Academic Field	Degree Field					
	Arts & Humanities	Business	Engineering	Other	Science, Technology, Mathematics	Social Sciences
Arts & Humanities	51.7%	10.2%	3.6%	5.5%	9.0%	20.0%
Business	4.7%	82.6%	0.7%	2.8%	2.3%	6.9%
Engineering	2.1%	5.1%	78.3%	1.9%	9.3%	3.4%
Other	4.1%	4.4%	0.8%	78.0%	4.7%	7.9%
Science, Technology, Mathematics	6.4%	8.0%	3.9%	4.6%	67.3%	9.7%
Social Sciences	9.5%	5.0%	0.4%	3.8%	2.8%	78.5%
Undeclared	20.9%	19.1%	6.5%	11.2%	15.3%	27.0%
% of All Degrees	17.1%	17.3%	16.3%	11.6%	17.3%	20.5%

TABLE III. OF STUDENTS STARTING IN EACH FIELD WHO GRADUATED WITHIN SIX YEARS, WHERE DID THEY GRADUATE? READ ACROSS THE ROW.

Starting Academic Field	Degree Field						
	Arts & Humanities	Business	Engineering	Other	Science, Technology, Mathematics	Social Sciences	Total
Arts & Humanities	71.4%	14.0%	5.2%	11.3%	12.3%	23.0%	23.6%
Business	3.5%	60.3%	0.5%	3.1%	1.7%	4.2%	12.6%
Engineering	2.2%	5.4%	87.2%	2.9%	9.7%	3.0%	18.1%
Other	2.4%	2.5%	0.5%	66.3%	2.7%	3.8%	9.8%
Science, Technology, Mathematics	6.4%	7.9%	4.1%	6.8%	66.6%	8.1%	17.1%
Social Sciences	7.4%	3.8%	0.3%	4.4%	2.1%	50.8%	13.3%
Undeclared	6.7%	6.1%	2.2%	5.3%	4.9%	7.2%	5.5%

IV. CONCLUDING DISCUSSION AND NEXT STEPS IN RESEARCH

This paper is a first step in our continued work in examining different methods to analyze student records and to derive better metrics for understanding student success in college. The next step in this line of research is to disaggregate the data by race and gender. This will allow us to conduct a more meaningful analysis of six-year graduation rate and stickiness for undergraduate students.

In particular, this paper aims to reignite the cross-disciplinary use of MIDFIELD as a data resource. Much of the work using MIDFIELD has viewed the data through an engineering lens, yet researchers from other fields have used the data to study those fields – and use research techniques typical to those fields, bringing an ever-richer set of research traditions to explore student pathways.

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