Understanding and Addressing Transfer Credit Loss in Engineering Education

Dr. Jeyoung Woo, California State Polytechnic University, Pomona

Dr. Jeyoung Woo is an associate professor in the Department of Civil Engineering at California State Polytechnic University, Pomona (Cal Poly Pomona). He is a registered Professional Engineer (Civil - Construction) in Texas. He has worked in the industry for nine years and he has conducted several research projects about engineering education, quality management, construction labor productivity, and construction sustainability. He earned a Ph.D. and an M.S. in Civil Engineering from The University of Texas at Austin (UT-Austin) and a B.S. in Architectural Engineering from Hanyang University, ERICA. He is a member of the American Society for Engineering Education (ASEE), the American Society of Civil Engineers (ASCE), and the Project Management Institute (PMI).

eugene leo draine mahmoud, Mt. San Antonio Community College & Purdue University

eugene is a Professor of Engineering, Engineering Technology and Physics and an educational researcher at Mt. San Antonio College (Mt. SAC). His research is focused on credit mobility for engineering transfer students, partnerships for successful STEM degree programs, and higher education policy. Currently, he is the chair of the California Engineering Liaison Council and is a doctoral student in Engineering Education.

Dr. Winny Dong,

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Abstract

The persistent transfer credit loss among engineering transfer students, particularly in California, has far-reaching implications for individual academic pathways, the higher education landscape, and workforce development. Academic transfer credit loss can result from multiple factors, including issues of transfer requirements, missing transfer pathways, and curriculum misalignment between community colleges and universities, often stemming from variations in course content, sequencing, and rigor. Because engineering courses have degree-specific prerequisites that must be met, transfer credit loss for engineering students is particularly problematic. Inadequate academic advising practices fail to provide students with clear guidance on course selection and transfer pathways. Moreover, factors associated with student demographics and academic preparedness, such as socioeconomic background, first-generation status, and prior academic performance, can increase the potential for academic credit loss. Transfer credit losses increase financial burdens for students through additional tuition costs and by postponing their entry into the workforce, which impacts the availability of qualified engineers to meet the demands of California's dynamic and rapidly evolving industries, potentially hindering economic growth and innovation. This paper summarizes academic transfer credit losses during two academic years (AY 2022-2024) for transfer students in the Department of Civil Engineering at one of the California State University campuses. The study revealed that 247 engineering transfer students lost an average of nearly 7 units, totaling 1,462 units during two academic years. This represents 6.1% of the total completed credits for these students. Understanding the causes and results of transfer credit loss allows educators to develop targeted strategies to streamline the transfer process, enhance academic advising, and promote curriculum alignment between community colleges and universities.

Keywords: Transfer credit loss, Transfer pathway, Transfer student success

Introduction

The transfer credit loss poses a significant challenge for engineering transfer students, often leading to a cascade of negative consequences. These include increased financial strain due to additional tuition costs, extended time to degree completion, and delayed entry into the workforce. This issue arises when coursework completed at one institution is not recognized or accepted for credit at another institution after transferring. Several factors contribute to this problem, including a lack of formal articulation agreements between institutions, unclear defined transfer pathways, and students inadvertently taking courses that do not align with the requirements of their specific engineering degree program.

This paper aims to thoroughly investigate the prevalence of transfer credit loss among engineering transfer students and quantify its impact on student outcomes, i.e., GPAs (Earned after transferring vs. Cumulative). This comparative analysis will identify best practices to address the transfer credit

loss, including the development of standardized course articulation guides and implementing academic advising programs specifically designed to assist transfer students.

Additionally, this paper highlights the need for increased accessibility of transfer credit policies and procedures, empowering students to make informed decisions about their coursework and academic pathways. It also emphasizes the importance of early and proactive academic advising for engineering students, particularly those who intend to transfer between institutions, to ensure that they are taking courses that will be recognized and accepted for credit at their intended destination institution. Ultimately, this paper aims to contribute to a more equitable and efficient transfer credit system for engineering students, recognizing the value of prior learning and supporting student success in higher education.

Methodology

This paper investigates the causes and impacts of transfer credit loss for engineering students and explores effective transfer pathway practices to minimize such losses. The research methodology comprises two distinct phases: a comprehensive literature review and a quantitative data analysis.

Phase 1: Literature Review

The first phase involved a systematic review of existing literature to establish a theoretical framework and identify best practices. The authors conducted a literature review on transfer credit loss, engineering transfer, and transfer pathways. The authors also consulted relevant policy documents and institutional websites related to transfer policies and practices in higher education. The review focused on: 1) identifying the primary causes of transfer credit loss for engineering students, 2) examining the impact of transfer credit loss on student academic performance, GPAs, and 3) analyzing current practices and strategies employed by institutions to minimize transfer credit loss and facilitate smooth transfer pathways. The synthesized findings from this literature review informed the development of the data analysis framework and provided context for interpreting the analysis.

Phase 2: Data Analysis

The second phase of the research involved a quantitative analysis of transfer student data from one state university in California. The authors examined student records in the Department of Civil Engineering covering a period of two academic years from 2022-2024. The dataset included information such as, student demographics, transfer student status (source institution), number of transfer credits attempted and accepted, cumulative GPA at the university vs. the total GPA from all institutions.

The authors analyzed the data to quantify the extent of transfer credit loss experienced by engineering students at a 4-year institution, to identify potential correlations between transfer credit loss and student demographics, transfer institution type, and declared engineering major,

and to assess the impact of transfer credit loss on students' academic performance at the university, measured by GPA.

Limitations

This study is subject to certain limitations. The data analysis is based on transfer students in one department at a single institution in California, which may limit the generalizability of the findings. Future research could explore these issues further by including data from multiple degree programs and multiple institutions and employing more sophisticated statistical techniques. Despite these limitations, this study provides valuable insights into the transfer credit loss phenomenon for engineering students and contributes to the ongoing discussion of effective transfer pathway practices.

Literature Review

This literature review examines the existing research on engineering transfer credit loss, focusing specifically on the California context. The review is divided into two sections: (1) the causes and impacts of transfer credit loss, and (2) current transfer pathway practices and the role of administrative support.

Causes and Impacts of Transfer Credit Loss

Transfer credit loss is a multifaceted problem with significant consequences for engineering students. Existing literature identifies several key contributing factors. A primary cause is the lack of "a transfer pathway" between community colleges and four-year universities [1-3, 7, 8, 11]. The transfer pathways, which outline how course credits are transferred between 2-year and 4-year institutions, are often incomplete or not available, leaving students unsure whether their coursework will be accepted. Furthermore, even when the transfer pathway exists, the complexity of navigating these pathways can be overwhelming for students ([2, 4-6, 8]). Students may unknowingly take courses that do not fulfill degree requirements at their target institution, resulting in lost time and tuition dollars. This issue is exacerbated by the rigorous and specific course requirements within engineering disciplines [4, 7, 10]. The highly sequential nature of engineering coursework makes it particularly vulnerable to transfer credit loss, as even a single unaccepted course can disrupt a student's progress [6, 8, 11].

The impact of transfer credit loss on engineering students is substantial. Studies have shown that students who experience transfer credit loss are more likely to take longer to graduate [4, 10]. This extended time-to-degree translates directly into increased tuition costs and delayed entry into the engineering workforce [7]. Moreover, transfer credit loss can lead to student frustration, decreased motivation, and even attrition from engineering programs [9, 10, 11]. The loss of potential engineers due to these systemic issues has broader implications for the state's economy and its ability to meet the growing demand for skilled STEM professionals [5, 12].

Transfer Pathway Practices and Administrative Support

California has implemented several initiatives aimed at improving transfer pathways for community college students, including the development of engineering transfer [2, 4, 8, 10]. These initiatives seek to streamline the transfer process by providing clear and consistent guidelines for students. Research suggests that these programs can be effective in reducing transfer credit loss and improving time-to-degree [2, 4, 11]. However, the literature also highlights the importance of effective implementation and ongoing evaluation to ensure that these pathways are truly serving the needs of students [6, 10].

Beyond formal transfer pathways, the role of administrative support in facilitating successful transfer outcomes is crucial. Studies have demonstrated the positive impact of comprehensive transfer advising, dedicated transfer centers, and proactive outreach to community college students [3]. These support services can help students navigate complex transfer requirements, identify appropriate courses, and connect with resources at their target institutions. Furthermore, research suggests that strong partnerships between community colleges and four-year universities are essential for creating seamless transfer experiences for students [3, 4, 8, 10, 13]. This includes collaborative curriculum development, joint advising initiatives, and data sharing to track student progress. However, access to and the quality of these support services can vary significantly across institutions, creating disparities in transfer outcomes for students [1, 3, 10, 11]. The review will further explore these variations and identify areas for improvement in supporting engineering transfer students.

Data Analysis

This paper examined transfer student performance within the Civil Engineering program at one state university in California, focusing on credit loss and its correlation with student background (Underrepresented Minority (URM) status and First-Generation college student status) and GPA.

To analyze the transfer credit losses, the authors focused on eight lower-division engineering courses, and seven of them are listed under the Course Identification Numbering System (C-ID) course. The C-ID provides a common course descriptor and plays a crucial role in streamlining student transfer between 116 California Community Colleges (CCCs) and 23 California State Universities (CSUs) [14]. The C-ID is a faculty-driven initiative that establishes common course descriptors for lower-division courses that are comparable in content and are transferrable between higher education systems (CCCs and CSUs). This standardization simplifies the transfer process for prospective transfer students, ensuring that equivalent coursework is recognized and reducing the potential for unnecessary course repetition by agreeing to a single C-ID descriptor. Moreover, C-ID promotes efficient articulation agreements for institutions, reduces the administrative burden of evaluating transfer credits, and fosters collaboration among faculty across different colleges. While C-ID covers a substantial range of disciplines, it is important to note that not all courses are

C-ID articulated. The C-ID system represents a significant advancement in facilitating student transfer and promoting academic success. Table 1 provides a representative list of C-ID articulated courses to the Civil Engineering Program at one state university in California.

Table 1. List of Engineering Courses

No.	C-ID	Course Title at the 4-year Institution
1	ENGR 150	Introduction to Civil Engineering
2	ENGR 150	Construction Drafting
3	ENGR 180	Surveying Engineering
4	ENGR 140	Civil Engineering Materials
5	ENGR 130	Engineering Statics
6	ENGR 220	Computer Programming and Numerical Methods (MATLAB)
7	ENGR 240	Mechanics of Materials
8	N/A	Fluid Mechanics

The data indicates that transfer students in Civil Engineering experience transfer credit loss upon entering the university. This loss can be attributed to various factors, including discrepancies in course articulation, differences in lower-division requirements between institutions, and changes in major requirements over time.

As shown in Table 2, this study examined the transfer credit loss among 248 transfer students enrolled in the Civil Engineering program at one state university in California over two academic years (AY 2022-2024). Of these students, 211 students had lower-division engineering credits, while 37 students transferred to the program without lower-division engineering credits. Collectively, these transfer students experienced a total loss of 1,462 units (credits), averaging 6.92 units (credits) lost per engineering transfer student in the Civil Engineering Department. This represents 6.1% of the total completed transfer credits for the 248 students.

Further analysis regarding the lower-division engineering curriculum (see Table 1) transfer credit loss reveals a total loss of 198 units (credits), averaging 0.93 units (credits) lost per engineering transfer student in the Civil Engineering Department. This represents a 9.3% loss of completed lower-division engineering credits completed. Despite the established alignment between California Community Colleges (CCCs) and California State Universities (CSUs) through C-ID courses (in Table 1), some credit loss still occurred in this area. Notably, Underrepresented Minority (URM) students experienced a 2.5% higher rate of credit loss (10.6% for URM vs. 8.1% for Non-URM) in these lower-division engineering courses compared to their non-URM counterparts. Moreover, first-generation college students also experienced 0.5% higher credit loss in these courses compared to non-first-generation students.

The majority of credit loss, however, occurred in non-engineering courses. A total of 1,264 units were lost in this category, averaging 5.09 units (credits) lost per transfer student in the Civil Engineering Department, or 5.8% of transferred non-engineering course credits. In contrast to the

lower-division engineering courses, non-URM students showed a 0.4% higher rate of credit loss in non-engineering courses compared to URM students. First-generation students, however, experienced a more substantial 3.4% higher rate of credit loss in non-engineering courses, such as physics, chemistry, and GE courses, compared to non-first-generation students. This suggests that while articulation for engineering courses may be relatively streamlined, challenges remain in the transferability of non-engineering coursework, particularly for first-generation college students.

Table 2. A Summary of the Transfer Credit Loss

Category			Completed Credits (A)	Transferred Credits (B)	Difference (A-B)	Percentage (A-B)/A
All Courses			**23,985**	**22,523**	**1,462**	**6.1%**
Engineering Courses	**Total**		**2,122**	**1,924**	**198**	**9.3%**
	URM	Yes	1,039	929	110	10.6%
		No	1,083	995	88	8.1%
	First-Gen	Yes	1,377	1,246	131	9.5%
		No	745	678	67	9.0%
Non-Engineering Courses	**Total**		**21,863**	**20,599**	**1,264**	**5.8%**
	URM	Yes	11,413	10,771	642	5.6%
		No	10,450	9,828	622	6.0%
	First-Gen	Yes	14,593	13,580	1,013	6.9%
		No	7,270	7,019	251	3.5%

As shown in Table 3, a significant portion of the observed credit loss (86.0%) occurred in non-engineering courses, such as physics, chemistry, and general education (GE) courses. This finding is further substantiated by a comparison of student GPAs. The analysis reveals a notable difference between students' cumulative GPA, encompassing grades earned at their previous institution(s), and their GPA earned solely at one state university in California post-transfer. The cumulative GPA is, on average, 0.3 points higher than the GPA earned after transferring. This disparity strongly suggests that students transferred a greater number of non-engineering courses, where they had achieved higher grades, thus contributing to the higher cumulative GPA. The lower GPA earned at the university after transfer likely reflects the more lower-division engineering coursework within the engineering major, as well as the potential challenges of adjusting to a new academic environment. The pattern of transfer credit loss, concentrated in non-engineering courses, underscores the need for improved articulation and transfer policies related to engineering major-related coursework.

Table 3. Academic Performance of Engineering Transfer Students

Category			GPA (After Transfer)	GPA (Cumulative)
Engineering Transfer Students			2.87	3.17
	URM	Yes	2.85	3.16
		No	3.00	3.28
	First-Generation	Yes	2.87	3.20
		No	3.01	3.26

These findings highlight the challenges faced by transfer students in Civil Engineering, particularly those from URM and first-generation backgrounds. The topics for further analysis are discussed in the following section.

Conclusions and Discussions

This paper examines that transfer credit loss poses a significant challenge for engineering transfer students, potentially adding to their financial burden and extending their time-to-degree. The analysis of 248 engineering transfer students in the Civil Engineering Department over two academic years (2022-2024) demonstrated a total loss of 1,462 units (credits), representing 6.1% of all completed credits with an average of 6.92 units. This transfer credit loss, while seemingly small on an individual basis, accumulates across the student population, impacting overall academic performance. Possible reasons are transfer students are limited by the number of units that they can transfer in to a California State University (CSU) or University of California (UC). Another reason is that transfer students completed higher-unit courses at the California Community College (CCC) for the articulated courses at either CSU or UC.

The findings indicate a trend of greater credit loss among URM and first-generation college students compared to their non-URM/non-first-generation students. This disparity suggests a need for targeted support systems, such as mentorship programs or enhanced advising services, specifically designed for transfer students. Such interventions could provide crucial guidance on course selection, transfer requirements, and navigating the complexities of university systems. Furthermore, the development of clearer engineering transfer pathways, including wider adoption and utilization of the ADT in Engineering, could significantly improve transfer efficiency and reduce credit loss by providing prospective transfer students with a well-defined roadmap.

This paper serves as a starting point for further investigation. Future research should delve deeper into the specific causes of credit loss. Examining the list of courses lost with the lost units, as well as identifying community colleges from which students experience higher rates of credit loss, could pinpoint areas where articulation agreements need improvement. Additionally, analyzing the correlation between transfer credit loss and time-to-degree would provide a more comprehensive understanding of the impact of credit loss on student academic progress. Such in-depth analysis

will be crucial in developing effective strategies to mitigate credit loss and support the success of transfer students in engineering.

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