International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 8, 2025
https://theaspd.com/index.php

# Engineering Students' Self-Efficacy At Kalinga State University: A Quantitative Analysis Of Confidence Across Sex And Course Specialization

**Cherie P. Malaggay[1], Mathew Jun Pego Mariani, Gerlie T. Soriano[1], Venus B. Elveña[1], Cecile B. Amon[1], Vida V. Gunnawa[1], Erica Vane R. Balcanao-Buco[1], Pommy Frances A. Viloria[1]**
[1]College of Engineering and Information Technology, Kalinga State University, Bulanao, Tabuk City, 3800, Kalinga, Philippines

***Abstract***
*This study examined the self-efficacy of engineering students in higher education, focusing on their confidence in mastering engineering concepts and applying technical skills in coursework and future professional practice with an emphasis on their potential role in addressing environmental challenges. A descriptive survey design was employed, with data collected from 321 engineering students enrolled at Kalinga State University during the first semester of academic year 2020–2021. Frequency distribution, t-tests, and one-way ANOVA were used to assess levels of self-efficacy and to test significant differences across sex and course specialization. Findings revealed that most students reported uncertainty in their engineering self-efficacy, particularly in domains requiring higher-order application such as experimentation, tinkering, and design—skills critical for developing sustainable engineering solutions. Significant differences emerged across sex, with male students reporting higher self-efficacy than females, while no significant differences were found across courses. These results suggest that confidence gaps in engineering education are shaped more by gendered perceptions than disciplinary specialization. The study underscores the importance of strengthening academic strategies, experiential learning opportunities, and institutional support systems not only to enhance student confidence and academic achievement but also to cultivate capable, resilient engineers who can contribute to national development through environmentally conscious engineering practices. Integrating environmental education and sustainability-focused projects within engineering curricula could empower students to apply technical skills creatively to tackle pressing ecological challenges, fostering a sense of responsibility and innovation essential for sustainable progress and improved licensure outcomes in the engineering field.*
***Keywords***: *self-efficacy, engineering education, higher education, gender disparities, course specialization*

## INTRODUCTION

Self-efficacy, defined as an individual's belief in their capacity to successfully execute tasks, plays a crucial role in academic persistence and achievement, particularly within the demanding field of engineering (Chen et al., 2023). Research consistently demonstrates a strong correlation between high self-efficacy and improved retention rates and academic performance among engineering students (Hsu et al., 2021; Laboga et al., 2021). Within STEM disciplines, self-efficacy not only influences learning outcomes but also reveals gender-based disparities, with women often reporting lower self-efficacy despite achieving comparable or even superior academic results (Whitcomb et al., 2020). This gap has significant implications, as lower confidence may discourage female students from persisting in engineering or pursuing leadership roles in the profession.

Understanding fluctuations in self-efficacy over time is therefore essential, yet most existing studies adopt cross-sectional designs, overlooking the dynamic nature of students' beliefs (Andrews et al., 2021). Longitudinal perspectives provide valuable insights into how academic experiences—both positive and negative—shape confidence and engagement throughout the course of study. For instance, practical, hands-on experiences such as design practica have been shown to be more effective than traditional exams in building students' self-efficacy, particularly for women and minority groups (Nolte et al., 2020). Such findings highlight the importance of authentic learning opportunities in strengthening engineering self-efficacy.

A person's belief in their ability to succeed is also closely tied to persistence in engineering studies and eventual career choices (Boylan-Ashraf et al., 2015). This belief, or self-efficacy, strongly predicts academic success in higher education and is widely recognized as a critical determinant of student achievement (Omari et al., 2020; Figueiredo et al., 2024). Self-efficacy is especially important for diverse student populations, as it influences not only academic performance but also overall engagement, resilience, and readiness to pursue STEM careers (Moussa, 2023). Higher levels of self-efficacy are associated with greater persistence and stronger career aspirations, making it a vital construct for both educational and professional development.

Low self-efficacy, by contrast, has been identified as a major barrier to success in STEM. Students with limited confidence are less likely to take on challenging tasks, persist through difficulties, or recover quickly from setbacks. They may also develop avoidance behaviors, perceiving complex challenges as threats rather than opportunities, which ultimately leads to disappointing academic outcomes (Chen et al., 2023; Figueiredo et al., 2024; Zakariya, 2021). This self-fulfilling feedback cycle illustrates how low self-efficacy not only limits performance but also undermines future aspirations. Conversely, self-effective students demonstrate greater intrinsic motivation, embrace difficult tasks, and display resilience in the face of failure, making them more likely to achieve their academic and personal goals.

Beyond academic success, fostering self-efficacy in engineering students also has broader social and environmental significance. Today's engineers are at the forefront of addressing urgent global challenges such as climate change, sustainable development, and environmental degradation. Integrating environmental education and awareness into engineering curricula can empower students to see their technical skills as tools for solving real-world ecological problems. When students believe in their capacity to innovate and contribute to environmental sustainability, they not only build stronger self-efficacy but also cultivate a sense of responsibility toward society and the planet. This synergy between self-efficacy and environmental awareness underscores the importance of nurturing future engineers who are both competent and environmentally conscious.

Against this backdrop, the present study seeks to investigate the self-efficacy of engineering students at Kalinga State University. Specifically, it examines how students' beliefs about their capabilities influence their academic trajectories and future professional aspirations. In situating the inquiry within the framework of self-efficacy research while acknowledging the growing demand for environmentally responsible engineering practice, this study aims to generate insights that can inform teaching practices, curriculum design, and institutional strategies for strengthening student confidence, competence, and commitment to sustainable development.

**Objectives of the study**

This study aimed to evaluate the self-efficacy of engineering students at Kalinga State University. Specifically, it sought to:

1. Identify and analyze the factors that influence the self-efficacy of engineering students.
2. Examine whether significant differences in self-efficacy exist across groups categorized by sex and course specialization.

Hypothesis

- Null Hypothesis ($H_0$): There is no significant difference in self-efficacy across student groups based on sex and course specialization.

## METHODOLOGY

The descriptive research design was used in the study, which takes a problem with little to no relevant information and gives it a befitting description using quantitative and qualitative methods. Descriptive analysis will characterize a research problem accurately. Further, a Descriptive survey will gather data about the varying subjects. This data aims to know the extent to which different conditions can be obtained among subjects.

The study was conducted at the College of Engineering and Information Technology, Kalinga State University-Main Campus. The study respondents are students of the Engineering Department students, and there were only three hundred twenty-one who responded in the google classroom.

**Instrumentation**

The Questionnaire used in the study is adapted from the study of Mamaril, N., Usher, E., Li, C., Economy, D., & Kennedy, M. (2016) which measure the efficacy of engineering students.

| **Table 1. Likert Scale** | | |
|---|---|---|
| **Numerical Value** | **Scale** | **Description** |
| 4 | 3.26 – 4.00 | Very Confident |

| | | |
|---|---|---|
| 3 | 2.51 – 3.25 | Confident |
| 2 | 1.75 – 2.50 | Not Sure |
| 1 | 1.00 – 1.74 | Not Confident |

**Statistical analysis**

The data that were collected were classified and tabulated for analysis. The following statistical tools were employed in interpreting the data that were obtained from the survey. Frequency was used to analyze the respondents' profiles and the self-efficacy level concerning the selected variables. Weighted Mean was used to determine self-efficacy.

One-way ANOVA was used to determine the significance between courses while a T-test was used to determine the significance between sexes.

## RESULT and DISCUSSION

### Causes that have an impact on Self-Efficiency

Engineering self-efficacy plays a pivotal role in shaping students' academic persistence, problem-solving ability, and professional readiness. In this study, self-efficacy was measured across four domains—general coursework, experimental tasks, tinkering, and design—to capture a comprehensive view of students' confidence in applying engineering skills. These measures are crucial because confidence affects not only performance but also motivation and long-term commitment to engineering careers (Meng & Zhang, 2023). The following discussion interprets the findings presented in Table 2, highlighting areas where students demonstrated moderate confidence and domains where they remain uncertain, and explores implications for curriculum, pedagogy, institutional reform, and environmental education.

**Table 2. Engineering Self-Efficacy of the Engineering Students**

| **Indicators** | Weighted Mean | Interpretation |
|---|---|---|
| **GENERAL ENGINEERING SELF-EFFICACY (GEN)** | | |
| I can master the content in the engineering-related courses I am taking this semester | **2.49** | Not Sure |
| I can master the content in even the most challenging engineering course | **2.45** | Not Sure |
| I can do a good job on almost all my engineering coursework | **2.57** | Confident |
| I can do an excellent job on engineering-related problems and tasks assigned this semester | **2.54** | Confident |
| I can learn the content taught in my engineering-related courses | **2.58** | Confident |
| I can earn a good grade in my engineering-related courses | **2.70** | Confident |
| **Average Weighted Mean** | **2.56** | Confident |
| **ENGINEERING SKILLS SELF-EFFICACY – Experimental Self-Efficacy** | | |
| I can perform experiments independently | **2.42** | Not Sure |
| I can analyze data resulting from experiments | **2.63** | Confident |
| I can orally communicate the results of experiments | **2.40** | Not Sure |
| I can communicate the results of experiments in written form | **2.87** | Confident |
| I can solve problems using a computer | **2.35** | Not Sure |
| **Average Weighted Mean** | **2.53** | Confident |
| **ENGINEERING SKILLS SELF-EFFICACY – Tinkering Self-Efficacy** | | |
| I can work with tools and use them to build things | **2.81** | Confident |
| I can work with tools and use them to fix things | **2.56** | Confident |
| I can work with machines | **2.35** | Not Sure |
| I can build machines | **1.79** | Not Sure |
| I can fix machines | **2.27** | Not Sure |
| I can manipulate components and devices | **2.19** | Not Sure |
| I can assemble things | **2.33** | Not Sure |
| I can disassemble things | **2.44** | Not Sure |

| | | |
|---|---|---|
| I can apply technical concepts in engineering | **2.59** | Confident |
| **Average Weighted Mean** | **2.37** | Not Sure |
| **ENGINEERING SKILLS SELF-EFFICACY – Design Self-Efficacy** | | |
| I can design new things | **2.59** | Confident |
| I can identify a design need | **2.68** | Confident |
| I can develop design solutions | **2.52** | Confident |
| I can evaluate a design | **2.51** | Confident |
| I can recognize changes needed for a design solution to work | **2.51** | Confident |
| **Average Weighted Mean** | **2.56** | Confident |
| **TOTAL AVERAGE WEIGHTED MEAN** | **2.50** | Confident |

As presented in Table 2, students' general engineering self-efficacy was rated at a weighted mean of 2.56, corresponding to "Not Sure." While students expressed confidence in managing routine coursework, they were less certain about excelling in more challenging subjects. This suggests that students believe they can meet basic requirements but doubt their ability to achieve mastery. Such hesitation may limit aspirations for academic distinction and advanced opportunities. Prior studies confirm that self-doubt often undermines persistence and motivation (Chen et al., 2023; O'Connor & Norton, 2022). Without intentional efforts to strengthen general self-efficacy, students risk adopting a "survival mindset" that focuses on course completion rather than achievement. Institutions can address this gap by embedding sustainability-oriented coursework, where students apply engineering concepts to real-world environmental challenges such as energy efficiency, climate adaptation, and waste reduction. These approaches not only promote mastery experiences but also cultivate environmental awareness, making students see engineering as a means of contributing to ecological resilience.

Experimental self-efficacy was similarly rated "Not Sure" (M = 2.53). Students felt relatively confident analyzing experimental data but were less certain about independently conducting procedures or communicating findings. This indicates that while comprehension skills are developing, procedural independence remains limited. Research shows that feedback alone does not guarantee application unless paired with opportunities for practice and problem-solving (Jordan et al., 2022; Rakoczy & Proft, 2022). Building experimental confidence requires iterative, inquiry-based laboratory work that normalizes mistakes and encourages autonomy (Ghaemi & Potvin, 2021). Incorporating environmental applications into laboratory tasks—such as renewable energy prototypes, air and water quality assessments, or sustainable materials testing—can enhance experimental self-efficacy while also fostering ecological responsibility. This dual focus equips students with the technical competence and environmental awareness required for professional readiness.

The lowest ratings were found in tinkering self-efficacy (M = 2.37), indicating uncertainty in working with machines, assembling components, and repairing devices. Tinkering skills are vital for creativity, adaptability, and practical problem-solving in engineering practice. Limited mechanical exposure has been shown to reduce students' confidence (Bernardo et al., 2023). Globally, hands-on tinkering fosters technical expertise and innovation (Ammar et al., 2024). The findings suggest that current curricula continue to prioritize theoretical mastery over practical engagement. Strengthening tinkering experiences by integrating eco-innovation projects—such as upcycling, green prototyping, or the repair of environmentally friendly devices—can simultaneously build mechanical confidence and environmental awareness. Without expanded opportunities for applied, sustainability-driven tinkering, students may graduate with strong theoretical knowledge but insufficient readiness to address real-world environmental challenges.

Design self-efficacy was slightly higher (M = 2.56), suggesting moderate confidence in identifying design needs and evaluating solutions, but lower confidence in independently developing and refining outputs. This indicates that students handle structured, guided design tasks but find open-ended innovation intimidating. Prior research confirms that students often excel in exams yet struggle with projects requiring creativity and iteration (Sperling et al., 2024). Creativity and critical thinking are strengthened through repeated design cycles rather than isolated assignments (Casakin & Wodehouse, 2021). Embedding project-based learning focused on sustainability—such as renewable energy systems, sustainable housing models, or green transportation solutions—can raise design confidence while aligning student innovation with environmental responsibility.

Collectively, these findings show that engineering students' confidence is fragile and clustered near the "Not Sure" threshold. This reflects not just a skills gap but also a developmental challenge that may limit motivation, professional readiness, and innovation potential. Strengthening self-efficacy must therefore become a core objective of engineering education, requiring curriculum reforms, mentorship, supportive feedback, and opportunities for authentic practice. Interpreted through Bandura's Social Cognitive Theory, these results affirm that confidence develops through mastery experiences, vicarious learning, social persuasion, and emotional regulation. Importantly, integrating environmental education into these experiences can transform hesitant learners into confident, resilient, and environmentally responsible engineers. Such graduates will not only be prepared to contribute to national development and global competitiveness but also to address pressing sustainability challenges that define the future of the engineering profession.

**Significant Differences between sex and course**

To further investigate the factors shaping engineering students' self-efficacy at Kalinga State University, a t-test was performed to compare male and female students' confidence levels. Table 3 shows a statistically significant difference, with males reporting a higher mean score (M = 2.76) compared to females (M = 2.44). This indicates that male students generally feel more confident in their ability to complete engineering tasks despite both groups receiving the same curriculum and opportunities. The results suggest that gender norms and expectations influence how students interpret academic experiences, with women more likely to experience self-doubt. This pattern reflects global trends in STEM, where women's confidence frequently lags behind performance outcomes.

**Table 3. Independent Samples t-Test for Engineering Self-Efficacy by Sex**

| **Statistic** | **Male** | **Female** |
|---|---|---|
| **Sample Mean** | 2.760 | 2.436 |
| **Sample Variance** | 0.6690 | 0.5176 |
| **Sample Size (n)** | 157 | 170 |
| **Pooled Variance** | 0.5909 | – |
| **Test Statistic (z)** | 3.79 | – |
| **p-value (one-tailed)** | 0.000075 | – |
| **Critical Value (one-tailed)** | 1.645 | – |
| **p-value (two-tailed)** | 0.000150 | – |
| **Critical Value (two-tailed)** | 1.960 | – |
| **Decision ($\alpha$ = 0.05)** | **Reject $H_0$** | |
| **Interpretation** | There is a **statistically significant difference** in the engineering self-efficacy of male and female students ($z = 3.79$, $p < 0.05$, two-tailed). | |

These results align with prior studies documenting persistent gender disparities in engineering self-efficacy, where female students report lower confidence even when achieving equal or better outcomes (Chan, 2022; Chen et al., 2023; Morán-Soto & Peña, 2022). Longitudinal research also indicates that women's motivational conceptions and attitudes toward engineering subjects decline over time (Conrad et al., 2024; González-Pérez et al., 2022). Together, this evidence underscores that the confidence gap observed is systemic rather than isolated.

From an environmental education perspective, this gender gap has broader implications. Environmental engineering and sustainability-related fields require diverse perspectives and inclusive participation to develop innovative solutions to climate change, resource management, and ecological protection. If female students continue to underestimate their abilities, the profession risks losing valuable insights that are critical for addressing sustainability challenges. Empowering women in engineering education therefore not only advances gender equity but also strengthens the collective capacity of future engineers to design environmentally conscious and socially responsible solutions.

Practically, these findings highlight the need for gender-responsive interventions that integrate environmental awareness. Confidence gaps are less about ability and more about social persuasions, vicarious experiences, and classroom climate. Mentorship programs, visible female role models, and inclusive pedagogies are critical for helping women internalize their competence and persist in engineering. Embedding sustainability-focused projects that encourage collaboration and leadership across genders can further enhance confidence by showing how technical skills directly contribute to environmental resilience. Addressing these disparities is essential not only to improve retention but also to ensure that capable female students contribute fully to the profession and to the urgent global task of building a more sustainable future.

| **Table 4. One-Way ANOVA of Engineering Self-Efficacy by Course** | | | | | | |
|---|---|---|---|---|---|---|
| **Source of Variation** | **SS** | **df** | **MS** | **F** | **p-value** | **Fcrit** |
| **Between Groups** | 2.1539 | 3 | 0.7180 | 1.5260 | 0.2076 | 2.6326 |
| **Within Groups** | 151.9668 | 323 | 0.4705 | – | – | – |
| **Total** | 154.1208 | 326 | – | – | – | – |
| **Decision ($\alpha$ = 0.05)** | | **Fail to Reject $H_0$** | | | | |
| **Interpretation** | There is **no statistically significant difference** in engineering self-efficacy among students across the different courses ($F = 1.53$, $p > 0.05$). | | | | | |

Table 4 presents the results of the one-way ANOVA, which revealed no statistically significant differences in self-efficacy across engineering courses ($F = 1.53$, $p = 0.21$). Although minor variations in mean scores were observed, these differences were not meaningful, suggesting that confidence-related issues are systemic rather than course-specific. Whether students were enrolled in civil, electrical, or mechanical engineering, their ratings clustered near the "Not Sure" range. This pattern points to shared institutional and structural influences on confidence, such as teaching approaches, resource availability, and feedback mechanisms.

This finding aligns with studies indicating that self-efficacy is a predictor of academic outcomes across multiple disciplines (Chen et al., 2023). The evidence emphasizes that confidence plays a more critical role in persistence and performance than the choice of specialization (Brashi, 2022). The consistency of "Not Sure" ratings across courses mirrors global observations, underscoring that self-efficacy gaps remain a widespread challenge in engineering education.

From an institutional perspective, these results highlight the need for broad, university-wide interventions rather than narrowly focused, course-specific strategies. Initiatives such as embedding experiential learning opportunities, improving laboratory access, and standardizing constructive feedback across programs may elevate student confidence more uniformly. Addressing these systemic factors will enable Kalinga State University to support students across all engineering disciplines in developing the self-efficacy necessary for academic success and professional readiness.

## CONCLUSION AND RECOMMENDATION

This study investigated the self-efficacy of engineering students at Kalinga State University across four domains: general coursework, experimentation, tinkering, and design. Overall, students reported "Not Sure" ratings, reflecting fragile confidence despite adequate ability. The lowest levels of self-efficacy were observed in tinkering and design, underscoring gaps in hands-on practice and innovative skills that are vital to engineering education and professional readiness. While significant sex differences were found in favor of male students, no differences emerged across courses, suggesting that self-efficacy challenges are systemic rather than discipline-specific.

Anchored in Bandura's Social Cognitive Theory, these findings affirm the importance of mastery experiences, vicarious learning, social persuasions, and emotional states in shaping students' confidence. To address these challenges, the engineering curriculum should be enriched with experiential and project-based learning approaches such as makerspaces, extended laboratory hours, and community-driven projects that foster autonomy and mastery. Faculty members are likewise encouraged to adopt inclusive, feedback-rich strategies and establish mentorship programs that develop confidence alongside competence.

At the institutional level, gender-responsive initiatives must be prioritized to support female students, cultivate peer networks, and mitigate stereotype threats. More broadly, Kalinga State University should implement coordinated, university-wide reforms to systematically strengthen student self-efficacy.

Finally, it is recommended that future research examine longitudinal trends in engineering students' self-efficacy and assess the effectiveness of targeted interventions designed to build confidence and motivation. Such efforts are essential for developing resilient, innovative engineers who can effectively meet national and global demands.

**FUNDINGS:** This research was fully funded by the Kalinga State University Research and Development Office (KSU-RDO) under its institutional research grant program. The funding agency had no involvement in the study design, data collection, analysis, interpretation, or decision to publish the results.

**ACKNOWLEDGEMENTS:** The researchers sincerely express their gratitude to Kalinga State University, particularly the Research and Development Office, for their invaluable support and encouragement throughout the conduct of this study. We also extend our appreciation to the College of Engineering and Information Technology administration, faculty, and students who willingly participated and provided the data necessary to accomplish this research. Finally, we are grateful to our colleagues, mentors, and peers for their insights and constructive feedback, which greatly contributed to the improvement of this work.

**LITERATURE CITED**

- Ammar, M., Al-Thani, N., & Ahmad, Z. (2024). Role of pedagogical approaches in fostering innovation among K-12 students in STEM education. Social Sciences & Humanities Open, 9, 100839. https://doi.org/10.1016/j.ssaho.2024.100839
- Andrews, M., Patrick, A., & Borrego, M. (2021). Engineering students' attitudinal beliefs by gender and student division: a methodological comparison of changes over time. International Journal of STEM Education, 8(1). https://doi.org/10.1186/s40594-020-00269-6
- Bandura, A. (1997). Self-efficacy: The exercise of control. W.H. Freeman.
- Bernardo, A. B. I., Cordel, M. O., Calleja, M. O., Teves, J. M. M., Yap, S. A., & Chua, U. (2023). Profiling low-proficiency science students in the Philippines using machine learning. Humanities and Social Sciences Communications, 10(1). https://doi.org/10.1057/s41599-023-01705-y
- Boylan-Ashraf, P., Billington, S. L., & Sheppard, S. (2015). Using Online and Hands-on Activities to Improve Self-efficacy in Mechanics. https://doi.org/10.18260/p.25008
- Brashi, A. (2022). Self-Efficacy in the Prediction of GPA and Academic Computer Use in Undergraduate Translation Students at a Saudi University. Frontiers in Psychology, 13. https://doi.org/10.3389/fpsyg.2022.865581
- Casakin, H., & Wodehouse, A. (2021). A Systematic Review of Design Creativity in the Architectural Design Studio [Review of A Systematic Review of Design Creativity in the Architectural Design Studio]. Buildings, 11(1), 31. Multidisciplinary Digital Publishing Institute. https://doi.org/10.3390/buildings11010031
- Chan, R. C. H. (2022). A social cognitive perspective on gender disparities in self-efficacy, interest, and aspirations in science, technology, engineering, and mathematics (STEM): the influence of cultural and gender norms. International Journal of STEM Education, 9(1). https://doi.org/10.1186/s40594-022-00352-0
- Chen, X., Usher, E. L., Roeder, M., Johnson, A. R., Kennedy, M., & Mamaril, N. A. (2023). Mastery, models, messengers, and mixed emotions: Examining the development of engineering self-efficacy by gender. Journal of Engineering Education, 112(1), 64. https://doi.org/10.1002/jee.20494
- Conrad, M. O., Abdallah, A. R., & Ross, L. (2024, February 20). Why is Retaining Women in STEM Careers so Challenging? A Closer Look at Women's Insights and Experiences in STEM Fields. 2020 ASEE Virtual Annual Conference Content Access Proceedings. https://doi.org/10.18260/1-2--38060
- Figueiredo, E., Fonseca, C., & Paiva, T. (2024). Self-efficacy and academic performance in higher education: a case study. European Public & Social Innovation Review, 9, 1. https://doi.org/10.31637/epsir-2024-960
- Ghaemi, R. V., & Potvin, G. (2021). Experimenting with labs: Practical and pedagogical considerations for the integration of problem-based lab instruction in chemical engineering. The Canadian Journal of Chemical Engineering, 99(10), 2163. https://doi.org/10.1002/cjce.24136
- González-Pérez, S., Martínez, M. M., Paredes, V. R., & Cifré, E. (2022). I am done with this! Women dropping out of engineering majors. Frontiers in Psychology, 13. https://doi.org/10.3389/fpsyg.2022.918439
- Hsu, H., Li, Y., Dugger, S. M., & Jones, J. (2021). Exploring the relationship between student-perceived faculty encouragement, self-efficacy, and intent to persist in engineering programs. European Journal of Engineering Education, 46(5), 718. https://doi.org/10.1080/03043797.2021.1889469
- Jordan, K., Zajac, R., Bernstein, D. M., Joshi, C., & Garry, M. (2022). Trivially informative semantic context inflates people's confidence they can perform a highly complex skill. Royal Society Open Science, 9(3). https://doi.org/10.1098/rsos.211977
- Laboga, J. A., Capala, J., Caliwan, R., & Naboya, A. (2021). Self – Efficacy and Academic Performance of Freshmen Engineering Students with Preparatory and Non-Preparatory Strands. Turkish Online Journal of Qualitative Inquiry, 12(7), 3379. https://tojqi.net/index.php/journal/article/view/4264
- Mamaril, N. A., Usher, E. L., Li, C. R., Economy, D. R., & Kennedy, M. S. (2016). Measuring Undergraduate Students' Engineering Self-Efficacy: A Validation Study. Journal of Engineering Education, 105(2), 366–395. https://doi.org/10.1002/jee.20121

- Meng, Q., & Zhang, Q. (2023). The Influence of Academic Self-Efficacy on University Students' Academic Performance: The Mediating Effect of Academic Engagement. Sustainability, 15(7), 5767. https://doi.org/10.3390/su15075767
- Morán-Soto, G., & Peña, O. I. G. (2022). Mathematics Anxiety and Self-Efficacy of Mexican Engineering Students: Is There Gender Gap? Education Sciences, 12(6), 391. https://doi.org/10.3390/educsci12060391
- Moussa, N. (2023). Promoting Academic Achievement: The Role of Self-efficacy in Predicting Students' Success in the Higher Education Settings. Psychological Science and Education, 28(2), 18. https://doi.org/10.17759/pse.2023280202
- Nolte, H., Berdanier, C., Menold, J., & McComb, C. (2020). Assessing Engineering Design: A Comparison of the Effect of Exams and Design Practica on First-Year Students' Design Self-Efficacy. Journal of Mechanical Design, 143(5). https://doi.org/10.1115/1.4048747
- O'Connor, B. R., & Norton, S. J. (2022). Exploring the challenges of learning quadratic equations and reflecting upon curriculum structure and implementation. Mathematics Education Research Journal, 36(1), 151. https://doi.org/10.1007/s13394-022-00434-w
- Omari, O., Moubtassime, M., & Ridouani, D. (2020). Factors Affecting Students' Self-Efficacy Beliefs in Moroccan Higher Education. Journal of Language and Education, 6(3), 108. https://doi.org/10.17323/jle.2020.9911
- Rakoczy, H., & Proft, M. (2022). Knowledge before belief ascription? Yes and no (depending on the type of "knowledge" under consideration). Frontiers in Psychology, 13. https://doi.org/10.3389/fpsyg.2022.988754
- Sperling, J., Mburi, M., Gray, M., Schmid, L., & Saterbak, A. (2024). Effects of a first-year undergraduate engineering design course: survey study of implications for student self-efficacy and professional skills, with focus on gender/sex and race/ethnicity. International Journal of STEM Education, 11(1). https://doi.org/10.1186/s40594-024-00467-6
- Whitcomb, K. M., Kalender, Z. Y., Nokes-Malach, T. J., Schunn, C. D., & Singh, C. (2020). A mismatch between self-efficacy and performance: Undergraduate women in engineering tend to have lower self-efficacy despite earning higher grades than men. arXiv (Cornell University). https://doi.org/10.48550/arxiv.2003.06006
- Zakariya, Y. F. (2021). Self-Efficacy Between Previous and Current Mathematics Performance of Undergraduate Students: An Instrumental Variable Approach to Exposing a Causal Relationship. Frontiers in Psychology, 11. https://doi.org/10.3389/fpsyg.2020.556607