Using Cohort-Based Analytics to Better Understand Student Progress

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Leveraging Cohort-Based Analytics for In-Depth Exploration of Student Progress in Engineering Programs

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Abstract

Engineering programs are typically among the most tightly prescribed programs within the academic landscape on any university campus. The strict nature of these programs often results in students taking more credits than stipulated, thereby leaving them struggling to graduate in a timely manner. The ability to identify potential blockers or challenges in an engineering program's curriculum is vital to student success and the promotion of on-time graduation. This paper provides a comprehensive examination of patterns and trends observed by a newly developed cohort tracking analytics platform. This platform provides analyses over a cohort of students which uncovers insights that are not easily identified when only looking at data at the individual student level. The analysis pinpoints courses that many students within the cohort have taken that are not applicable to the degree, along with the reasons why these courses are not applicable. It also identifies trends in courses that must be repeated by a significant portion of the cohort. It examines the courses constituting a program's degree requirements that have yielded both the best and worst grade value outcomes. In addition, an exploration of a cohort's efficiency of credit hour production is provided for both the home institution units and transfer units, which shows where credits are not aligning with degree requirements and therefore not counting towards degree completion. Finally, a comparative analysis of programs within the engineering field is performed as well as a comparison of engineering programs to non-engineering programs. This type of analysis demonstrates the differences in how students in engineering programs make progress towards their degree completion. The statistical analyses furnished by this platform provide administrators with an evidence-based foundation to support programmatic modifications and enhancements. This allows administrators to depart from the past practices of having to rely on anecdotal evidence and individual experiences. The empirical information from this platform assists advisors in aiding students in creating academic plans that provide students with the best chance for success while maximizing their credit hour efficiency. In this paper, the architecture and the visual display of the cohort tracking analytics platform are briefly discussed. Then we pivot to focus on the results of the analyses, comparing and contrasting three groups that consist of engineering disciplines within a department, departments within engineering colleges, and engineering colleges to other colleges at the institution. We conclude with a discussion of the potential actionable changes dictated by these results.

Keywords: progress analytics, student success, learning analytics, program curriculum, engineering curriculum, educational data mining

Introduction

In higher education, it is crucial for engineering students to not only finish their degrees, but to finish them on time. This urgency comes from global challenges, like those outlined in the United Nations Sustainable Development Goals,[1] where engineering will play a key role in addressing important issues.[2] Timely graduation in engineering is not only vital for individual success but also contributes to broader societal achievements in the engineering field.[3–5] However, despite the demand for skilled engineers, only 6.1% of degrees awarded in 2021 were in engineering disciplines.[6]

Concerningly, only 33% of students in engineering programs complete their degrees within the typical four-year time-frame.[7] This percentage increases to roughly 60% graduating in a six-year time-frame.[4,7] Recognizing that only three out of ten students graduate in four years, and that one in four students will fail to complete a degree after six years,[8] emphasizes the need for institutions to actively improve the support systems for engineering students.[9] The strict nature of engineering programs, combined with research findings that show four-year graduation rates decrease with increasing curricular complexity, make understanding student progress towards degree completion fundamental.[10] To address this, a comprehensive analysis of current engineering student cohorts is necessary, exploring how they progress towards their degrees and identifying potential obstacles to a timely graduation. This examination involves delving into the subtleties of engineering programs, requiring a data-driven approach to understand patterns and trends within groups. In the past, this type of analysis would have been a painstaking and labor-intensive endeavor. However, with the aid of a newly developed cohort analytics platform a complete analysis can be accomplished in a short time with minimal effort.[11]

Combining an understanding of the unique dynamics of engineering education with actionable data insights allows institutions to create targeted strategies. These strategies aim not only to overcome identified obstacles but also to promote resilience and success among engineering students, aligning with the educational objectives crucial to the engineering field. In the dynamic landscape of engineering education, a commitment to innovation and research-driven interventions is essential for reshaping the narrative of engineering student learning and achievement. This paper begins by briefly discussing the architecture of a newly developed cohort tracking analytics platform used to conduct the analysis. The focus will then shift to an in-depth analysis, comparing three distinct cohorts within the engineering domain: engineering disciplines within the engineering college, engineering disciplines to disciplines in other colleges, and the engineering college compared to other colleges within the institution. The discussion concludes with an exploration of potential changes based on these findings, tailored to enhance on-time graduation and success in the unique context of engineering education.

The Architecture

Institutional research offices across higher education have learned much from the business analytics community, and have worked to create their own data platforms in support of institutional analytics.[11–14] A recently developed cohort analytics platform provides a key element in the higher education analytics landscape by addressing a previous gap in learning analytics through its ability to conduct progress-based analyses across cohorts of students.[11] Notably this entails the academic progress to be easily understood for specific groups such as students in engineering programs. This type of analysis requires three fundamental components:

- Individual Student Data: The information pertaining to each student found within the cohort.
- Degree Requirements: The specific criteria and requisites required for the targeted degree.
- A framework capable of optimally reconciling individual student data with the degree requirements.

While this platform resembles a conventional degree audit system, it distinguishes itself by transcending the limitations inherent in these existing systems. Current degree audit systems analyze a singular student transcript for earned credit hours without delving into degree satisfaction. Alternatively, the cohort analytics platform navigates the intricacies of reasoning over degree requirement satisfaction and the complexity associated with comprehending how to reason across a cohort of students. By examining a cohort of students at once rather than a single student at a time we are able to identify patterns and trends that would be otherwise hard to discern.

The heart of the matter lies in recognizing that a student's progress toward their degree is contingent upon fulfilling specific degree requirements rather than a mere accumulation of credit hours. This challenge is exacerbated by the complicated nature of deciphering how each student's coursework aligns with their program's degree requirements. A realistic set of degree requirements may be comprised of requirements with dozens of sub-requirements, each of which may be satisfied by hundreds of course combinations. Figure 1 demonstrates how the resulting permutations in curricula may yield thousands of different degree plans capable of satisfying a single degree.

The cohort analytics platform utilizes a Boolean formula satisfiability problem paradigm to represent degree requirements.[11] A program's set of requirements assumes the form of the Boolean formula, while the extracted grade values from the student transcripts serve as the Boolean values. Given the NP-completeness of this problem, an integer linear programming algorithm was devised. This algorithm optimally assigns courses and functions to serve as the analytics engine powering the cohort analytics platform.[15] The results produced in this platform allow for an easy analysis of anticipated graduation rates, credit hour efficiency, reasons why courses may not be able to be

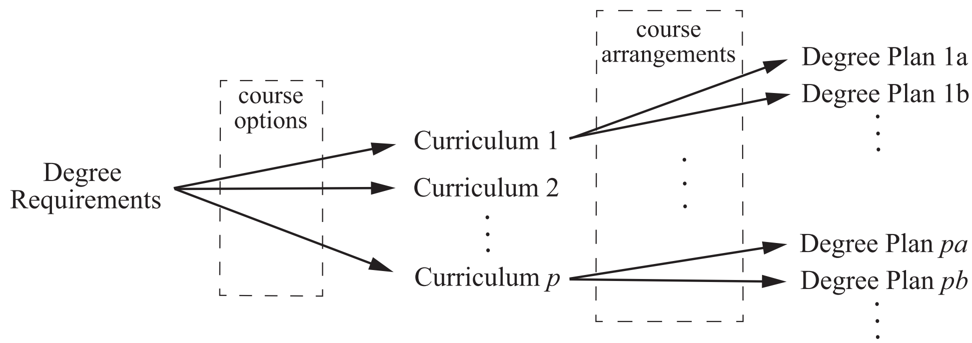

Figure 1: The relationships between degree requirements, curricula and degree plans.

applied toward degree satisfaction, and courses where populations within the cohort are appearing to struggle.

Analysis

The cohort tracking analytics dashboard aims to provide information that is useful in understanding and gaining insights into the performance and progress of engineering students. An overview image of the platform can be seen in Figure 9 on the final page. This analysis will focus on four key areas in the current cohort of engineering students at the University of Arizona (UA): a cohort's progress in 4-year and 6-year graduation, a cohort's credit hour efficiency, a breakdown reasons for credit hours not being counted, and most frequent courses that students within the cohort are either withdrawing from or receiving insufficient grades.

Graduation Rates. The analytical inquiry starts with an examination of the anticipated graduation rates within the student cohort. The framework embedded within the cohort analytics tracking platform evaluates the progression of students toward the milestones of a four-year, five-year, or six-year graduation trajectory. This analysis involves an assessment of earned credits applicable to the degree requirements in each respective program. Unlike the conventional assumption that all credits undertaken by a student will contribute toward degree satisfaction, this approach delineates progress based on the quantification that credits align with requirements. To clarify, if a student has 32 credits that are applicable toward requirements in a program that mandates 128 credit hours for fulfillment, their degree completion is at 25% for a 4-year graduation. Conversely, if the student has 32 credits but only 25 of these contribute to satisfying requirements, the 4-year graduation progress is only at 20%. After this calculation, a histogram is generated which places all individuals within the selected cohort into the bins corresponding to their respective completion percentage based on the desired graduation milestone. The students in each bin are then categorized as being either ahead of schedule, on-track, or behind for degree completion. This classification is based on ratio of credits meeting degree requirements to the total attempted credits of the student.

Upon scrutinizing the entirety of the College of Engineering, a discernible pattern emerges, revealing a notable disparity in the overall 4-year graduation rate versus the national average. Among the cohort of 2,496 enrolled engineering students, the top histogram in Figure 2 shows a mere 23.5% or 586 individuals exhibit progression that positions them as either ahead or on-track to complete their degree within the stipulated 4-year time-frame. This percentile falls approximately 10 percentage points below the corresponding national average of 33%,[7] denoting a substantial deviation from the norm.

A more disquieting revelation pertains to the subset of 494 engineering students requiring fewer than 32 credits before reaching the culmination of their degree requirements. Within this cohort, a mere 94 individuals, constituting 19% of this subset, are poised to attain a 4-year graduation status. This portends an impending 4-year graduation rate descending below the 20% threshold. However, recalculating this metric for a 6-year graduation rate unveils a more favorable scenario is revealed in bottom histogram in Figure 2, with 70.5% or 1,760 students positioned to achieve graduation by this milestone. This figure surpasses the national average of 60% by a substantial margin.

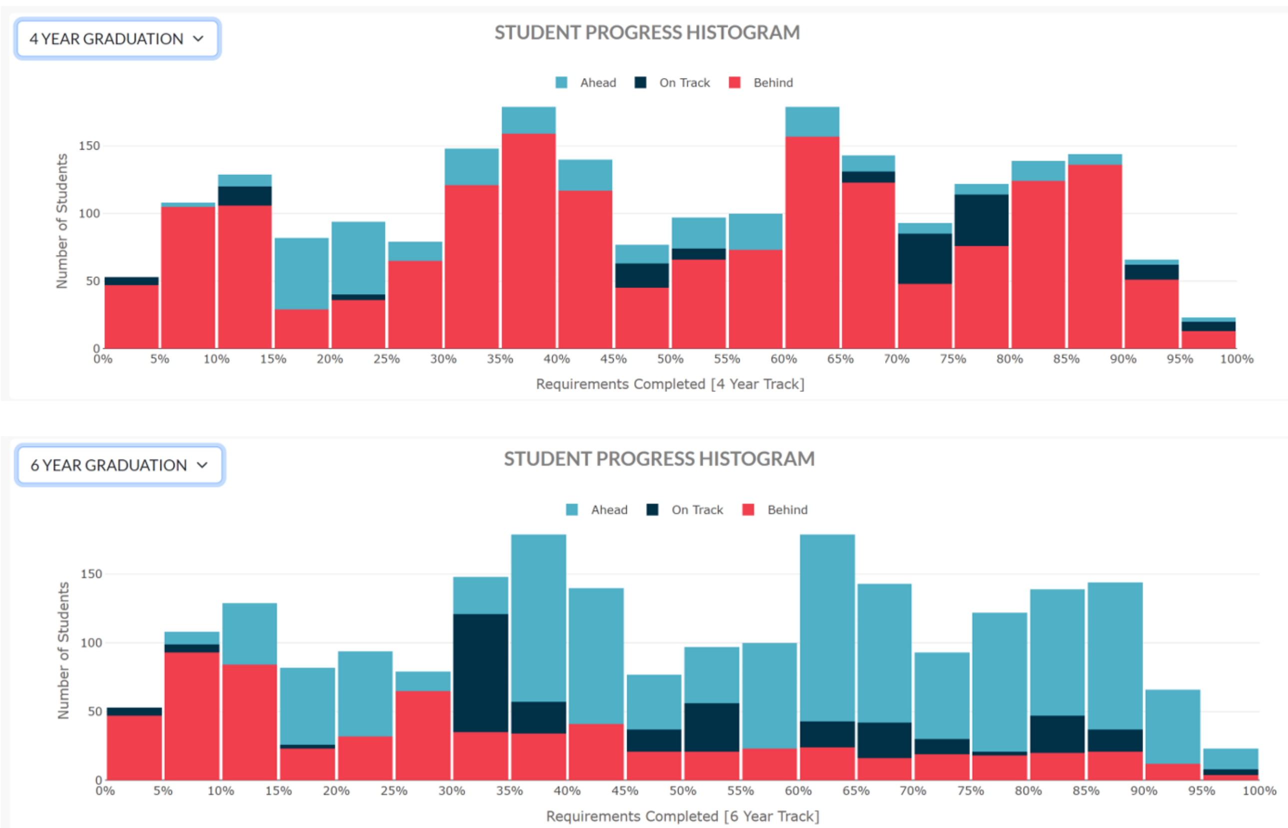

Figure 2: Histogram representation of student ahead, on-track, or behind for an anticipated 4-year and 6-year graduation in the current cohort of engineering students.

Within the domain of the College of Engineering, Figure 3 lists the 4-year and 6-Year anticipated graduation rates. An examination reveals the Industrial Engineering program as having an exemplar performance, evidencing a noteworthy 43% of students positioned for a 4-year graduation, coupled with a 6-year graduation rate at an impressive 77%. This attainment surpasses the overall college average by a substantial margin, registering an increase of 20 percentage points and surpassing the national average by 10 percentage points.

Conversely, the Materials Science and the Environmental Engineering degree programs exhibit the lowest graduation rates within the purview of the College. A mere 6% of students in these programs are on track for a 4-year graduation. This constitutes a decrement of 17 percentage points from the college-wide average and a more pronounced decrease of 27 percentage points in relation to the national 4-year graduation average. While the 6-year graduation for Environmental Engineering jumps to 67%, the Materials Science program only escalates modestly to 29% placing it drastically below both the college and the national averages.

4 & 6-Year Graduation Rate in Percentage		
College of Engineering	**23.21**	**70.52**
Aerospace Engineering	17.80	72.34
Mechanical Engineering	22.38	82.14
Biomedical Engineering	21.11	88.30
Chemical Engineering	15.59	81.72
Environmental Engineering	6.12	67.34
Architectural Engineering	10.41	81.25
Civil Engineering	25.39	76.98
Electrical and Computer Engineering	23.20	50.06
Materials Science and Engineering	6.18	28.86
Mining and Geological Engineering	42.62	71.64
Engineering Management	40.42	82.97
Industrial Management	43.15	76.84
Software Engineering	22.14	73.57
Systems Engineering	53.48	87.20

rate 4, 6 year .png

Figure 3: The anticipated 4-year and 6-year graduation rates for the current cohort of engineering students.

Upon comparing the College of Engineering with its counterparts across the university, a discernible trend emerges, indicating that, university-wide, the College of Engineering manifests the highest time-to-degree ratio. Notwithstanding, it is imperative to note an exception in the form of the College of Architecture, wherein degree programs extend to a duration of 5 years, necessitating the completion of 166 credit hours. The highest 4-year graduation percentage is observed within the College of Applied Science and Technology. Their attainment of an anticipated 75% of students achieving a 4-year graduation exceeds that of the College of Engineering by more than 50 percentage points, thereby establishing a remarkable gap between the two colleges.

Furthermore, an in-depth examination of engineering programs reveals markedly diminished 4-year and 6-year graduation rates when contrasted with analogous STEM programs housed within the College of Science. Illustratively, a comparative analysis between the Electrical and Computing Engineering program and a Bachelor of Science degree in Computer Science underscores a notable discrepancy, where 42.95% of students are deemed on track for a 4-year graduation and 83.45% on track for 6-year graduation in Computer Science compared to the 23.2% and 61.4% in Electrical and Computer Engineering.

Efficiency Ratings The efficiency rating gauges progress by evaluating the ratio of credit hours applicable to a degree to the total attempted credit hours. This measure, calculated individually for each student, is then averaged for the cohort, offering insights into students' effectiveness in selecting and completing degree-relevant courses. Three measures—Total Efficiency, University of Arizona (UA) Efficiency, and Transfer Efficiency—are employed to comprehensively assess the cohort's efficiency. UA Efficiency is determined by dividing the average credit hours applied toward degree completion at the home institution by the average credit hours attempted at the same institution. Transfer Efficiency follows a similar calculation for courses taken outside the home institution. Total Efficiency is the average of credits that are applicable regardless of whether they occurred at the home institution divided by all credit hours attempted.

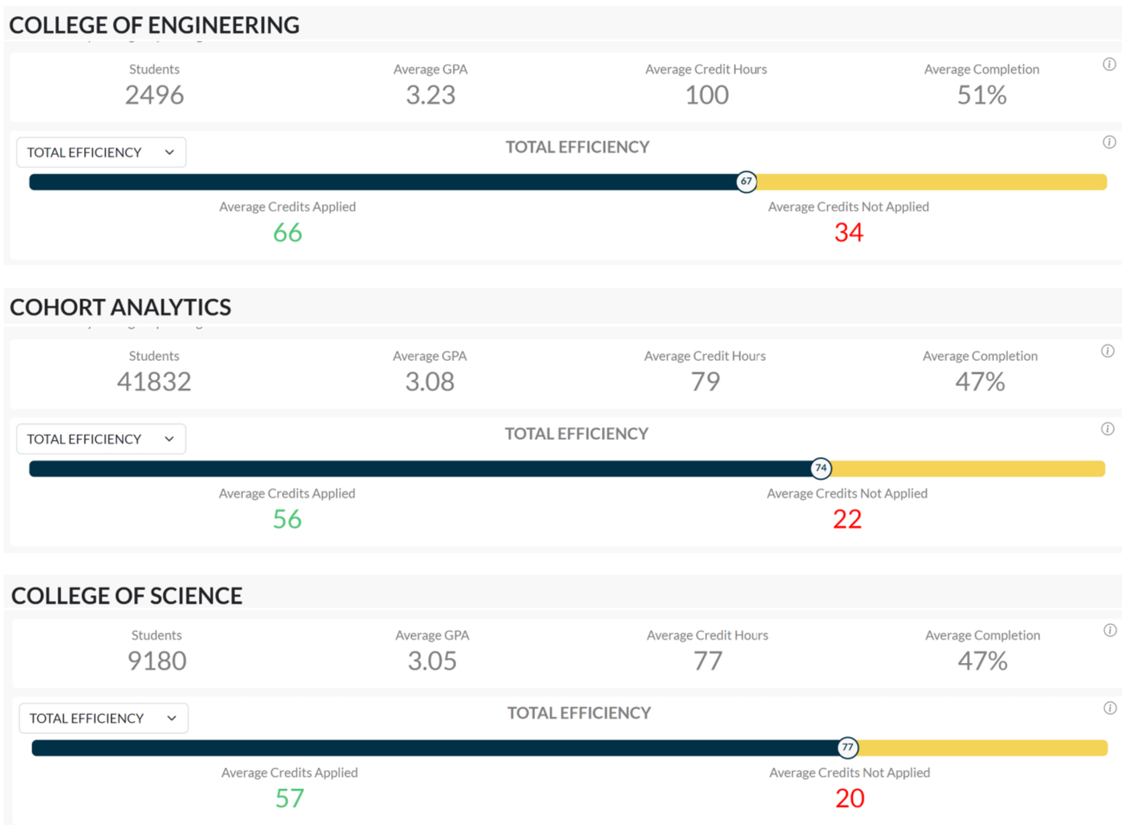

Figure 4: Comparison of Efficiency Metrics for the College of Engineering to the Entire Cohort and to the College of Science.

In calculating these efficiencies, a marked difference in the credit accumulation and grade point averages is also observed. The average number of credits a student has attempted in the engineering programs is 100 credit hours of which 66 credits apply to degree requirements while 34 credits are unable to satisfy degree requirements. Figure 4 shows students in these programs carry an average grade point average of 3.23 with an average degree completion rate of 51%. On the other hand, the university summary statistics labeled as Cohort Analytics in Figure 4 show the credit hour completion is 79 credit hours with 56 credits being applicable toward degree satisfaction and 22 credit hours not being applicable. The grade point average for the University rests at 3.08 with an average completion rate of 47%. When engineering programs are compared to similar programs in the College of Science a finding of the average numbers of credit hours attempted falls to 77 with 57 applicable for requirements and 20 not able to be applied. The average grade point average decreases to 3.05 with an average completion rate of 47%. This demonstrates that programs that are considered to be math and science heavy in the College of Science are producing far better results in terms of credits applicable towards degree satisfaction than their counterparts in the engineering fields.

Furthermore, Figure 4 the overall efficiency rating in the College of Engineering is 67% which indicates the need to delve into this sub-optimal performance. This implies a shortcoming within these programs as on average 1 out of every 3 credit hours a student takes are not applicable towards their prospective degree. The UA Efficiency for these programs is 73%. Transfer efficiency was even more worrisome at 47%, raising alarms about the effectiveness of academic pathways for transfer students. In the engineering program efficiency ratings, minimal variations were noted, typically within a 1 or 2 percentage point range from the college-wide averages for a majority of programs. However, Mining Engineering exhibited a notably high performance, boasting a Total Efficiency of 78%, UA Efficiency of 82%, and Transfer Efficiency of 60%. Conversely, Electrical and Computer Engineering lagged with a Total Efficiency of 58%, UA Efficiency of 72%, and meager Transfer Efficiency of 39%. However, all these programs fall below the university-wide averages of UA Efficiency 76% and Transfer Efficiency 58%. In comparison to the top performing college at the University of Arizona is the College of Humanities, with UA Efficiency of 79% and an impressive Transfer Efficiency of 76%, the disparities become more pronounced.

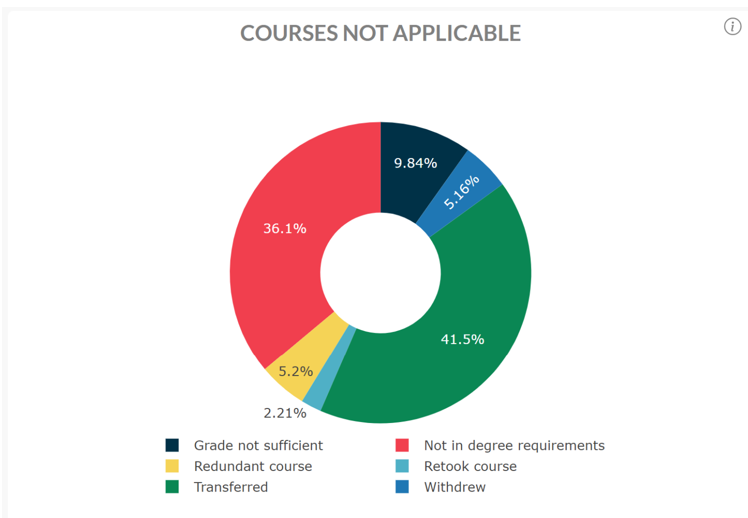

Figure 5: Breakdown of courses not applicable in degree requirements in the College of Engineering.

Courses Not Applicable to Degree Satisfaction Two concerning issues impacting the efficiency ratings were identified as courses undertaken by students that did not align with their degree requirements. The first issue arises from courses being transferred into the institution. The second issue occurs when students enroll in courses that are not pertinent to their degree completion. Both scenarios contribute to a longer time to graduation, resulting in students expending significant effort and financial resources on courses that do not advance them towards degree completion.

This highlights the need for more effective guidance and support systems to ensure students select courses that are directly relevant to their degree objectives.

Within the College of Engineering, Figure 5 shows approximately 42% of non-degree courses fall under the category of Transferred courses. This amounts to over twelve thousand instances of transferred courses that do not fulfill degree requirements. The current tuition in the College of Engineering is approximately $700 per credit hour.[16] Assuming these are traditional 3 credit hour courses, Figure 7 shows this amounts to over $26 million in tuition costs. The financial implications of this phenomenon impose an extreme burden on students, potentially influencing attrition rates in the field of engineering.[17] The most common cause for this occurs as these courses often lack direct equivalency at the home institution. This leads to courses being labeled as 1TR as shown in Figure 6 and thus only able to be applied as electives. However, the engineering programs have on average less than 3 elective credits in their program requirements. This high number of courses not able to satisfy requirements points to potential challenges in the transfer credit evaluation process, suggesting that a large number of courses are not being recognized as fulfilling degree requirements upon transfer.

Course Name	Course Code	Frequency
ELCR Lower Division Transfer	ELCR1TR	2098
MATH Lower Division Transfer	MATH1TR	1081
HIST Lower Division Transfer	HIST1TR	431
ENGR Lower Division Transfer	ENGR1TR	324
Calculus Preparation	MATH120R	313
PHYS Lower Division Transfer	PHYS1TR	304
CHEM Lower Division Transfer	CHEM1TR	293
ELCR Upper Division Transfer	ELCR3TR	271
Col Alg Cncpts+Aplcns	MATH112	262
PE Lower Division Transfer	PE1TR	249

Figure 6: Top 10 Transfer courses unable to satisfy degree requirements in the College of Engineering.

The issue with transfer courses not being applicable towards a degree was not unique to the college of engineering. The university overall reports that 30% of courses that are not counted towards degree completion are transfer courses. A comparative analysis between the Electrical and Computer Engineering (ECE) and Computer Science (CS) programs within the College of Science shows similar proportions in terms of transfer credits not counted towards the degrees. In ECE, with a total enrollment of 500 students, 57.2% of courses are not applicable are transferred courses, amounting to approximately 3700 courses. Meanwhile, in the CS program, which has more than double the enrollment at 1100 students, only 20.5% of courses unable to be applied to degree requirements are the result of transferred courses or roughly 2,000 courses.

Additionally, the second most prominent category, accounting for 36.1% of non-applicable courses, is identified as 'Not in degree requirements' as shown in Figure 5. This reveals that a significant proportion of course enrollments are in classes that do not align with the prescribed curriculum for the students' intended degree paths. Figure 7 illustrates this amounts to approximately $23 million in additional tuition costs. The cohort analysis platform reveals that 575 of 2496 or 23% of enrolled engineering students required a pre-calculus course before attempting calculus level coursework as shown is Figure 6, despite its lack of applicability to their degree progression. The need to take pre-calculus courses has the potential to delay a student's graduation by a full semester.

College of Engineering: Courses Not Applicable			
Reason Not Applicable	**% of Courses**	**Count of Courses**	**Estimated Cost**
Transferred	41.55%	12,655	$26,575,500
Not in Degree Requirements	36.1%	10,993	$23,085,300
Grade Not Sufficient	9.84%	2,999	$6,297,900
Redundant Course	5.2%	1,584	$3,326,400
Withdrew	5.16%	1,572	$3,301,200
Retook Course	2.21%	672	$1,411,200
Total Courses Not Applicable		**30,475**	**$63,997,500**

Figure 7: Percentages, total counts, and estimated cost of courses that were not applicable in engineering degree requirements.

Courses with High Fail or Withdraw Grades When scrutinizing courses not counting toward degree completion, a notable trend emerges as approximately 15% of these courses are the result of a student withdrawing (5.16%) or receiving an insufficient grade (9.84%). In a detailed analysis of the individual engineering programs, in the Industrial Engineering degree just over 23% of courses not applicable towards a degree were due to course withdrawal (7.09%) or insufficient grades (16.3%). These measures mark this program as having the highest percentages in engineering programs for both the categories of course withdrawal and grades not being sufficient despite the fact that Industrial engineering has the highest percentage of students being on track for a 4-year graduation. However, the lowest percentages in these categories were seen in Electrical and Computer Engineering where they only accounted for approximately 14% (9.21% for grades not sufficient and 4.76% course withdrawal) of courses not being counted. These figures align with the percentages being realized in these categories across the university, at other individual colleges, and for programs in other colleges.

Further examination of the individual courses within these categories reveals consistent challenges across all engineering programs. Calculus II, Vector Calculus, and Introductory Mechanics consistently ranked in the top courses for every engineering program where students are either withdrawing from the course or receiving an insufficient grade. Roughly 10% of students will have to retake Calculus II, 12% will be required to retake Vector Calculus, and 7% will need to repeat Introductory Mechanics. The course Statics, which has prerequisites of both Calculus II and Introductory Mechanics, also emerged as a significant challenge as 8.7% of the enrolled students withdrew or received a poor grade in their initial attempt. This highlights that if a student struggled in these courses, it has the potential to require the student to add an additional two to three semesters onto their degrees.

The College of Engineering performs better in the areas of student withdrawal and or receiving grades not sufficient than the overall university average of 25% in these categories. When compared to the College of Science which is 31%, we find that the engineering programs are producing a significantly lower percentage in these fields. This suggests that courses not applicable for degree satisfaction in engineering programs are less likely to be the result of an withdraw or an insufficient grade. While the top courses in this category for the College of Science continued to be in math, the courses are consistently lower-level math courses than those in engineering degree requirements. Within the College of Science, recurrent enrollment is observed in courses such as College Algebra Concepts and Applications (5.6%), Calculus Preparation (4.6%), and Calculus I (4.4%). Among these, only Calculus I is a mandatory component of the engineering program's degree requirements. However, upon disaggregating these metrics for Mathematics Majors with akin mathematics requirements, the predominant courses reemerge as Calculus II with a repetition rate of 6% and Vector Calculus at 8.6%. A discernible enhancement in performance is realized for both Calculus II and Vector Calculus in mathematics majors as visualized in Figure 8.

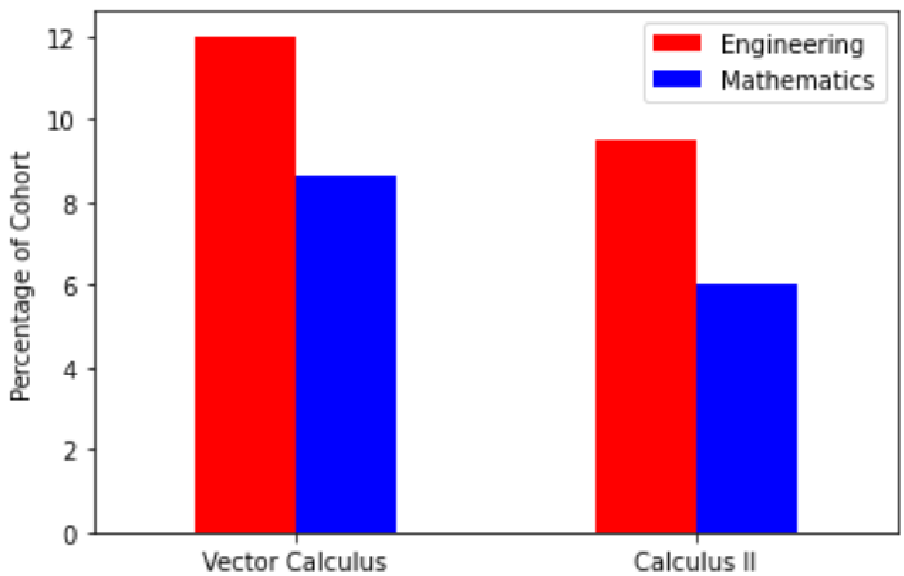

Figure 8: Comparison of percentage of the program population that received D, F, and Withdraw grade in Vector Calculus or Calculus II.

Noteworthy is the fact that Mathematics Majors, sharing analogous mathematics degree requisites, demonstrate a commendable 3.5% point escalation in the proportion of students successfully completing Calculus II on their initial attempt and a 3.4% increase in Vector Calculus. While the mathematics majors have more flexibility in their degrees than typical engineering programs, this achievement contributes to an enhanced four-year graduation rate of 51.4%, which is more than double the 23% rate observed in engineering majors.

Discussion

The utilization of a cohort-based analytics platform has provided valuable insights into the progression and challenges faced by students within engineering programs. The platform's ability to analyze cohorts collectively, rather than focusing solely on individual students, has revealed patterns and trends that offer actionable information for programmatic improvements.

Graduation Rates: The analysis of graduation rates within the College of Engineering highlights both successes and challenges. While the overall 4-year graduation rate falls below the national average, certain programs, such as Industrial Engineering, demonstrate commendable performance. Identifying specific programs with high graduation rates allows for the dissemination of best practices across the college. Conversely, programs with lower graduation rates, like Materials Science and Engineering, require targeted interventions to address obstacles hindering timely degree completion.

Program Efficiency: Efficiency ratings provide insights into students' effectiveness in selecting and completing degree-relevant courses. The variation in efficiency among engineering programs suggests the need for tailored strategies. For instance, addressing the efficiency challenges in Electrical and Computer Engineering may involve reviewing program requirements and providing additional support for students.

Courses Not Applicable to Degree Satisfaction: Identifying courses that do not count towards degree completion sheds light on systemic issues, such as challenges with transferred courses lacking equivalency recognition. This information underscores the importance of refining the transfer credit evaluation process so that more transfer courses may be applied to general education requirements. Additionally, the prevalence of courses not in degree requirements signals the need for improved guidance to ensure students choose courses aligned with their degree objectives.

Courses with High Fail or Withdraw Grades: The analysis of courses not counting toward degree completion due to withdrawals or insufficient grades reveals consistent challenges across engineering programs. The common occurrence of struggles in courses like Calculus II and Introductory Mechanics calls for targeted academic support interventions. Addressing the root causes of high withdrawal and insufficient grade rates in specific courses can contribute to improved student success.

Comparative Analysis: Comparative analyses across engineering disciplines, departments, and colleges provide a comprehensive view of the educational landscape. Recognizing disparities in graduation rates and efficiency compared to other colleges informs strategic planning. For instance, understanding the higher time-to-degree ratio in the College of Engineering compared to other colleges prompts a deeper investigation into the reasons behind this difference.

Actionable Changes:

- Targeted Program Interventions: Identify successful strategies from programs with high graduation rates and implement them in programs facing challenges.
- Enhanced Transfer Credit Evaluation: Refine the process of evaluating transfer credits to ensure a higher recognition rate, particularly for courses lacking direct equivalency.

- Academic Support Initiatives: Implement targeted academic support programs for courses with high withdrawal and insufficient grade rates, such as Calculus II and Introductory Mechanics.
- Guidance and Advising Enhancement: Strengthen guidance and advising systems to ensure students select courses aligned with degree requirements, reducing the prevalence of courses not in degree plans.
- Collaborative Learning Initiatives: Foster collaboration between engineering programs and other colleges to share best practices and improve overall efficiency and graduation rates.

In conclusion, the cohort-based analytics platform offers a data-driven foundation for administrators and advisors to make evidence-based decisions, contributing to the enhancement of student success and on-time graduation in engineering programs.

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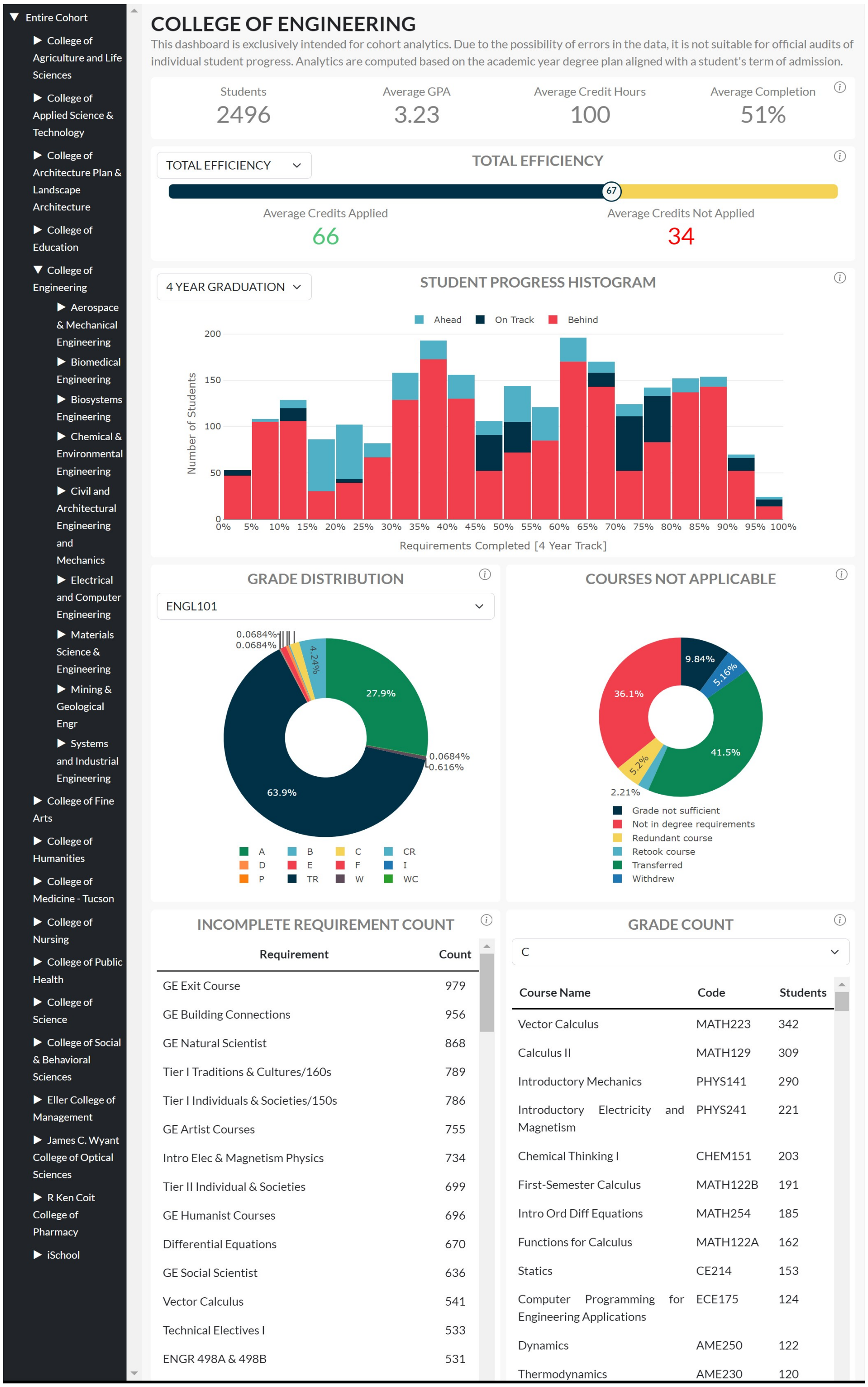

Figure 9: The Cohort Analytics Platform.