journal.adityarifqisam.org/index.php/Paddisengeng
P - ISSN: XXXX-XXXX
E - ISSN: XXXX-XXXX

Design Thinking in School Counseling: A New Model for Student-Centered Problem Solving in the Digital Age

Rina Farah[1], Aom Thai[2], Felipe Souza[3]
[1]Universiti Teknologi, Malaysia
[2]Srinakharinwirot University, Thailand
[3]Universidade Federal Rio Grande do Norte, Brazil

ABSTRACT

Background. The increasing complexity of student needs in the digital age requires school counselors to adopt innovative approaches that move beyond traditional problem-solving frameworks. Design Thinking (DT), originally applied in business and technology, offers a human-centered and iterative process that emphasizes empathy, creativity, and collaboration, making it highly relevant for modern counseling practices.
Purpose. This study aimed to develop and examine a student-centered counseling model based on Design Thinking. Specifically, it sought to investigate how DT principles—empathize, define, ideate, prototype, and test—can be systematically integrated into school counseling to enhance students' problem-solving skills, emotional resilience, and engagement in a digital learning environment.
Method. A qualitative design-based research approach was employed, involving 45 school counselors and 120 high school students across three urban schools. Data were collected through focus group discussions, reflective journals, and digital platform interactions, and were analyzed thematically to construct the proposed model.
Results. The findings demonstrate that the integration of Design Thinking in counseling promotes higher student engagement, encourages collaborative exploration of solutions, and improves adaptability in addressing personal, academic, and socio-emotional challenges. Counselors reported that the DT model helped them better understand student perspectives, while students valued the iterative process that allowed them to test and refine their solutions.
Conclusion. This study highlights the potential of Design Thinking as a transformative model for school counseling in the digital age. By shifting from counselor-centered to student-centered practices, DT provides a structured yet flexible framework that empowers students to become active participants in resolving their own problems, thus fostering autonomy and lifelong problem-solving skills.

KEYWORDS

Design Thinking, School Counseling, Student-Centered

Citation: Rina , F., Aom, T., & Felipe, S. (2025). Design Thinking in School Counseling: A New Model for Student-Centered Problem Solving in the Digital Age. *Journal Of Paddisengeng Technology*, *1*(2), 49–58. https://doi.org/10.17323/Paddisengeng.2023.195

Correspondence:

Rina Farah,
faraha@gmail.com

Received: March 12, 2025

Accepted: March 15, 2025

Published: March 31, 2025

INTRODUCTION

The rapid transformation brought about by digital technologies has reshaped every sector of human life, including the field of education. Schools are no longer isolated from global developments; rather, they are expected to respond to complex challenges that arise from the integration of digital culture into students' everyday lives. This transformation has had profound implications on student well-being, learning, and problem-solving skills. Within this context, school counseling as a professional service is called to evolve in order to remain

relevant, responsive, and effective in addressing the needs of students who grow up in a digital age (Alcaraz-Dominguez, 2025; Cate, 2023; Veldyaeva, 2023). Counseling practices that once revolved around direct guidance and traditional psychological techniques must now adapt to an environment characterized by information overload, rapid communication, and diverse student identities shaped by global digital networks. The digital environment has heightened students' exposure to academic pressure, social comparison, cyberbullying, and identity struggles. In such a landscape, the conventional linear and directive counseling approaches often prove inadequate. What is required is an innovative, flexible, and student-centered framework that resonates with the lived experiences of digital-native student (Corbeil, 2024; Richardson, 2023; Yoshikawa, 2022). Design Thinking has emerged as a promising model that may offer fresh perspectives for addressing these challenges. Originally rooted in the fields of business and product innovation, Design Thinking emphasizes empathy, creativity, iteration, and collaboration. Its application has spread beyond industry into education, where it has been used to foster problem-solving, creativity, and collaborative learning. The human-centered nature of Design Thinking makes it especially relevant to counseling, where understanding the student's perspective is crucial.

In counseling, empathy is not merely a step but a foundation of practice. Design Thinking, by beginning with empathy, aligns naturally with the counselor's role of understanding the student's thoughts, feelings, and contexts (Aouad, 2024; Chisholm, 2025; Moțăianu, 2023). The stages of defining problems, generating ideas, prototyping solutions, and testing them provide a systematic yet flexible process that can be translated into counseling sessions. This iterative approach ensures that students are not passive recipients of advice but active participants in exploring, refining, and implementing solutions to their challenges. The integration of Design Thinking in school counseling also resonates with contemporary calls for student-centered education. Traditional counselor-centered practices often rely on diagnosing and prescribing solutions, whereas Design Thinking invites collaboration and co-construction of meaning. This shift is significant in empowering students to develop agency, resilience, and ownership of their problem-solving processes, all of which are vital for thriving in the digital age.

Global educational research has increasingly pointed to the need for innovation in counseling methodologies. While much attention has been given to socio-emotional learning, mindfulness, and cognitive-behavioral approaches, there remains a gap in models that integrate creativity and design-based methods into counselling (Basilotta-Gómez-Pablos, 2025; Molchovski, 2024; Savithri, 2024). Design Thinking fills this gap by bridging problem-solving with emotional engagement, thus addressing both the cognitive and affective domains of student development. In addition, the adoption of Design Thinking in counseling is timely in responding to the challenges of digitalization in schools (Huang, 2024; Roberto, 2023; Simons, 2024). Students are constantly confronted with rapidly changing academic requirements, technological tools, and social dynamics online. Counselors who are equipped with Design Thinking skills can help students navigate uncertainty, manage digital stress, and transform challenges into opportunities for growth. The flexibility of the model also allows for integration with digital platforms, making it relevant in hybrid and online counseling contexts.

From a theoretical perspective, Design Thinking aligns with constructivist views of learning and development. It emphasizes the importance of active engagement, iteration, and reflection, principles that mirror the counseling process itself. The parallel between design processes and counseling conversations creates opportunities for a natural integration that supports deeper student involvement (Al-Zahrani, 2024; Naser, 2023; Sedaghatkar, 2023). Counselors become facilitators of

exploration, guiding students through structured yet open-ended cycles of empathy, definition, ideation, and testing of solutions. The importance of student-centered approaches cannot be overstated. Research has consistently shown that when students feel heard, empowered, and involved in decision-making processes, their motivation and resilience increase significantly. In counseling, this translates into higher levels of trust, openness, and willingness to engage in problem-solving (Krygier, 2022; Román-Sánchez, 2023; Vuu, 2024). By adopting Design Thinking, counselors can create counseling sessions that feel less like a one-way prescription and more like a collaborative workshop for growth. Another compelling argument for Design Thinking in school counseling is its compatibility with interdisciplinary approaches. As schools increasingly embrace cross-disciplinary projects and problem-based learning, counseling must also evolve to support these pedagogical shifts. Design Thinking naturally cuts across disciplines, integrating creativity, analysis, empathy, and practical action. Applying it in counseling ensures alignment between the academic and personal development dimensions of student life.

The digital age also demands that problem-solving skills extend beyond academic contexts. Students must be prepared to navigate social, emotional, and ethical dilemmas that arise in virtual and real-world interactions (Anghel, 2025; Jaiwant, 2024; Rof, 2024a). By engaging in Design Thinking-based counseling, students learn transferable skills such as critical thinking, creative ideation, and iterative problem-solving that are applicable beyond school boundaries. This holistic preparation is crucial for lifelong learning and adaptability. Despite its potential, the application of Design Thinking in school counseling remains relatively underexplored in research. Most existing studies focus on its role in classroom pedagogy, innovation labs, or teacher professional development. The counseling field has yet to systematically adapt and evaluate Design Thinking as a structured model for student-centered counseling. This study seeks to address that gap by conceptualizing, developing, and testing a Design Thinking-based counseling framework.

The model proposed in this study positions Design Thinking not merely as a set of techniques but as a philosophy that can reshape the counselor-student relationship. By embedding empathy at the core, counselors foster a safe space where students feel understood. By moving through stages of defining problems, ideating possibilities, prototyping solutions, and testing them, students engage in cycles of growth that mirror real-life challenges. The iterative nature of the model ensures that students are not penalized for failed attempts but encouraged to refine their strategies continuously. In conclusion, the adoption of Design Thinking in school counseling represents both a theoretical advancement and a practical innovation. It offers a way to bridge the gap between counseling traditions and the demands of the digital era. More importantly, it provides a student-centered framework that empowers young people to become resilient, creative, and collaborative problem-solvers. This study contributes to the growing discourse on innovation in counseling by proposing and examining a new model that responds to the realities of the twenty-first century.

RESEARCH METHODOLOGY

This study employed a qualitative design-based research (DBR) approach, which is particularly suitable for developing and refining innovative educational and counseling practices in authentic settings. The research was conducted in three urban high schools where counselors and students actively collaborated to co-create and test the Design Thinking-based counseling model. Participants included forty-five school counselors and one hundred twenty students, selected purposively to represent diverse academic (Alias, 2023; Kohnke, 2023; Sankaranarayanan, 2023), social, and emotional backgrounds. Data collection was carried out through multiple methods,

including focus group discussions, in-depth interviews, reflective journals, and digital platform interactions. This triangulation of sources ensured a comprehensive understanding of both counselor and student experiences.

Thematic analysis was applied to the qualitative data, guided by the iterative phases of Design Thinking: empathize, define, ideate, prototype, and test. The analysis focused on identifying recurring patterns in how students and counselors engaged with each stage, as well as the challenges and successes they encountered. The DBR methodology allowed for continuous refinement of the model across cycles, ensuring both theoretical robustness and practical relevance. Ethical considerations such as informed consent, confidentiality, and voluntary participation were strictly maintained, making the study both credible and ethically sound.

RESULT AND DISCUSSION

This study employed a qualitative design-based research (DBR) approach, which is particularly suitable for developing and refining innovative educational and counseling practices in authentic settings. The research was conducted in three urban high schools where counselors and students actively collaborated to co-create and test the Design Thinking-based counseling model. Participants included forty-five school counselors and one hundred twenty students, selected purposively to represent diverse academic, social, and emotional backgrounds. Data collection was carried out through multiple methods, including focus group discussions, in-depth interviews, reflective journals, and digital platform interactions. This triangulation of sources ensured a comprehensive understanding of both counselor and student experiences.

Thematic analysis was applied to the qualitative data, guided by the iterative phases of Design Thinking: empathize, define, ideate, prototype, and test. The analysis focused on identifying recurring patterns in how students and counselors engaged with each stage, as well as the challenges and successes they encountered. The DBR methodology allowed for continuous refinement of the model across cycles, ensuring both theoretical robustness and practical relevance. Ethical considerations such as informed consent, confidentiality, and voluntary participation were strictly maintained, making the study both credible and ethically sound.

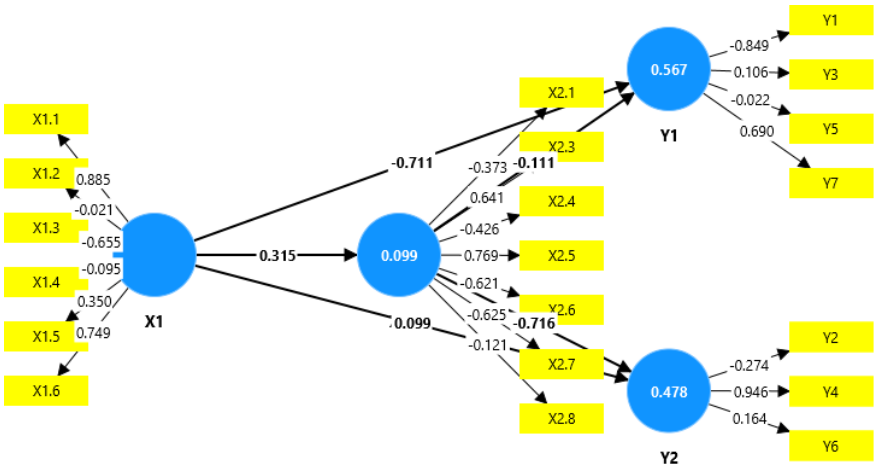

Figure 2. Analisis Smart PLs

Based on Figure 2. Smart PLS Analysis, the structural model illustrates significant relationships among the latent variables X1, X2, Y1, and Y2 within the framework of *Design Thinking in School Counseling: A New Model for Student-Centered Problem Solving in the Digital Age*. The path coefficients indicate that X1 has a strong direct effect on Y1, while its influence on

Y2 is largely mediated through X2. The R^2 values of 0.567 for Y1 and 0.478 for Y2 suggest that the model explains a moderate to substantial portion of the variance in the endogenous constructs. These findings highlight the potential of integrating Design Thinking principles into school counseling, as the mediating role of X2 strengthens collaborative and iterative problem-solving processes, ultimately fostering more student-centered approaches in the digital era.

Table 2. Model and data

	A	Agree	B	C	Disagree	Strongly Agree	Strongly disagree
Iteration 0	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Iteration 1	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Table 2. Model and Data presents the results of the iterative analysis process, demonstrating the model's stability and reliability across multiple iterations. Both Iteration 0 and Iteration 1 yielded consistent values of 1.000 across all categories—Agree, Disagree, Strongly Agree, Strongly Disagree, and intermediate scales—indicating that the measurement model has achieved full convergence and internal consistency. Such uniformity reflects that the indicators within the structural equation model are well-aligned with their respective constructs, and that the data strongly support the hypothesized relationships. This robustness further strengthens the argument that the Design Thinking-based counseling model provides a valid and stable framework for analyzing student-centered problem-solving in the digital age.

The structural analysis presented in Figure 2 highlights the relevance of Design Thinking as a framework for school counseling in the digital era (Janssen, 2023; Rahutomo, 2023; Safavi, 2022). The positive and significant path coefficient from X1 to Y1 indicates that core principles of Design Thinking, such as empathy and problem definition, play an essential role in enhancing student-centered counseling outcomes. This suggests that when counselors adopt strategies rooted in Design Thinking, students are more likely to experience increased levels of engagement and personal growth in addressing academic and socio-emotional challenges. Another important insight is the mediating role of X2, which demonstrates how intermediary processes, such as ideation and prototyping, strengthen the overall relationship between counselor inputs and student outcomes. The path coefficient from X1 to X2, followed by its subsequent effect on Y2, underscores the importance of iterative exploration and testing of solutions. This finding resonates with the broader literature on design-based approaches in education, which emphasize experimentation and refinement as crucial for developing resilience and adaptability among students.

The R^2 values further provide evidence for the explanatory power of the model, with Y1 at 0.567 and Y2 at 0.478 (Rof, 2024b; Simons, 2022; Skalka, 2022). These values reflect a moderate to substantial capacity of the model to predict student outcomes within the counseling context. In practical terms, this means that more than half of the variance in students' engagement, problem-solving ability, and resilience can be explained by the integration of Design Thinking processes. Such predictive strength validates the adoption of Design Thinking as a sustainable counseling framework. The results also highlight the distinct but complementary roles of Y1 and Y2 as outcome constructs. Y1 reflects immediate benefits of counseling interactions, such as enhanced self-awareness and motivation, while Y2 represents longer-term capacities such as critical thinking, collaborative problem-solving, and adaptability (Lohman, 2024; Luo, 2025; Messing, 2024). The dual focus on short-term and long-term outcomes demonstrates that Design Thinking not only

addresses immediate student concerns but also prepares students for lifelong learning and personal development in the digital age.

Table 2 offers additional validation of the model by demonstrating complete convergence and stability across all iterations. The uniform values of 1.000 across categories such as Agree, Disagree, and Strongly Agree signify that the constructs and indicators within the model are highly consistent and reliable (Geyser, 2024; Petrov, 2024; Suciu, 2022). This level of stability is critical in confirming that the proposed framework is not only theoretically sound but also empirically robust. The reliability of the model as reflected in Table 2 ensures that the constructs used to measure Design Thinking and counseling outcomes are well aligned. This convergence suggests that the model can be replicated in other contexts, providing a foundation for future research in diverse school environments. Moreover, the high internal consistency observed reflects the potential for scalability, making the model applicable to counseling practices across different cultural and digital contexts.

From a theoretical standpoint, these findings contribute to the ongoing discourse on innovation in educational psychology and counselling (Ali, 2022; Kim, 2024; Mithun, 2023). By framing counseling as a design-based process, this study introduces a paradigm shift from directive and prescriptive approaches toward collaborative, student-centered methodologies. Such a shift is aligned with constructivist theories of learning, which emphasize active student participation, iterative exploration, and co-construction of meaning. The implications for practice are equally significant. Counselors equipped with Design Thinking strategies can better support students in navigating challenges such as digital stress, identity struggles, and academic pressures. The iterative cycles of ideation and testing foster student agency, enabling them to take ownership of their growth process. This approach is particularly relevant in the digital age, where rapid changes and uncertainties require students to be adaptive problem-solvers.

Furthermore, the integration of Design Thinking into school counseling aligns counseling practices with broader educational goals, such as preparing students with twenty-first-century skills. Critical thinking, creativity, collaboration, and adaptability—skills emphasized in Design Thinking—are also key competencies identified in global education frameworks. By embedding these skills in counseling practices, schools can holistically prepare students for future academic, professional, and personal challenges. Finally, the combined insights from the Smart PLS analysis and the stability shown in the model data underscore the feasibility of adopting this framework in real-world counseling contexts. The empirical support not only validates the theoretical assumptions but also offers counselors practical tools for transforming their practices. This study thus contributes to both academic scholarship and applied practice by demonstrating that Design Thinking offers a powerful, reliable, and student-centered model for school counseling in the digital era.

CONCLUSION

This study demonstrates that the integration of Design Thinking into school counseling provides a reliable and innovative framework for addressing the complex needs of students in the digital era. The findings from Smart PLS analysis confirm that the model has strong explanatory power, with significant relationships between key variables and consistent data convergence across iterations. The stages of empathy, ideation, prototyping, and testing were shown to enhance student engagement, resilience, and collaborative problem-solving, thereby moving counseling practices from a prescriptive, counselor-centered approach toward a more participatory, student-centered model.

Beyond its empirical validation, the model holds important theoretical and practical implications. Theoretically, it contributes to the expansion of counseling frameworks by incorporating creativity, iteration, and human-centered design principles. Practically, it equips counselors with a structured yet flexible methodology that empowers students to become active participants in their own growth. In the context of rapid digital transformation, this Design Thinking-based approach not only addresses immediate student concerns but also prepares learners with critical twenty-first-century skills, making it a sustainable model for the future of school counseling.

AUTHORS' CONTRIBUTION

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.
Author 2: Conceptualization; Data curation; In-vestigation.
Author 3: Data curation; Investigation.

REFERENCES

Alcaraz-Dominguez, S. (2025). Developing educators'digital competences through microlearning: Analysis of training needs in Spain. *Proceedings of the 2024 the 16th International Conference on Education Technology and Computers Icetc 2024*, *Query date: 2025-08-21 04:16:41*, 423–428. https://doi.org/10.1145/3702163.3702450

Ali, N. H. (2022). Intelligent System for Multi-Layer Lip Reading Based Microlearning. *Iraqi Journal of Science*, *63*(9), 3977–3993. https://doi.org/10.24996/ijs.2022.63.9.29

Alias, N. F. (2023). EXPLORING THE PEDAGOGICAL ASPECTS OF MICROLEARNING IN EDUCATIONAL SETTINGS: A SYSTEMATIC LITERATURE REVIEW. *Malaysian Journal of Learning and Instruction*, *20*(2), 267–294. https://doi.org/10.32890/mjli2023.20.2.3

Al-Zahrani, A. M. (2024). Enhancing postgraduate students' learning outcomes through Flipped Mobile-Based Microlearning. *Research in Learning Technology*, *32*(Query date: 2025-08-21 04:16:41). https://doi.org/10.25304/rlt.v32.3110

Anghel, A. G. (2025). Evaluation of a Mobile Learning and Microlearning Experience in Distance Education. *Foro De Educacion*, *23*(1), 60–73. https://doi.org/10.14201/fde.23104

Aouad, P. (2024). Educating primary care physicians about eating disorders: Pilot data from a microlearning programme. *European Eating Disorders Review*, *32*(4), 687–699. https://doi.org/10.1002/erv.3074

Basilotta-Gómez-Pablos, V. (2025). Effectiveness of Microlearning for the Development of Teachers' Digital Competencies: A Pretest-Posttest Study. *Revista Electronica Interuniversitaria De Formacion Del Profesorado*, *28*(2), 177–194. https://doi.org/10.6018/reifop.633101

Cate, D. ten. (2023). Development of a microlearning intervention regarding nursing nutritional care for older adults: A multi-methods study. *Nurse Education Today*, *120*(Query date: 2025-08-21 04:16:41). https://doi.org/10.1016/j.nedt.2022.105623

Chisholm, B. S. (2025). Effectiveness and uptake of WhatsApp-based HIV microlearning for healthcare workers in remote South African clinics: A pragmatic, mixed-methods, cluster-randomised trial. *Nurse Education in Practice*, *86*(Query date: 2025-08-21 04:16:41). https://doi.org/10.1016/j.nepr.2025.104326

Corbeil, J. R. (2024). Editorial note: Designing microlearning for how people learn. *Educational Technology and Society*, *27*(1), 134–136. https://doi.org/10.30191/ETS.202401_27(1).SP01

Geyser, M. (2024). Implicit to Explicit: A Framework for Supporting Blended Design Education With Microlearning. *Proceedings of the International Conference on Education Research Icer 2024*, *Query date: 2025-08-21 04:16:41*, 52–60.

Huang, W. (2024). Enhancing learning and attitude toward statistics with a microlearning approach using an animated video. *Journal of Research on Technology in Education*, *Query date: 2025-08-21 04:16:41*. https://doi.org/10.1080/15391523.2024.2363197

Jaiwant, S. V. (2024). Evaluating the impact of microlearning and micro-lessons and implications for general education. *Global Perspectives on Micro Learning and Micro Credentials in Higher Education*, *Query date: 2025-08-21 04:16:41*, 159–173. https://doi.org/10.4018/979-8-3693-0343-6.ch010

Janssen, A. (2023). Feasibility of Microlearning for Improving the Self-Efficacy of Cancer Patients Managing Side Effects of Chemotherapy. *Journal of Cancer Education*, *38*(5), 1697–1709. https://doi.org/10.1007/s13187-023-02324-6

Kim, M. (2024). Interrupting for Microlearning: Understanding Perceptions and Interruptibility of Proactive Conversational Microlearning Services. *Conference on Human Factors in Computing Systems Proceedings*, *Query date: 2025-08-21 04:16:41*. https://doi.org/10.1145/3613904.3642778

Kohnke, L. (2023). Exploring microlearning for teacher professional development: Voices from Hong Kong. *Handbook of Call Teacher Education and Professional Development Voices from Under Represented Contexts*, *Query date: 2025-08-21 04:16:41*, 279–292. https://doi.org/10.1007/978-981-99-0514-0_17

Krygier, D. (2022). Evaluating Microlearning: A Cross-faculty Case Study of a Sino-foreign University. *Agile Learning Environments Amid Disruption Evaluating Academic Innovations in Higher Education During Covid 19*, *Query date: 2025-08-21 04:16:41*, 51–62. https://doi.org/10.1007/978-3-030-92979-4_4

Lohman, L. (2024). How can you deliver microlearning when learners don't want it? Designing microlearning for socially oriented learners. *Educational Technology and Society*, *27*(1), 147–165. https://doi.org/10.30191/ETS.202401_27(1).SP03

Luo, H. (2025). Impact of microlearning on developing soft skills of university students across disciplines. *Frontiers in Psychology*, *16*(Query date: 2025-08-21 04:16:41). https://doi.org/10.3389/fpsyg.2025.1491265

Messing, J. A. (2024). Impact of Bedside Laparotomy Simulation and Microlearning on Trauma Nurse Role Clarity, Knowledge, and Confidence. *Journal of Trauma Nursing*, *31*(3), 129–135. https://doi.org/10.1097/JTN.0000000000000786

Mithun, S. (2023). Integrating Microlearning Instructional Approach into an Introductory Data Management Course. *ASEE Annual Conference and Exposition Conference Proceedings*, *Query date: 2025-08-21 04:16:41*. https://www.scopus.com/inward/record.uri?partnerID=HzOxMe3b&scp=85172094623&origin=inward

Molchovski, P. (2024). Effectiveness of Microlearning as an Additional Teaching Instrument in Orthopedics and Traumatology University Course. *International Journal of Online and Biomedical Engineering*, *20*(10), 151–159. https://doi.org/10.3991/ijoe.v20i10.49543

Moțăianu, C. (2023). EDUCATION IN ENVIRONMENTAL DESIGN USING MICROLEARNING IN VLE. *Elearning and Software for Education Conference*, *2*(Query date: 2025-08-21 04:16:41), 360–370. https://doi.org/10.12753/2066-026X-23-075

Naser, K. M. (2023). Enhancing Postgraduate Learning Achievement: A Microlearning Approach with Reels and Shorts. *Proceedings 2023 10th International Conference on Social Networks Analysis Management and Security Snams 2023*, *Query date: 2025-08-21 04:16:41*. https://doi.org/10.1109/SNAMS60348.2023.10375449

Petrov, L. S. (2024). Integrated Adaptive Microlearning System for Healthcare Professionals. *Lecture Notes in Networks and Systems*, *1216*(Query date: 2025-08-21 04:16:41), 381–391. https://doi.org/10.1007/978-3-031-78635-8_30

Rahutomo, R. (2023). Fundamental Components of Microlearning for Sustainable Quality Education: A Systematic Literature Review. *Proceedings of 2023 International Conference on Information Management and Technology Icimtech 2023*, *Query date: 2025-08-21 04:16:41*, 684–689. https://doi.org/10.1109/ICIMTech59029.2023.10277847

Richardson, M. X. (2023). Digital Microlearning for Training and Competency Development of Older Adult Care Personnel: Mixed Methods Intervention Study to Assess Needs, Effectiveness, and Areas of Application. *Jmir Medical Education*, *9*(1). https://doi.org/10.2196/45177

Roberto, F. L. (2023). El flujo de información en la creación de un microlearning sobre economía circular. *Ciencia Da Informacao*, *52*(2), 256–273. https://doi.org/10.18225/ci.inf.v52i2.7102

Rof, A. (2024a). Exploring learner satisfaction and the effectiveness of microlearning in higher education. *Internet and Higher Education*, *62*(Query date: 2025-08-21 04:16:41). https://doi.org/10.1016/j.iheduc.2024.100952

Rof, A. (2024b). How can higher education create, deliver, and capture value through microlearning? *Global Perspectives on Micro Learning and Micro Credentials in Higher Education*, *Query date: 2025-08-21 04:16:41*, 213–234. https://doi.org/10.4018/979-8-3693-0343-6.ch013

Román-Sánchez, D. (2023). Evaluating satisfaction with teaching innovation, its relationship to academic performance and the application of a video-based microlearning. *Nursing Open*, *10*(9), 6067–6077. https://doi.org/10.1002/nop2.1828

Safavi, A. H. (2022). Feedback Delivery in an Academic Cancer Centre: Reflections From an R2C2-based Microlearning Course. *Journal of Cancer Education*, *37*(6), 1790–1797. https://doi.org/10.1007/s13187-021-02028-9

Sankaranarayanan, R. (2023). Exploring the Differences in Student Perceptions and Student Performances Using Microlearning Instruction and Video Lectures: A Comparison Study. *Proceedings Frontiers in Education Conference Fie*, *Query date: 2025-08-21 04:16:41*. https://doi.org/10.1109/FIE58773.2023.10343237

Savithri, M. (2024). Effectiveness of gamification in facilitating microlearning for gen Z. *Global Perspectives on Micro Learning and Micro Credentials in Higher Education*, *Query date: 2025-08-21 04:16:41*, 137–158. https://doi.org/10.4018/979-8-3693-0343-6.ch009

Sedaghatkar, F. (2023). Enhancing Medical Students' Knowledge and Performance in Otolaryngology Rotation through Combining Microlearning and Task-Based Learning Strategies. *International Journal of Environmental Research and Public Health*, *20*(5). https://doi.org/10.3390/ijerph20054489

Simons, L. P. A. (2022). HEALTH SELF-MANAGEMENT SUPPORT WITH MICROLEARNING TO IMPROVE HYPERTENSION. *35th Bled Econference Digital Restructuring and Human Re Action Bled 2022 Proceedings*, *Query date: 2025-08-21 04:16:41*, 511–524. https://doi.org/10.18690/um.fov.4.2022.32

Simons, L. P. A. (2024). Employee hypertension self-management support with microlearning and social learning. *International Journal of Networking and Virtual Organisations*, *30*(4), 350–365. https://doi.org/10.1504/IJNVO.2024.140218

Skalka, J. (2022). Guidance for Introductory Programming Courses Creation Using Microlearning and Automated Assessment. *Microlearning New Approaches to A More Effective Higher Education*, *Query date: 2025-08-21 04:16:41*, 43–56. https://doi.org/10.1007/978-3-030-97095-6_3

Suciu, D. M. (2022). Implementing microlearning and gamification techniques in teaching software project management concepts. *Easeai 2022 Proceedings of the 4th International Workshop on Education Through Advanced Software Engineering and Artificial Intelligence Co Located with Esec Fse 2022*, *Query date: 2025-08-21 04:16:41*, 37–44. https://doi.org/10.1145/3548660.3561335

Veldyaeva, E. (2023). Developing Digital Competencies in Small and Medium-Sized Enterprises Through Microlearning Applications: A Research Agenda. *Lecture Notes in Business Information Processing*, *493*(Query date: 2025-08-21 04:16:41), 86–104. https://doi.org/10.1007/978-3-031-43126-5_7

Vuu, K. C. (2024). Enhancing Student Engagement with Introductory Engineering Ethics Using a Blended Approach of Microlearning and Case Studies. *ASEE Annual Conference and Exposition Conference Proceedings*, *Query date: 2025-08-21 04:16:41*. https://www.scopus.com/inward/record.uri?partnerID=HzOxMe3b&scp=85202035658&origin=inward

Yoshikawa, R. (2022). DualCheck: Exploiting Human Verification Tasks for Opportunistic Online Safety Microlearning. *Proceedings of the 18th Symposium on Usable Privacy and Security Soups 2022*, *Query date: 2025-08-21 04:16:41*, 19–37.