Three Analytical Approaches to Understanding Transfer Students and Their Success

Nathan Greenstein, Claire Matese, and Julie Wren

Three Analytical Approaches to Understanding Transfer Students and Their Success

Our Institution and the Transfer Population

The University of Oregon (UO) is a large, public, R1 research institution. The university enrolls approximately 22,000 students annually with undergraduate students comprising over 80% of the student population. This current figure represents a steady decline since Fall 2012 when UO had its peak total enrollment and peak undergraduate enrollment, 24,591 and 20,829, respectively. Despite these declining numbers, first-time students have been enrolling at record rates with the highest number of first-time, full-time students enrolling in Fall 2021 (N=4,525). Coupled with this rise is the loss of transfer students; transfer student enrollment has dropped 35 percent from 4,589 in Fall 2010 to 2,955 in Fall 2021. Despite this loss, transfer students continue to experience similar levels of academic success; full-time transfer students continue to graduate at rates similar to first-time, fulltime students. The current three-year graduation rate for transfer students is 61.3% which matches the four-year graduation rate of first-time, full-time students. Additionally, both full-time, first-time and full-time transfer students have similar 6-year graduation rates, ranging from 70% to 76% across the past six cohorts. Although transfer students have experienced success at the university, community college transfer has been a rising concern across the state.

Our Unit and Our Work

The Academic Data Analytics unit at UO is a recent investment in student success. In January 2021, the unit was formed to provide data-driven decision-making into the hands of stakeholders at the University of Oregon, while building a body of research that can be generalized to other higher education institutions. The unit emphasizes research on student and faculty success in a variety of research areas and technical methods. We envision the unit as one that pushes the boundaries of what is possible in higher education research, through the exploration of machine learning and other advanced methods of analysis. The goal is to use these techniques to more efficiently distribute resources (in predicting student success), determining what the main issues are (in using text analytics), and to uncover any issues that are a hindrance to student success (in focusing on a specific subgroup of students or their paths to graduation). We invite you to learn more about our work here: https://provost.uoregon.edu/analytics.

This three-part analysis aims to provide a deeper understanding of the transfer student population by leveraging existing university data through three distinct methods: a descriptive academic report, a dynamic data dashboard, and exploratory machine learning. Our aims for sharing this information out to our peers is not to provide an exhaustive explanation of our institutional nuances, but to describe how and why we undertook this work, and how the three analytical approaches fit together.

Part One: The Transfer Landscape Report
What did we find?

The data demonstrated that transfer enrollment at the University of Oregon is declining with little evidence that the trend will reverse itself without intervention. Data show that this decline is not simply a function of lower community college enrollment, but it is a complex interplay of the loss of the international student population, more competition within the transfer landscape, and overall, less interest in the institution as a transfer destination. Although transfer students are fewer in number, they remain successful at the institution and contribute to the overall fiscal health and the diversity of the campus. Further, a stable transfer population communicates an institutional commitment to Oregon and its people.

Challenges/Opportunities

Although this paper included data and insights that were previously available to institutional leaders, it was the first time that these data were pulled together to allow a more comprehensive understanding of the transfer population. There were many difficulties in synthesizing the data, including (1) sourcing transfer population data for other four-year institutions; (2)

consistently defining a degree-seeking population at two-year partner institutions; and (3) a lack of information about transfer student preferences that potentially drive their enrollment decisions (e.g. availability of specific disciplines and/or online programs). However, the results allowed campus stakeholders to better understand where the university sits within the landscape, and helped to chart a path forward both for campus action and for future research.

Part Two: The Transfer Dashboard
What did we find?
While still in development, early versions of the Transfer Time to Degree dashboard have already yielded many insights. For example, a student entering with freshman standing takes an average of 3.78 years to earn a degree. By comparison, a student entering with senior standing takes an average of 2.42 years – a difference of only 1.36 years. In addition, even after controlling for class standing at matriculation we see an extended time-to-degree for (a) students who transfer in from two-year institutions, (b) students receiving Pell grants, and (c) resident students, with significant overlap in these populations. Each of these suggests the need for additional discussions of both policy and curriculum, which will help inform future research.

Challenges/Opportunities
Engaging in this analysis highlighted the limits of our institutional data systems, particularly with regard to a comprehensive degree audit system. Transfer students' academic progress is highly variable and can shift unexpectedly when coursework is transferred in belatedly or when current coursework conflicts with previous coursework. We tried to address these limitations by working with cohorts of recent graduates, but informational gaps remained. However we are excited by the opportunities created by shifting from the format of a written research paper to that of a dashboard. This choice was initially driven by the dynamic nature of our inquiries, which was more than could ever be conveyed in a static paper. However the dashboard will be of use both internally to inform future research, and as a tool to drive transformational conversations with campus constituents and our institutional partners.

Part Three: Exploring Machine Learning for Transfer Student Success
Machine learning (ML) can extract meaning from data that is too complex for human eyes or traditional mathematical models to grasp. Applied thoughtfully, ML can help educational institutions take action proactively, rather than reactively, to support student success. However, the complexity that gives ML its power means that high-performing ML models tend to have less explanatory utility than their simpler, lower-performing counterparts. Our roundtable session discusses this tradeoff and, more broadly, the process of determining how suitable ML is to a given need. The following table, to be referenced during discussion, contains an illustration of the type of explanatory output produced by three modeling strategies. Note that the models used in this discussion are proofs of concept for illustrative purposes only.

Linear Regression (Simple)		Linear Rule Regression (Balanced)		XGBoost (Performant)		
Feature	ΔTTD	Rule	ΔTTD		Feature	ΔR^2
+ Variable A	1.10	+ Variable B <= 1.5	1.48	1	Variable B	0.38
+ Variable B	0.65	+ Variable A is True	1.26	2	Variable D	0.33
+ Variable C	0.22	+ Variable G <= 0.36	0.23	3	Variable A	0.25
- Variable D	-1.40	- Variable D >= -0.84	-0.25	4	Variable J	0.17
- Variable E	-0.77	- Variable H is True	-0.17	5	Variable G	0.10
- Variable F	-0.36	- Variable E <= 0.59	-0.16	6	Variable K	0.06

APPENDIX: Variables Used in Preliminary Predictive Model
Exploring Machine Learning for Transfer Student Success

Machine learning (ML) can extract meaning from data that is too complex for human eyes or traditional mathematical models to grasp. Applied thoughtfully, ML can help educational institutions take action proactively, rather than reactively, to support student success. However, the complexity that gives ML its power means that high-performing ML models tend to have less explanatory utility than their simpler, lower-performing counterparts. Our roundtable session discusses this tradeoff and, more broadly, the process of determining how suitable ML is to a given need.

The following list, to be referenced during discussion, contains a list of variables included in our preliminary predictive model. The model is designed to be used at the end of a transfer student's first term ("T1") at the University of Oregon, and it aims to predict how much more or less time than expected the student would require to graduate, absent intervention. Note that the model used in this discussion is a work in progress, and the list of variables used in future versions of the model may change. Variables are presented in no particular order.

- Entry year
- Entry term season (F/W/S/X)
- Gender
- Oregon residency
- Race
- Ethnicity
- First-generation status
- Age as of T1 at UO
- Class standing (Fr/So/Jr/Sr) as of T1 at UO
- Transfer GPA
- Transfer credits earned
- Varsity athlete status
- Transfer hours as of T1 at UO
- AP and/or IB credits
- Major as of T1 at UO
- Number of majors as of T1 at UO
- Department as of T1 at UO
- School as of T1 at UO
- Whether major changed between UO admit and end of T1 at UO
- Fraction of total transfer hours deducted
- Ratio of AP/IB credits to transfer credits
- Pell eligibility
- Financial aid amounts, by source
- Whether student applied for financial aid
- Total financial aid
- Ratio of grant financial aid to loan/work financial aid
- Ratio of government financial aid to institutional financial aid
- Previous institution number of credits
- Previous institution number of terms enrolled
- Whether previous institution was OR community college
- Whether previous institution was in OR Univ System
- Whether previous institution was other OR university
- Whether previous institution was two-year
- Sector of previous institution
- State of previous institution
- Whether student's most recent previous institution differed from previous institution where they received the most credits
- Season of last term at previous institution
- Time elapsed between last term at previous institution and first term at UO
- Degree(s) transferred in
- Number of degrees transferred in
- Number of credits earned during T1 at UO
- Ratio of credits earned during T1 at UO to credits attempted during T1 at UO
- GPA during T1 at UO
- Number of D/F/N/Ws during T1 at UO
- Whether student took any incompletes during T1 at UO
- Number of courses taken as pass/fail during T1 at UO
- Overlap between subject of student's T1 courses at UO and their major
- Overlap between subject of student's T1 courses at UO and their minor
- Whether any of student's T1 courses at UO satisfy general education requirements
- Which general education requirements student satisfied at time of transfer
- Whether student satisfied all general education requirements at time of transfer
- Ratio of student's GPA during T1 at UO to student's transfer GP

ACADEMIC DATA ANALYTICS

Driving Student & Faculty Success with Data

The Academic Data Analytics unit is designed to provide data-driven decision-making into the hands of stakeholders at the University of Oregon, while building a body of research that can be generalized to other higher education institutions. The unit emphasizes research on student and faculty success in a variety of research areas and technical methods.

We envision the unit as one that pushes the boundaries of what is possible in higher education research, through the exploration of machine learning and other advanced methods of analysis. The goal is to use these techniques to more efficiently distribute resources (in predicting student success), determining what the main issues are (in using text analytics), and to uncover any issues that are a hindrance to student success (in focusing on a specific subgroup of students or their paths to graduation).

Scan the barcode to visit the ADA site for more on our work to understand transfer students and predict student success

provost.uoregon.edu/analytics
ngreenst@uoregon.edu