

The Impact of Confidence and Perceived Relevance on Student Motivation and Academic Performance: A Case Study in Electrical Fundamentals Course

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Abstract—This paper investigates the impact of student confidence and perceived relevance on motivation and academic performance in an introductory electrical fundamentals course. Based on Bandura's self-efficacy theory and Keller's ARCS model, interventions were designed to improve student confidence and relevance perception. Pre- and post-intervention surveys indicate significant improvements in perceived relevance and overall academic performance. These findings suggest that targeted activities can enhance motivation and learning outcomes in engineering education.

Keywords— Student motivation, confidence, perceived relevance, engineering education, academic performance.

I. INTRODUCTION

Education researchers have long recognized that motivation is a critical factor in academic success. However, two aspects of motivation—student confidence and perceived relevance—are often underexplored. Confidence influences students' willingness to engage with difficult material, while perceived relevance ensures they remain committed to learning.

Engineering education often in particular faces challenges related to student motivation and engagement. In the EET2035 Electrical Fundamentals I course, many students struggle due to a lack of confidence in their technical abilities and difficulties in perceiving the relevance of the subject matter to their future careers. This lack of confidence can result in lower engagement levels, avoidance of challenging coursework, and ultimately, poor academic outcomes. Similarly, when students fail to see the relevance of their coursework, they may not be fully invested in the learning process. This issue is particularly prevalent in technical and theoretical subjects, where real-world applications are not always immediately apparent. This study explores how targeted interventions can enhance students' confidence and perception of relevance, ultimately improving learning outcomes.

II. LITERATURE REVIEW

A. Student Confidence and Self-Efficacy

Bandura's self-efficacy theory [1] suggests that individuals who believe in their ability to succeed are more likely to persevere in challenging tasks. High self-efficacy correlates with greater effort, resilience, and ultimately, improved academic performance. Studies have shown that

confidence-building exercises, such as peer mentoring and scaffolded learning, can help students develop a stronger belief in their abilities.

A study by Zimmerman [2] further supports this notion, indicating that students who have confidence in their problem-solving skills tend to take a proactive approach to learning. They are more likely to seek out resources, engage in study groups, and attempt challenging problems, all of which contribute to higher academic achievement.

B. Perceived Relevance and Motivation

Keller's ARCS model of motivation [3] includes relevance as a key factor in student engagement. When students see the connection between their studies and real-world applications, their intrinsic motivation increases, leading to deeper learning and better retention of knowledge. Research also indicates that integrating industry exposure and real-world applications within coursework significantly enhances perceived relevance and long-term retention of knowledge.

In a study conducted by Brophy [4], students who participated in real-world engineering projects reported higher engagement and motivation compared to those who engaged in purely theoretical exercises. This suggests that aligning academic material with industry needs and applications can positively influence student motivation and learning outcomes.

III. METHODOLOGY

A. Course Context and Participants

A mixed-methods approach was employed, combining qualitative surveys with quantitative grade assessment. Students in EET2035 Electrical Fundamentals I course were surveyed at the beginning and end of a semester to assess changes in their confidence and perception of relevance. Additionally, targeted interventions—including guest lectures from industry professionals and industry field trips were designed to enhance these attributes.

The study participants consisted of 15 students enrolled in Fall 2024's EET2035 Electrical Fundamentals course. They received targeted interventions. The students in the previous year's EET2035 class were chosen to be the control group for academic performance assessment's purpose. They did not receive any motivation-enhancing activities.

B. Intervention Activities

1) Pre-Survey: Students completed a survey assessing their confidence and perception of course relevance.

2) Industry Speaker Session: A guest speaker from the engineering industry discussed career paths and the importance of electrical fundamentals.

3) Field Trip: A visit to a power plant provided real-world context (later replaced with an industry talk due to scheduling conflicts).

4) Post-Survey: The same survey was administered at the end of the semester to measure changes in confidence and perceived relevance.

Besides these activities, we also have two senior students to be tutors for EET2035 class. They serve as peer mentors. Each of them works 10 hours per week. Not only do they tutor for the homework, but they also help with the students' in the lab.

IV. RESULTS

A. Survey Findings

Survey results showed a significant increase in students' perceived relevance of electrical fundamentals. The following is the survey questions 1, 2 and 3. The results are shown in Table 1.

- Sample Survey questions:

Please rate your agreement with the following statements on a scale from 1 to 5, where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree.

1. I feel confident in my ability to understand the basic concepts of electrical fundamentals.
2. I am comfortable asking questions in class about electrical fundamentals.
3. I believe I can successfully complete the Electrical Fundamentals I course.

TABLE I
SURVEY QUESTIONNAIRE RESULTS

Metric	Pre-Survey Score	Post-Survey Score
Relevance (Q1)	2.3	3.8
Relevance (Q2)	3.1	4.2
Relevance (Q3)	2.8	3.6

Students reported feeling more capable and interested in their coursework following the interventions. The data indicate that hands-on learning experiences and exposure to industry professionals had a direct impact on student motivation.

B. Academic Performance

Comparative analysis of test scores showed that students in the experimental group scored, on average, 12% higher than those in the control group. Additionally, students who participated in hands-on projects demonstrated better problem-solving abilities and were more likely to seek additional learning opportunities outside of class.

V. DISCUSSION

The results highlight the importance of student confidence and perceived relevance in engineering education. The interventions led to higher engagement and improved performance, aligning with existing theories on motivation and learning. Future studies could explore additional activities, such as hands-on projects and extended industry collaborations.

These findings suggest that fostering student confidence and emphasizing real-world relevance are effective strategies for improving academic outcomes. The data align with established motivation theories, confirming that self-efficacy and perceived relevance are vital components of student success.

Educators can implement several strategies to enhance these factors:

1. Incorporating Real-World Examples: Demonstrating how course concepts apply in industry settings.
2. Active Learning Approaches: Using project-based learning and collaborative assignments.
3. Mentorship Programs: Pairing students with industry professionals or senior peers to build confidence.

Because of the time limitation, the field trip activity was not implemented. This activity is believed to be very helpful in shaping the students' perception of relevance. It will be carried out in the next year and the results will be reported. Future studies should explore longitudinal effects and assess whether enhanced relevance perception leads to sustained academic success.

VI. CONCLUSION

Enhancing student confidence and perceived relevance through targeted interventions positively impacts motivation and academic performance. These findings contribute to best practices in engineering education and may benefit educators seeking to improve student engagement.

ACKNOWLEDGMENT

The author would like to acknowledge the students and faculty who participated in this study and provided valuable insights. The research was supported by our school's SOTL summer research funding.

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