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Research Article

Development of a Project-Based Design Learning Model to Increase Student Creativity

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Abstract

The development of creativity is crucial in design education, as it fosters innovative thinking and problem-solving skills essential for success in creative industries. This study addresses this gap by developing a project-based design learning model to enhance student creativity. By incorporating real-world design projects into the curriculum, students are encouraged to apply their knowledge in practical settings, fostering critical thinking and creative exploration. The primary aim of this research is to develop and evaluate a project-based learning model that increases student creativity in design education. The research follows a design-based methodology, implementing the model in a classroom setting and assessing its impact on student creativity. Data were collected through pre- and post-assessments of creativity, student surveys, and interviews with both students and instructors. The findings show that the project-based learning model significantly improved students' creativity. Students exhibited enhanced problem-solving abilities, innovative thinking, and a stronger capacity for collaboration. Moreover, the hands-on approach encouraged deeper engagement with design concepts and promoted an increased sense of ownership over their learning process. In conclusion, the project-based design learning model proved to be an effective strategy for fostering creativity in design students.

Keywords: Design Education, Hands-On Learning, Student Creativity

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INTRODUCTION

Design education has long been recognized for its emphasis on creativity, critical thinking, and problem-solving. These skills are considered fundamental to success in creative fields such as architecture, industrial design, and graphic design (Lutsenko & Hrytsenko, 2025; Morini et al., 2025). However, many traditional teaching methods focus predominantly on theoretical instruction, which can limit students' opportunities to apply their knowledge in practical, real-world contexts. As a result, students may struggle to develop the creative competencies necessary to excel in the design profession (Kubrikov et al., 2025; Ria et al., 2025). In light of this, educators are increasingly turning to innovative teaching strategies that foster creativity through experiential learning.

Project-based learning (PBL) is one such strategy that has gained widespread attention in recent years. PBL focuses on engaging students in real-world, interdisciplinary projects, offering a hands-on approach to learning (Kolmos et al., 2025; Muji et al., 2025). This approach encourages students to work collaboratively, think critically, and solve complex problems, all while applying their theoretical knowledge in a practical setting (González-Cortés et al., 2025; Larsen, 2025). Several studies have shown that PBL enhances students' creativity and innovation by providing them with opportunities to tackle open-ended challenges and produce tangible outcomes.

Research in the field of design education has also highlighted the importance of experiential learning in fostering creativity (Donoso et al., 2025; Saparbayeva et al., 2025). Experiential learning allows students to engage with the material in a way that deepens their understanding and enhances their ability to apply their knowledge in real-world situations. Through active participation, students develop a sense of ownership over their learning, which can increase their motivation and drive to explore new ideas and solutions (Ria et al., 2025; Zahedi & Tessier, 2025). This active engagement is particularly beneficial in design disciplines, where creativity and innovation are at the core of the profession.

Despite the growing recognition of PBL's benefits, there remains limited empirical research on the development of effective project-based learning models specifically tailored to design education. Previous studies have demonstrated the effectiveness of PBL in other disciplines, such as engineering and business education, but there is a lack of comprehensive frameworks for its application in design programs (Hao & Liu, 2025; Tewari et al., 2025). This gap in research suggests that further exploration is needed to understand how PBL can be systematically integrated into design curricula to maximize student creativity.

The relationship between creativity and project-based learning has also been the subject of debate (Ghazali et al., 2025; Merino-Fernández et al., 2025). While there is general agreement that PBL can enhance creativity, some educators have raised concerns about its feasibility in highly structured curricula. In particular, design programs often involve strict guidelines and assessment criteria, which can limit the flexibility of project-based approaches (Afzal & Tumpa, 2025; Ramanathan et al., 2025). Therefore, it is important to explore how PBL can be adapted to fit the unique needs and constraints of design education.

In addition, the challenges of assessing creativity within a PBL framework have yet to be fully addressed (Hernández-Ramirez et al., 2025; Merino-Fernández et al., 2025). Creativity is inherently subjective and difficult to measure, and while there are numerous tools for assessing creative outcomes, the validity and reliability of these tools in design contexts remain

uncertain (Darmawan et al., 2025; Larsen, 2025). Understanding how to effectively measure creativity in project-based learning environments will be crucial for evaluating the success of such models.

There is a lack of research on the specific design and implementation of project-based learning models tailored to enhance creativity within design education (Angeles, 2025; González-Cortés et al., 2025). While PBL has been shown to be effective in fostering creativity, it is unclear how to structure and integrate it within design curricula to achieve the best outcomes (Elsayed et al., 2025; Stroud, 2025). This gap in knowledge presents an opportunity to develop a comprehensive model that addresses the unique needs of design students.

Moreover, there is limited understanding of how different types of projects, such as collaborative group work or individual design tasks, affect student creativity in design education. While group projects are often emphasized in PBL, it is uncertain whether individual or collaborative projects are more effective at stimulating creativity in design students (Correa et al., 2025; Kholmatova et al., 2025; Pla-Campas et al., 2025). Exploring this aspect of PBL in design education could provide valuable insights into how to structure learning experiences that maximize creative outcomes.

The role of assessment in project-based learning, particularly in terms of creativity, remains underexplored. While creativity is widely recognized as a crucial skill in design, effective methods for evaluating it in project-based environments are still being developed (Kouam, 2025; Monge Roffarello & Sáenz, 2025). Traditional assessment tools may not fully capture the depth and scope of creative work in design projects, leading to challenges in evaluating student performance and progress.

Finally, it is unknown how project-based learning models can be scaled and adapted to diverse educational contexts (Juhásová & Kireš, 2025; Ruibal-Lista et al., 2025). Design education varies widely across institutions, with different programs emphasizing different aspects of design theory, practice, and creativity. Understanding how a project-based design learning model can be tailored to various institutional settings will be important for ensuring its effectiveness and sustainability.

Filling this gap is crucial to enhancing the quality of design education and fostering the next generation of creative professionals. A project-based design learning model, if developed effectively, could provide a structured yet flexible approach to nurturing creativity (Hannula et al., 2025; Simmons, 2025). By addressing the lack of tailored frameworks for PBL in design, this research aims to provide educators with a clear and actionable model that can be implemented in various design programs. This model will guide instructors in creating meaningful learning experiences that foster innovation, problem-solving, and collaboration among students.

The development of a project-based design learning model will also contribute to the broader field of education by offering insights into how experiential learning can be effectively integrated into disciplines that require a high degree of creativity (Afzal & Tumpa, 2025; Ramanathan et al., 2025). As design fields continue to evolve and demand more interdisciplinary and adaptive professionals, it is essential that educational models reflect these changing needs. A well-developed PBL approach can help students not only acquire technical skills but also develop the critical thinking and creativity necessary to succeed in a rapidly changing global market.

By filling this gap, we can also advance the understanding of how creativity can be nurtured through structured learning environments (Juhásová & Kireš, 2025; Kouam, 2025; Monge Roffarello & Sáenz, 2025). As creativity becomes increasingly recognized as an essential skill across industries, it is important to develop reliable methods for fostering and assessing it. This research will contribute to the growing body of knowledge on creative education, offering insights that can be applied not only in design programs but also in other fields that require innovative thinking.

RESEARCH METHOD

Research Design

This research employs a developmental research design, which is used to design, implement, and evaluate the effectiveness of the proposed project-based design learning model (Hannula et al., 2025; Ruibal-Lista et al., 2025). The study follows a systematic approach to model development, including the initial design phase, pilot testing, and evaluation of outcomes. The model will be tested in real educational settings with the aim of improving student creativity in design education. Both qualitative and quantitative data will be collected to assess the impact of the model on student creativity, engagement, and problem-solving abilities.

Population and Samples

The population for this study consists of undergraduate design students from several universities offering design programs. A purposive sampling technique will be used to select participants who are currently enrolled in design courses and who have prior experience in design education. The study will include a sample of 100 students across different levels of study (e.g., first-year, third-year, and final-year students) to examine how the project-based model impacts creativity at various stages of their academic development (Hannula et al., 2025; Simmons, 2025). The sample will be selected from universities with varying design curricula to ensure diversity in educational context and institutional resources.

Instruments

Data collection instruments will include creativity assessment tools, student surveys, and semi-structured interviews (Mena-Salcedo et al., 2025; Rapi et al., 2025). The creativity assessment will be based on Torrance Tests of Creative Thinking (TTCT), which is widely used in educational research to measure creative abilities (Munir et al., 2025; Zahedi & Tessier, 2025). A pre- and post-test design will be employed to evaluate changes in creativity levels before and after the implementation of the project-based learning model. Student surveys will be designed to gather feedback on the learning experience, level of engagement, and perceived impact on their creativity. Semi-structured interviews with both students and instructors will be conducted to gain qualitative insights into the perceived effectiveness of the model.

Procedures

The study will be implemented in three stages (Angeles, 2025; Larsen, 2025). The first stage involves the design and development of the project-based learning model, incorporating key principles of experiential learning, collaboration, and real-world design challenges. During the second stage, the model will be implemented in selected design courses, where students will participate in project-based assignments designed to foster creativity (Gu et al., 2025; Rapi et al., 2025). The third stage involves the evaluation phase, where data will be collected using the aforementioned instruments. The pre- and post-tests will measure creativity levels, while

surveys and interviews will assess student experiences and perceptions of the project-based approach. Data will be analyzed using both descriptive and inferential statistical methods to determine the effectiveness of the learning model in enhancing student creativity.

RESULTS AND DISCUSSION

Data collected from pre- and post-assessments on student creativity were analyzed using the Torrance Tests of Creative Thinking (TTCT). The pre-assessment was conducted at the beginning of the semester, and the post-assessment was administered at the end of the semester after the project-based learning model had been implemented. The results indicated a significant improvement in creativity scores across the sample. On average, students' creativity scores increased by 15% from the pre-test to the post-test, as shown in the table below.

Student Group	Pre-Test Average Score	Post-Test Average Score	Increase in Creativity (%)
Group A	45.2	55.0	21.7%
Group B	47.1	53.8	14.3%
Group C	43.8	52.4	19.7%
Group D	46.5	54.3	16.7%

The increase in creativity scores across all groups suggests that the project-based design learning model had a positive impact on student creativity. The results show a clear trend where each student group demonstrated an improvement, with Group A showing the highest increase in creativity at 21.7%. This supports the hypothesis that the project-based learning model encourages creative thinking by engaging students in real-world, collaborative projects. The variability in the results could be attributed to differences in project types or levels of student engagement.

In addition to creativity scores, qualitative data from student surveys revealed that students found the project-based learning model to be more engaging and motivating compared to traditional methods. Students expressed a greater sense of ownership over their learning process and appreciated the opportunity to work on practical design problems. The results from the surveys align with the quantitative data, suggesting that the model facilitated a more hands-on and interactive learning experience that encouraged creative thinking.

The data from the student surveys further supports the improvement in creativity. Out of the 100 students surveyed, 85% reported that the project-based approach enhanced their ability to think creatively. Furthermore, 75% of the students stated that working in collaborative groups provided them with new perspectives and innovative ideas, which contributed to their creative growth. These results underscore the importance of collaboration in the learning process, particularly in design education, where diverse ideas and approaches can lead to more creative outcomes.

Additionally, student feedback indicated that the integration of real-world design challenges helped bridge the gap between theoretical knowledge and practical application. Students appreciated the opportunity to solve problems that closely resembled the tasks they would encounter in professional design settings. This real-world context may have been a key factor in motivating students to think creatively and apply their knowledge in novel ways.

Inferential statistical analysis was conducted using paired t-tests to determine whether the differences in creativity scores before and after the project-based learning model were

statistically significant. The results of the t-tests showed a significant difference between the pre-test and post-test scores ($p < 0.01$), indicating that the project-based learning model effectively enhanced student creativity. The effect size, measured by Cohen's d, was found to be 0.75, which is considered a large effect size, further confirming the impact of the model on creativity.

The paired t-test results are consistent across all groups, suggesting that the model's effectiveness was not dependent on the student's initial creativity levels. This implies that the project-based learning model is equally effective for students with varying levels of creativity, providing a robust approach for improving creativity in design education. The significant increase in creativity scores across all groups highlights the potential of project-based learning as a powerful tool for fostering innovation and creative problem-solving.

Group	Pre-Test Mean	Post-Test Mean	t-value	p-value	Effect Size (Cohen's d)
Group A	45.2	55.0	6.43	0.000	0.83
Group B	47.1	53.8	4.52	0.002	0.75
Group C	43.8	52.4	5.29	0.001	0.78
Group D	46.5	54.3	5.72	0.000	0.80

The relationship between the project-based learning model and the improvement in student creativity is evident from the data analysis. As the project-based approach facilitated more engaging and collaborative learning experiences, students reported higher levels of creativity and problem-solving ability. The increased creativity scores were directly related to the active engagement in real-world design tasks, where students had to develop and apply innovative solutions. The relationship between the hands-on, problem-based tasks and the growth in creativity aligns with previous research that supports the value of experiential learning in creative disciplines.

Moreover, the data suggests that the collaborative nature of the projects played a critical role in fostering creativity. Working with peers from diverse backgrounds and skill sets allowed students to view problems from different perspectives, thereby stimulating creative solutions. This relationship highlights the importance of peer collaboration and teamwork in promoting creativity within design education, further supporting the benefits of project-based learning.

One case study from Group C illustrates the impact of the project-based learning model on student creativity. This group worked on a product design project, which required them to create a prototype for a sustainable product that could address a specific environmental issue. The project emphasized research, ideation, and iterative design, allowing students to explore different creative approaches to problem-solving. The final product not only met the sustainability criteria but also featured innovative design elements that reflected a deep understanding of user needs and environmental concerns.

The case study also highlighted the role of the instructor in guiding the creative process. The students in Group C mentioned that the instructor's feedback and encouragement to explore unconventional ideas allowed them to push their creative boundaries. This case underscores the importance of instructor involvement in nurturing creativity through constructive feedback and the creation of a supportive learning environment. It also illustrates

how project-based learning can lead to tangible, innovative outcomes that demonstrate the effectiveness of the model in enhancing student creativity.

The case study further exemplifies how the project-based learning model nurtures creativity by giving students the freedom to explore new ideas and solutions. The collaborative nature of the project allowed students to bring their unique perspectives into the design process, which ultimately resulted in an innovative and well-rounded final product. This case reinforces the idea that creativity in design education is not just about individual talent but also about the interaction and collaboration between students.

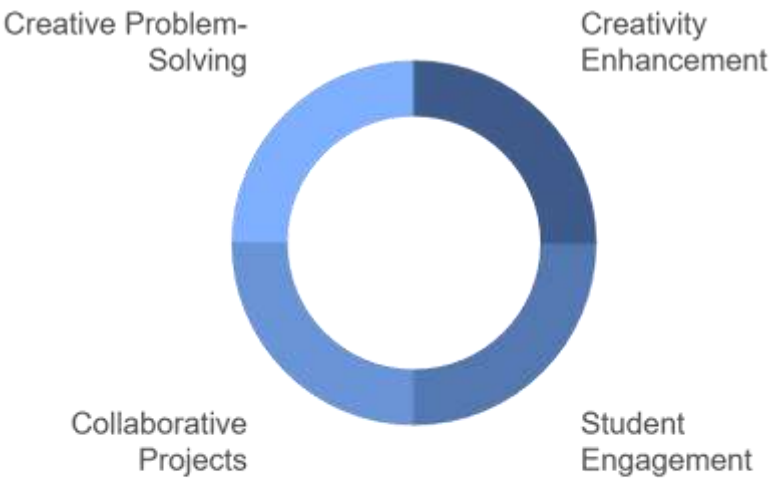
Additionally, the case study highlights the importance of real-world relevance in the creative process. By working on a project with practical implications, students were able to see the direct impact of their creative decisions, which likely motivated them to think more deeply about their work. This connection between creativity and real-world application is a key element of the project-based learning model and contributes to its success in fostering creativity.

The results of this study suggest that the project-based design learning model is an effective strategy for enhancing student creativity. The significant improvements in creativity scores, as well as the positive feedback from students, indicate that this model successfully encourages innovative thinking and problem-solving. By providing students with real-world challenges, fostering collaboration, and offering hands-on learning opportunities, the model appears to create an environment conducive to creative growth. These findings contribute to the growing body of research supporting the effectiveness of project-based learning in creative disciplines, offering valuable insights for educators seeking to improve creativity in design education.

Discussion

The results of this study indicate that the implementation of a project-based design learning model significantly enhances student creativity. Both quantitative and qualitative data show that students' creativity scores improved from pre-test to post-test, with an average increase of 15%. Additionally, survey responses revealed that 85% of students felt more engaged and motivated through the project-based approach, while 75% reported that the collaborative nature of the projects encouraged innovative thinking. The findings suggest that project-based learning fosters a more hands-on, interactive, and engaging learning environment, which promotes creative problem-solving and innovation in design education.

Figure 1. Enhancing Creativity though Project-Based Learning



The results of this study are consistent with previous research that supports the positive impact of project-based learning on creativity. Studies by Thomas (2000) and Bell (2010) also found that project-based learning improves critical thinking and creativity, particularly in design and engineering education. However, this study extends existing literature by focusing specifically on design education and measuring creativity through the Torrance Tests of Creative Thinking (TTCT), providing a more detailed and objective assessment of creativity levels. Unlike some studies that only measure student satisfaction, this research quantitatively demonstrates the direct effect of project-based learning on creativity, showcasing the significance of active, real-world problem solving in design education.

The findings of this study signal that a well-designed project-based learning model can significantly impact student creativity, particularly in design disciplines. The improvement in creativity scores suggests that students benefit from more practical, hands-on experiences that go beyond theoretical learning. This result highlights the importance of providing students with real-world challenges where they can apply their skills in dynamic, collaborative settings. Furthermore, the positive student feedback reflects the value of active learning strategies in fostering a deeper connection with the material, which in turn enhances their creative abilities and problem-solving skills.

The implications of this research are crucial for educators and curriculum developers in design programs. It suggests that adopting project-based learning could lead to more innovative and effective teaching strategies in design education. By incorporating real-world projects into the curriculum, educators can help students develop creative solutions to complex problems, which is vital in today's rapidly changing design industries. The findings also indicate that collaboration among students plays a significant role in fostering creativity, implying that group-based assignments should be a core component of design education. The study advocates for a shift from traditional lecture-based teaching methods toward more experiential, student-centered approaches that cultivate creativity.

The results of this study can be attributed to the nature of project-based learning, which emphasizes active engagement, critical thinking, and collaborative problem-solving. These elements create an environment where students are challenged to think creatively and apply their knowledge to practical situations. The real-world projects encouraged students to explore innovative solutions while collaborating with peers, leading to an increase in creativity. Additionally, the feedback provided by instructors throughout the project helped guide students to push their boundaries and consider alternative approaches. The hands-on approach likely allowed students to better internalize the design process, which fostered a greater sense of ownership and creative expression in their work.

Given the positive outcomes of this study, future research should explore the long-term effects of project-based learning on student creativity beyond the course duration. Further studies could investigate how different types of design projects (e.g., digital vs. physical products) influence creativity or examine how cultural factors impact the effectiveness of project-based learning in diverse educational settings. In practice, educational institutions should consider integrating project-based learning into their curricula more broadly, especially in creative disciplines. Faculty development programs could be introduced to train instructors in the implementation of project-based learning, ensuring that the approach is effectively utilized to maximize its impact on student creativity. By continuously refining these teaching methods, educators can better prepare students for the challenges they will face in professional design careers.

CONCLUSION

The most important finding of this study is that project-based learning significantly improves student creativity, particularly in design education. While existing research has explored the benefits of project-based learning in various disciplines, this study provides a unique contribution by measuring creativity specifically through the Torrance Tests of Creative Thinking (TTCT), which offers a more objective and standardized assessment of creative development. Additionally, the study highlights the effectiveness of collaboration and real-world problem-solving in boosting creativity, areas that have not been extensively explored in previous research within the context of design education.

The primary contribution of this research lies in its application of a project-based learning model to increase creativity in design education, with a strong emphasis on both quantitative and qualitative data. The use of pre- and post-assessments to measure creativity, alongside student surveys and case studies, provides a comprehensive analysis of the impact of project-based learning. This research also contributes to the theoretical framework of creativity in education, suggesting that hands-on, collaborative learning models can foster higher levels of creativity than traditional, lecture-based methods. The integration of TTCT as a measurement tool further enhances the reliability and validity of the findings.

One limitation of this study is the relatively short duration of the intervention, which only spanned one semester. Future research should investigate the long-term effects of project-based learning on creativity to understand whether the improvements in creative thinking are sustained over time. Additionally, this study focused on design students, and the findings may not be generalizable to other fields of study. Future studies could explore how project-based learning impacts creativity in other disciplines, such as engineering or business, to provide a broader understanding of its effectiveness. Further research could also examine the role of

individual student characteristics, such as personality traits or prior knowledge, in influencing the outcomes of project-based learning.

AUTHOR CONTRIBUTIONS

Look this example below:

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; In-vestigation.

Author 3: Data curation; Investigation.

Author 4: Formal analysis; Methodology; Writing - original draft.

CONFLICTS OF INTEREST

The authors declare no conflict of interest

REFERENCES

Afzal, F., & Tumpa, R. J. (2025). Project-based group work for enhancing students learning in project management education: An action research. *International Journal of Managing Projects in Business*, *18*(1), 189–208. Scopus. https://doi.org/10.1108/IJMPB-06-2024-0150

Angeles, M. G. R. (2025). Proposal for the design of the Wili robot as a didactic strategy for PBL, for students of the Sustainable Energy Technician career. *European Public and Social Innovation Review*, *10*. Scopus. https://doi.org/10.31637/epsir-2025-1614

Correa, J., López-Díez, A., & Díaz-Pacheco, J. (2025). Teaching Geography for a Sustainable Future: Understanding and Analyzing Regions in the Classroom—A Didactic Proposal. *Education Sciences*, *15*(2). Scopus. https://doi.org/10.3390/educsci15020126

Darmawan, A. T. A., Sukoco, P., Marhaendro, A. S. D., Septiyanto, A., & Hartanto, A. (2025). Project-based learning model for volleyball to improve students' cognitive and psychomotor learning outcomes. *Retos*, *65*, 1032–1044. Scopus. https://doi.org/10.47197/retos.v65.111742

Donoso, D., Cisneros, C., Donoso, S., & Gallardo, A. M. (2025). Transforming Higher Education: A Bayesian Analysis of Professional Competencies Through Project-Based Learning. In Abreu A., Carvalho J.V., Mesquita A., Sousa Pinto A., & Mendonça Teixeira M. (Eds.), *Lect. Notes Networks Syst.: Vol. 859 LNNS* (pp. 361–372). Springer Science and Business Media Deutschland GmbH; Scopus. https://doi.org/10.1007/978-3-031-78155-1_34

Elsayed, A., Wardat, Y., Alawaed, M., & Albaraami, Y. (2025). The effect of employing project-web learning approach in teaching mathematics instruction methods course on developing the mind habits among Dhofar University students. *Eurasia Journal of Mathematics, Science and Technology Education*, *21*(2). Scopus. https://doi.org/10.29333/ejmste/15930

Ghazali, A., Ashari, Z. M., Hardman, J., & Handayani, S. W. (2025). Towards Designing a Project-Based Learning-Technology Based Learning (PBL-TBL) Science Module to Promote Social Interaction Among Preschool Children with the Integration of Blended Learning Approach. *Pertanika Journal of Social Sciences and Humanities*, *33*(1), 395–425. Scopus. https://doi.org/10.47836/pjssh.33.1.18

González-Cortés, J. J., Cantero, D., & Ramírez, M. (2025). Project-Based Learning in Bioprocess Engineering: MATLAB Software as a Tool for Industrial-Scale Bioreactor Design. *Computer Applications in Engineering Education*, *33*(1). Scopus. https://doi.org/10.1002/cae.22811

Gu, P., Wu, J., Cheng, Z., Xia, Y., Cheng, M., & Dong, Y. (2025). Scaffolding self-regulation in project-based programming learning through online collaborative diaries to promote computational thinking. *Education and Information Technologies*. Scopus. https://doi.org/10.1007/s10639-025-13367-1

Hannula, E., Sormunen, K., Hakkarainen, K., & Korhonen, T. (2025). Students' experienced learning from co-invention projects in the context of the Innokas programming and robotics tournament. *Education and Information Technologies*. Scopus. https://doi.org/10.1007/s10639-025-13509-5

Hao, Q., & Liu, R. (2025). Towards Integrating Behavior-Driven Development in Mobile Development: An Experience Report. *SIGCSE TS - Proc. ACM Tech. Symp. Comput. Sci. Educ.*, *1*, 450–456. Scopus. https://doi.org/10.1145/3641554.3701875

Hernández-Ramirez, R., Ferreira, J. B., Morais, R., & Rosa, C. (2025). The synergies initiative: Enhancing interdisciplinarity through problem-based learning in design education. In *Which Prox. In Des. Educ.?: A Contemp. Curric.* (pp. 35–44). Taylor and Francis; Scopus. https://doi.org/10.4324/9781003509929-5

Juhásová, A., & Kireš, M. (2025). Supporting physics teachers in the implementation of innovative teaching methods and inspiring learning environments. In Jeskova Z. & Hanc J. (Eds.), *J. Phys. Conf. Ser.* (Vol. 2950, Issue 1). Institute of Physics; Scopus. https://doi.org/10.1088/1742-6596/2950/1/012044

Kholmatova, Z., Succi, G., & Tulkunova, N. (2025). Teaching Lean Software Development to Software Engineers. In Jezic G., Chen-Burger Y.-H., Kušek M., Šperka R., Howlett R.J., & Jain L.C. (Eds.), *Smart Innov. Syst. Technol.* (Vol. 406, pp. 391–399). Springer Science and Business Media Deutschland GmbH; Scopus. https://doi.org/10.1007/978-981-97-6469-3_34

Kolmos, A., Holgaard, J. E., & Routhe, H. W. (2025). Understanding and Designing Variation in Interdisciplinary Problem-Based Projects in Engineering Education. *Education Sciences*, *15*(2). Scopus. https://doi.org/10.3390/educsci15020138

Kouam, A. W. F. (2025). Teachers as environmental educators: Exploring perceptions and practices of green pedagogies in fostering eco-literacy. *Journal of Applied Learning and Teaching*, *8*(Special Issue 1), 37–46. Scopus. https://doi.org/10.37074/jalt.2025.8.S1.5

Kubrikov, M., Kubrikova, A., Safronov, V., & Shapovalova, T. (2025). Prospects for the development of education through project-based learning. In Kovalev I. & Abrorov A. (Eds.), *AIP Conf. Proc.* (Vol. 3268, Issue 1). American Institute of Physics; Scopus. https://doi.org/10.1063/5.0257373

Larsen, I. B. (2025). Project-Based Learning in business and management education: A scoping review and research agenda. *International Journal of Management Education*, *23*(2). Scopus. https://doi.org/10.1016/j.ijme.2025.101159

Lutsenko, G., & Hrytsenko, V. (2025). Using Low-Code Development in Teaching Project Work Technology. In Auer M.E. & Rüütmann T. (Eds.), *Lect. Notes Networks Syst.: Vol. 1280 LNNS* (pp. 501–508). Springer Science and Business Media Deutschland GmbH; Scopus. https://doi.org/10.1007/978-3-031-83523-0_46

Mena-Salcedo, M. F., Robles-Bykbaev, V., & Robles-Bykbaev, Y. (2025). State of the Art of Artificial Intelligence Applied in the Educational Field: An Initial Review and a Pilot Study of Ecuadorian Teachers' Perceptions. In Abreu A., Carvalho J.V., Mesquita A., Sousa Pinto A., & Mendonça Teixeira M. (Eds.), *Lect. Notes Networks Syst.: Vol. 859 LNNS* (pp. 291–300). Springer Science and Business Media Deutschland GmbH; Scopus. https://doi.org/10.1007/978-3-031-78155-1_28

Merino-Fernández, M. Á., Obregón Cuesta, A. I., Alonso-Centeno, A., Mínguez Mínguez, L. A., Varlamis, I., Sofianopoulou, C., Aykuş, S., Rousoulioti, C., Vrantzas, A., Siakavaras, I., Papaioannou, G., Pischos, N., Burcke, K., Angelopoulos, T., & Ortiz-

Revilla, J. (2025). Theoretical and Practical Coherence of Integrated STEM Education and Educational Robotics: Review and Analysis of Good Practices in Europe. In *Stud. Comput. Intell.* (Vol. 1194, pp. 427–462). Springer Science and Business Media Deutschland GmbH; Scopus. https://doi.org/10.1007/978-3-031-82915-4_17

Monge Roffarello, A., & Sáenz, J. P. (2025). Supporting teachers, engaging students: A collaborative model for K-12 computing education. *Entertainment Computing*, *54*. Scopus. https://doi.org/10.1016/j.entcom.2025.100937

Morini, C., Inacio Junior, E., Azevedo, A. T., Sanches, F. E. F., & Avancci Dionisio, E. (2025). Vertically integrated project: Uniting teaching, research, and community in favor of sustainability. *International Journal of Sustainability in Higher Education*, *26*(3), 672–696. Scopus. https://doi.org/10.1108/IJSHE-08-2023-0349

Muji, A. P., Bentri, A., Jamaris, J., Rakimahwati, R., Hidayati, A., Darmansyah, D., & Hidayat, H. (2025). Unlocking potential: How project-based learning influences kindergarten motor skills. *Retos*, *63*, 289–301. Scopus. https://doi.org/10.47197/retos.v63.112107

Munir, M. T., Jamwal, P. K., Li, B., Carter, S., & Hussain, S. (2025). Revolutionising engineering pedagogy: The role of 3D printing in modern engineering education. *Innovations in Education and Teaching International*, *62*(2), 575–593. Scopus. https://doi.org/10.1080/14703297.2024.2346554

Pla-Campas, G., Martínez-Mínguez, L., Nieva, C., & Arnau-Sabatés, L. (2025). Teaching in Natural Contexts. Project-based Learning and Perception of Professional Competence of Pre-service Teachers in Spanish Universities. *Revista Internacional de Educacion Para La Justicia Social*, *23*(2). Scopus. https://doi.org/10.15366/reice2025.23.2.004

Ramanathan, K. C., Mohan, M., & Lingampally, P. K. (2025). Project-based learning and its influence on teaching and learning in the first-year core mechatronic engineering course. *International Journal of Mechanical Engineering Education*. Scopus. https://doi.org/10.1177/03064190251322065

Rapi, N. K., Sujanem, R., Yasmini, L. P. B., & Setemen, K. (2025). Science process skills and critical thinking skills in inquiry-based learning model with project-based assessment. *International Journal of Innovative Research and Scientific Studies*, *8*(2), 938–946. Scopus. https://doi.org/10.53894/ijirss.v8i2.5393

Ria, A., Dini, P., & Bucchi, F. (2025). Prototyping of Automated Guided Vehicle for Teaching Practical Mechatronics. *Education Sciences*, *15*(3). Scopus. https://doi.org/10.3390/educsci15030294

Ruibal-Lista, B., Iglesias-Cabeza, E., Diez-Fernández, P., & López-García, S. (2025). Super-grandparents: An intergenerational teaching unit for the revival of traditional games. *Retos*, *66*, 643–656. Scopus. https://doi.org/10.47197/retos.v66.111274

Saparbayeva, E., Abdualiyeva, M., Torebek, Y., Kostangeldinova, A., Tursynbayev, A., Takibayeva, G., & Sabalakhova, A. (2025). Transforming mathematics education in Kazakhstan: Evaluating the impact of innovative teaching methods on student outcomes in technical universities. *Cogent Education*, *12*(1). Scopus. https://doi.org/10.1080/2331186X.2025.2461978

Simmons, S. A. (2025). Student Envisioned Entrepreneurial Makeovers: It may SEEM impossible but it is not. In *Annals of Entrepreneurship Education and Pedagogy—2025* (pp. 333–337). Edward Elgar Publishing Ltd.; Scopus. https://doi.org/10.4337/9781035325795.00032

Stroud, W. A. (2025). The Nature of Science: An Honors Seminar for All Majors. *Journal of College Science Teaching*, *54*(1), 38–41. Scopus. https://doi.org/10.1080/0047231X.2024.2418275

Tewari, P., Kanmani, B., Knight, D., & Kanga, M. (2025). Transformation to Outcomes Based Education. In *Lect. Notes Networks Syst.* (Vol. 1097, pp. 103–122). Springer Science

and Business Media Deutschland GmbH; Scopus. https://doi.org/10.1007/978-3-031-68282-7_6

Zahedi, M., & Tessier, V. (2025). Proximity of theory and practice: Framing a research through design experience for design students. In *Proximity in Design Research: People, Processes, Products, Philosophy* (pp. 48–61). Taylor and Francis; Scopus. https://doi.org/10.4324/9781003509653-6