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STEM Education and Academic Identity: The Influence of Program Titles on Construction Students' Perceptions

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ABSTRACT

Academic identity formation is essential for student engagement in STEM education. In construction-related fields, degree programs like Construction Management (CM), Construction Engineering (CE), and Construction Engineering Technology (CET) have distinct curricula and career paths. However, similar program names often confuse, affecting students' academic choices and career alignment. This study examines how construction students at different academic levels perceive the equivalency of CM degrees compared to CE and CET degrees. Using chi-square tests and binary logistic regression, the results indicate that while early-year students exhibit varied opinions, senior students are significantly less likely to view these degrees as equivalent. This suggests that

exposure to advanced coursework, industry interactions, and faculty guidance may refine students' understanding of discipline-specific learning outcomes. These findings highlight the need for more transparent communication regarding academic pathways and professional trajectories within construction-related STEM programs.

Keywords: STEM education, Construction programs, Student perception, Program name, Academic Choice

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INTRODUCTION

Construction-Related STEM Degree Programs and Student Confusion

Despite the America COMPETES Act allocating $6.9 billion annually to the NSF to improve STEM education at all levels, challenges such as low retention and graduation rates persist, suggesting that factors beyond funding continue to hinder student success (Carnevale et al., 2023). Gunter and Polidori (2024) opinioned that a key contributor to this issue is the lack of innovative, equitable, and student-centered teaching practices in STEM education. Notably, around 38% of students who initially declared STEM majors, such as physics or mathematics, did not complete their degrees in those fields (Whitcomb & Singh, 2021).

STEM education plays a crucial role in shaping students' academic identity and career trajectories, particularly in construction-related fields. In the United States, degree programs such as Construction Management (CM), Construction Engineering (CE), and Construction Engineering Technology (CET) prepare students for distinct roles within the construction industry. Despite their specialized curricular emphases and career pathways, overlapping program titles and similar content create confusion among prospective students. This uncertainty may impact students' educational choices, making it difficult to align their academic paths with their career aspirations.

Each of these programs offers a unique focus. CM programs emphasize project oversight, budgeting, client communication, and regulatory compliance, preparing students for leadership and management roles (Sealey-Morris, 2024). CE programs incorporate engineering principles, mathematical applications, and technical expertise required for large-scale infrastructure development. CET programs provide a balance between theoretical knowledge and practical training, equipping students with hands-on skills for direct project supervision. While these distinctions exist, many students lack the guidance needed to navigate these programs effectively, leading to potential misalignment between their academic preparation and career goals.

Influence of Program Titles on Academic Identity and Decision-Making

The naming and branding of construction-related degree programs play a significant role in shaping students' academic identity and career expectations. However, existing literature on construction education and career pathways has largely overlooked this aspect. Past studies have explored curriculum design and skill differentiation between CM and CE programs (Singh & Hamada, 1996; Chinowsky & Vanegas, 1996), but they fail to examine how students interpret program names or how these names influence academic decision-making.

The introduction of new program tracks, such as Construction Engineering and Management, has further blurred the distinctions between CM and CE degrees (Duran, 2022). This lack of clarity can misguide students' expectations, affecting their educational satisfaction, job satisfaction, and employability. Addressing these misconceptions is critical to ensuring that students make informed academic decisions and that institutions provide transparent curriculum communication and academic advising.

Factors Influencing Student Enrollment in Construction Programs

Research suggests that students select construction-related programs based on their interests, career aspirations, and external influences such as family background, salary expectations, and high school exposure to construction careers (Bennett et al., 1999; Chileshe & Haupt, 2010; Bigelow et al., 2015; Sparkling et al., 2019). However, the role of career counseling remains limited. Koch et al. (2009) found that counselors have minimal influence on students' decisions to pursue construction degrees, often leaving them to navigate degree options without structured guidance.

Additionally, Coskun et al. (2024) identified a lack of career information at the high school level, suggesting that students may enter construction programs with incomplete or inaccurate perceptions of their curriculum and career prospects. Kisi et al. (2011) reported that only 26% of construction students had CM or CE as their top program choice, highlighting the need for greater awareness and guidance in these fields. Bigelow et al. (2017) emphasized the importance of internships, field trips, and work experience in attracting students to CM programs, demonstrating the need for industry engagement to improve program visibility. Furthermore, literature also shows that the considerable benefits of interdisciplinary approaches enhance project management effectiveness and outcomes by examining the complex interplay between cognitive processes, decision-making, and project management (Kisi & Sulbaran, 2025).

Addressing the Gap: The Need for Clearer Program Differentiation

While substantial research has been conducted on curriculum development and career outcomes in construction education, limited studies have examined the impact of program titles on students' perceptions and academic decisions. This study seeks to address this gap by investigating how students interpret CM, CE, and CET program titles and whether confusion regarding degree equivalency affects their academic identity formation.

By analyzing students' perceptions, this research contributes to the broader discourse on STEM education, curriculum transparency, and academic advising. The findings will offer valuable insights for educators, policymakers, and advisors to refine program naming conventions, enhance academic guidance, and ensure that students make well-informed choices aligned with industry expectations.

RESEARCH OBJECTIVES

This study aims to bridge the gap in understanding how students perceive the names of construction-related degree programs and how these perceptions influence their academic decision-making. Specifically, this research seeks to:

1. Assess students' perceptions of construction-related degree programs to determine whether they view these programs as distinct or interchangeable.
2. Analyze how students' academic standing influences their perceptions, comparing how freshmen through seniors differ in their understanding of construction program distinctions.
3. Examine variations in students' perceptions of learning outcomes across different construction programs, identifying potential misconceptions or gaps in understanding.

RESEARCH METHOD

Survey Design and Data Collection

A structured questionnaire survey was developed to examine undergraduate students' perceptions of construction-related program names. The survey targeted students enrolled in construction related majors across five universities in the United States. The questionnaire for this study was divided into two sections:

1. Demographic Information – Collected data on gender, academic level, and prior construction experience.

2. Program Perceptions – Assessed students' understanding and differentiation of construction program names and student learning outcomes (SLOs).

The survey was administered to students at all academic levels, from freshmen to seniors, and a total of 206 students completed the survey.

Data Processing and Analysis

This study employed a quantitative research approach to analyze students' perceptions of construction-related degree equivalence across academic levels. Survey data were collected from 206 students across four academic levels (freshmen, sophomores, juniors, and seniors). Responses were categorized into a binary outcome variable: whether students perceived CM as equivalent to CE or CET (Yes = 1, No = 0). Data processing involved cleaning and coding responses for statistical analysis. A chi-square test was conducted to examine the association between academic level and perception, while a binary logistic regression model assessed whether academic level predicted the likelihood of perceiving degree equivalence and their SLOs. The statistical significance was determined at $p < 0.05$. All analyses were performed using SPSS.

RESULTS

The researcher received 206 complete responses from the five different institutes across the United States. The survey was administered to students that were enrolled in construction related programs. This section has been subdivided into several other parts to analyze data.

Demography

Within the valid responses received, 89% (183 students) were male and 11% (23 students) were female. As shown in Figure 1, there were variations in the level of students who were enrolled in the construction program. There were 32 freshmen (16%), 41 Sophomore (20%), 49 juniors (24%), and 84 Seniors (41%).

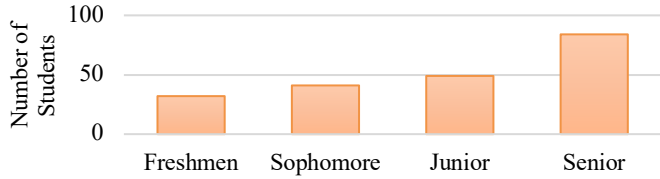

Figure 1. Distribution of student's level

As shown in Figure 2, the students reported whether they had work experience related to construction or related tasks. The result shows that 88% of students had experience related to construction, 65% related to drafting, 33% related to working with architects, and 50% reported that they had worked with engineers.

Figure 2. Work experience

Program Perception

This section delves into overall students' perceptions of construction programs. When students were asked if they think universities across the United States offering construction program with different names such as CM, CE, CET, construction science, and construction science and management were the same degree, 41% (84 students) believed they were the same program and 59% (122 students) believed they were different program. Although the result from Figure 2 above shows that all students had experience working related to construction, the result shows that many are still not able to differentiate between the construction program's naming. The fact that 41% of respondents thought the those programs were identical points to a possible lack of differentiation between them, which may have an effect on how students make decisions and how well the programs work out. This finding supports the study's statement that students become confused by program titles and curricula that overlap, which is consistent with the introduction's focus on the difficulties prospective students encounter when differentiating between CM, CE, and CET programs.

To determine if there is a significant difference between the academic level of students (freshmen, sophomore, junior, and senior) and the perception that a bachelor's degree in CM is the same as a bachelor's degree in CE or CET, this study conducted the chi-square test of independence. The test is based on the observed values as shown in Table 1 below. The null hypothesis of this test is there is no significant association between the academic level and their perceptions of construction programs despite different names.

The results indicate that the relationship was not statistically significant, $\chi 2(3, N=206) = 7.77$, $p=.051$. While the result is close to statistical significance,

it does not meet the conventional threshold of $p < .05$, indicating that academic level may not have a strong influence on students' perceptions. However, the trend suggests that seniors are more likely to think bachelor's degree in CM is different from bachelor's degree in CE/CET compared to freshmen, sophomores, and juniors.

Table 1

Academic level and their responses to construction related degrees

Academic Level	Thinks degree of CM = CET/CE	Thinks degree of CM ≠ CET/CE	Total
Freshmen	14	18	32
Sophomores	15	26	41
Juniors	19	30	49
Seniors	18	66	84

A binary logistic regression was performed to assess whether academic level predicts students' perception of whether a bachelor's degree in CM is the same as a degree in CE or CET, using freshmen as the reference category. The overall model was statistically significant, $\chi 2(3)=7.93$, $p=.047$, indicating that academic level influences students' perceptions. The regression coefficients are shown in the following Table 2.

Table 2

Statistical values of binary logistic regression test related to degree equivalency

Predictor (Academic Level)	β (Coefficient)	SE	OR (Odds Ratio)	p-Value
Intercept	0.358	0.408	1.431	0.381
Sophomores vs. Freshmen	-0.405	0.438	0.667	0.355
Juniors vs. Freshmen	-0.452	0.421	0.636	0.283
Seniors vs. Freshmen	-1.002	0.414	0.367	0.016*

The result suggests that academic level significantly influences students' perceptions, but the difference is mainly observed between seniors (B = -1.002, p = 0.016, OR = 0.367) and freshmen (B = -0.405, p = 0.355, OR = 0.667). As student progresses, particularly at the senior level, they are less likely (63.3%) to believe that CM is the same as CE or CET. These findings suggest that as students progress academically, they become more aware of the distinctions between construction

degrees. This trend underscores the importance of early curriculum interventions to clarify the differences between these degree programs and their learning outcomes.

Similarly, the respondents were asked if they think graduating from a degree in CM will have the same student learning outcome (SLO) as graduating from a degree in CET, 39.9% (81 students) believed they were the same. To determine if there is a notable difference in how freshmen through seniors perceive difference in student learning outcomes from different construction programs, a chi-square test of independence was performed using the data in Table 3 shown below. The null hypothesis was that there is no significant link between the academic level and their views on SLOs from different construction programs. Table 3 shows 15 freshmen and 21 sophomores, 21 juniors, and 24 seniors answered "Yes" (indicating they think all construction programs have same SLOs).

Table 3

Academic level and their responses to SLOs

Academic Level	Think SLOs of CM = CET/CE	Think SLOs of CM ≠ CET/CE	Total
Freshmen	15	17	32
Sophomores	21	20	41
Juniors	21	28	49
Seniors	24	60	84

Table 4

Statistical values of binary logistic regression test related to SLOs

Predictor (Academic Level)	β (Coefficient)	SE	OR (Odds Ratio)	p-Value
Intercept	-0.125	0.354	0.882	0.724
Sophomores vs. Freshmen	0.174	0.472	1.190	0.713
Juniors vs. Freshmen	-0.163	0.457	0.850	0.722
Seniors vs. Freshmen	-0.791	0.429	0.453	0.065

A chi-square test of independence was conducted to examine the association between academic level and perceptions of whether the SLOs of CM are equivalent to those of CET/CE. The results indicated that the association was not statistically significant, $\chi^2(3, N = 206) = 7.52$, $p = .057$. While the result is close to statistical significance, it does not meet the conventional threshold of $p < .05$;

we fail to reject the null hypothesis, suggesting that academic level does not have a strong influence on students' perceptions of SLO equivalent.

A binary logistic regression was performed to predict students' perceptions of SLO equivalency (Yes = 1, No = 0) based on their academic level. Freshmen were used as the reference category. The regression coefficients are shown in the following Table 4.

The logistic regression model was not statistically significant for predicting perceptions of SLO equivalency based on academic level. None of the academic level comparisons (sophomore, junior, or senior vs. freshmen) showed significant differences (all p-values > .05). However, there was a marginal trend suggesting that seniors were less likely to perceive SLOs as equivalent compared to freshmen (B = -0.791, p = .065), but this did not reach statistical significance.

DISCUSSIONS

The results of this study indicate that academic level plays a significant role in shaping students' perceptions of whether construction-related degree programs—such as CM, CE, and CET—are equivalent. Specifically, freshmen, sophomores, and juniors did not show statistically significant differences in their perceptions, while seniors were significantly less likely to believe that these degrees are the same. This trend suggests that students develop a clearer understanding of program distinctions as they progress through their academic journey.

One likely explanation for this pattern is the increasing exposure to discipline-specific coursework and professional experiences as students advance. Freshmen and sophomores may have limited exposure to the technical and managerial distinctions between these degrees, leading them to perceive them as similar based on overlapping introductory coursework. However, by the time students reach their senior year, they will have engaged in advanced coursework, faculty discussions, and internships that will provide deeper insights into the unique competencies, career trajectories, and professional expectations associated with each degree. This exposure likely reinforces the distinctions between CM, CE, and CET, leading seniors to be more aware of their differences.

Another contributing factor may be the role of faculty and academic advising. Seniors may have received more direct guidance from instructors, advisors, and industry professionals regarding the specialized skills and career paths tied to each degree, further shaping their understanding. Additionally, engagement with industry—such as internships, job fairs, and networking opportunities—may expose seniors to employer preferences and accreditation standards that differentiate these degrees in practice.

The non-significant differences among students regarding their perception of SLOs suggest that program structures and advising efforts may not be sufficiently communicating degree distinctions early in students' academic journeys. The non-significance could be due to sample size limitations, the diversity of institutional program structures, and the possibility that students' perceptions may be shaped by early experiences or generalized understandings that are not strongly influenced by academic progression. This could also indicate a gap in curriculum design or advising strategies that should be addressed to ensure students develop a clear understanding of the unique learning outcomes and career paths associated with their chosen field. Okele and Chukwuma (2024) found a moderate positive relationship between school managers' strategies—such as curriculum design, extracurricular activities, and external partnerships—and STEM students' acquisition of lifelong skills, highlighting the interconnection between educational approaches and skill development. Additionally, institutional variations in how construction programs are structured—some with overlapping coursework and others with distinct educational tracks—could contribute to the mixed perceptions observed in this study.

These findings highlight the need for universities to provide clearer guidance on program distinctions from the early stages of a student's academic journey. Future research should explore how external factors, such as accreditation standards, employer expectations, and industry engagement, influence student perceptions. Addressing these gaps in understanding can help ensure that students make informed decisions about their education and career paths early in their academic progression.

IMPLICATIONS

The findings of this study have important implications for students, academic institutions, and industry professionals.

1) Students: This study underscores the importance of seeking out information beyond coursework to fully understand the implications of their degree choice. Engaging with faculty, participating in internships, and networking with industry professionals can help clarify the unique skill sets and job opportunities associated with each program.
2) Universities and academic advisors: The results highlight the need to provide clearer guidance on the distinctions between CM, CE, and CET programs early in students' academic careers. Institutions should consider integrating discussions about program learning outcomes, accreditation differences, and career pathways into introductory courses or advising sessions. Ensuring that students have a clear understanding of these differences from the outset may help them make more informed decisions about their academic and professional paths. For example, embedding

comparative modules early in the curriculum to help students' academic identities with accurate and discipline specific information, advisors proactively addressing degree misconceptions during introductory courses or departmental orientations.

3) Industry professionals and employers: The findings suggest that students' understanding of degree distinctions is not uniform, particularly in the early stages of their education. Employers may need to play a more active role in reinforcing degree-specific competencies through internships, mentorship programs, and recruitment efforts. Industry organizations and accreditation bodies may also consider developing clearer messaging about the differences between construction-related degrees to ensure alignment between education and workforce expectations. Moreover, industry partners can contribute to classroom lectures and panel discussions to share real-world insights on how each degree aligns with specific job roles. Employers can help students understand by specifying degree preferences and expected competencies in job postings. They can continue feedback to academic programs through advisory boards and inform institutions about the evolving demands of the construction sector.

Overall, this research contributes to the broader discussion on curriculum development and academic advising in construction education. By addressing gaps in student knowledge and perception, universities can enhance program transparency and better prepare graduates for their respective career paths.

LIMITATION

This study is limited by its reliance on self-reported perceptions, which may not accurately reflect students' actual understanding of degree distinctions. Additionally, the findings may not be generalizable to all institutions, as program structures and curricula vary across universities. The study also does not account for external influences such as faculty guidance, industry exposure, or employer expectations, which may shape student perceptions. Lastly, its cross-sectional design prevents tracking changes in perceptions over time. Future study will be conducted to address this limitation.

CONCLUSION

The findings from this study suggest that students' academic levels do not significantly influence their perceptions of whether construction-related degrees are equivalent despite their different programs naming across universities. This implies that educational exposure alone may not be sufficient to clarify the distinctions between different construction programs. To improve student

understanding, universities and industry organizations could provide clearer guidelines on the unique competencies, career pathways, and professional expectations associated with each degree.

Further research should explore the role of external influences—such as employer preferences, accreditation requirements, and industry trends—in shaping student perceptions. By identifying and addressing the factors that contribute to misconceptions about construction degrees, educators and industry professionals can better align academic programs with workforce expectations, ensuring that students make informed decisions about their education and career paths.

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