10 (2) (2025) 58-64

International Journal of Active Learning

http://journal.unnes.ac.id/nju/index.php/ijal

Strengthening Digital Character and Social Skills Through Board Games in Social Impact Informatics Learning

Nunuk Riza Puji, Yeri Sutopo, Eko Supraptono, Ulfah Mediaty Arief

Universitas Negeri Semarang

Keywords

Game-Based Learning, Board Game Educative, Social Impact of Informatics, Digital Characters, Social Skills

Abstract

This study aims to develop Game-Based learning media, specifically a board game, as an innovative strategy to strengthen students' digital character and social skills in the context of the Social Impact of Informatics material. The development model used is ADDIE (Analysis, Design, Development, Implementation, Evaluation), with high school students as research subjects. The learning media were designed based on the learning outcomes of the Independent Curriculum with a focus on digital ethics, information literacy, and social responsibility as digital citizens. Validation results from material and media experts indicate that the developed board game media is feasible to use. Practical tests conducted by teachers and students demonstrated a high level of ease of use, clarity of instructions, attractiveness, and learning benefits. The effectiveness of the media was tested using a pretest-posttest design with N-Gain analysis and an independent t-test, which showed a significant increase in students' cognitive abilities and social attitudes. Observations during the learning process also strengthened aspects of cooperation, empathy, responsibility, and ethical reflection on the use of technology. This board game has been proven to facilitate cognitive understanding of the Social Impact of Informatics and foster wise digital character and relevant social competencies in the digital age. These findings contribute to contextual and meaningful informatics learning practices and offer a practical solution for values education in the digital transformation era.

*Correspondence Address:
E-mail:
riza.puji@gmail.com

p-ISSN 2528-505X
e-ISSN 2615-6377

INTRODUCTION

The global development of digital technology has shifted the educational paradigm, demanding a more participatory, contextual, and values-based approach to the learning process (Vettriselvan, R., 2025). Amid this transformation, Informatics education at the secondary school level no longer focuses solely on technical skills. However, it must also instill ethical awareness and social responsibility in students as part of a digital society (Sampson et al., 2025). One of the key elements included in the Independent Curriculum is the Social Impact of Informatics, which aims to equip students with the skills to assess and understand the social implications of using information and communication technology (Kemdikbudristek, 2022).

In practice, learning in the Social Impact of Informatics element often faces obstacles, primarily due to its still theoretical and abstract approach (Nel, D., & Taeihagh, A., 2024). Students struggle to connect material to real-life experiences, resulting in low learning engagement, motivation, and academic achievement (Rosenzweig et al., 2024; Lujan & DiCarlo, 2025). In some educational institutions, the average student score in Informatics, particularly on the Social Impact of Informatics, does not meet the Minimum Completion Criteria. Increasing reliance on technology in everyday life has contributed to a decline in the practice of higher-order cognitive skills, including critical thinking, problem-solving, and creativity (George et al., 2024). This poses a serious challenge in the educational context because students tend to rely passively on digital tools without developing independent and reflective thinking skills. Therefore, innovative learning approaches are needed to deliver material and stimulate ongoing active cognitive engagement. This phenomenon indicates the need for pedagogical breakthroughs that can bridge conceptual understanding with applicable social skills. A relevant approach to address this challenge is Game-Based Learning (GBL). Various studies have shown that GBL can increase student engagement, motivate them to learn, and facilitate understanding complex concepts through fun and interactive media (Mikrouli et al., 2024; Ding & Yu, 2024). Beyond simply delivering material, GBL also provides space for strengthening attitudes, values, and character through educational play experiences (Chen & Chang, 2024). In the context of the Social Impact of Informatics, this is crucial because students are not only required to understand concepts but also to develop ethical reflection, digital empathy, and social responsibility as digital citizens (Yunus & Ismail, 2025).

Globally, the trend of using GBL in Informatics education has increased, but it is still dominated by a focus on technical aspects such as computational thinking and programming (Videnovik et al., 2023; Liu et al., 2025). Widely circulated educational games such as Kahoot, Quizizz, or Minecraft Education are widely used to support assessment or challenge-based learning. However, not many specifically address critical topics such as digital ethics, data privacy, or digital footprints (Tabaghdehi, S. A. H., 2024). Meanwhile, approaches that integrate social values and character into game structures are still rare in national and international literature (Putri et al., 2024; Rebecchi et al., 2024). Another limitation of previous studies is the reliance on digital media, which requires adequate technological infrastructure and is not always evenly available across all educational units. In fact, according to Jobert and Sanchiz (2025), educational board games, as a form of analogue play, can be an effective alternative, particularly in encouraging social interaction, cooperation, and value discussions in face-to-face learning situations. Board games can create an active, enjoyable learning atmosphere and provide space for strengthening students' character through direct experience.

This research aims to develop and test the effectiveness of GBL-based learning media in the form of an educational board game for the Social Impact of Informatics topic. The media developed refers to the learning outcomes of the Independent Curriculum Phase F and is specifically designed to address current issues in the digital society, such as hoaxes, information security, cyberbullying, and ethical technology use. Unlike ready-to-use media, the board game in this study was developed through a pedagogical design process involving expert validation, practicality testing, and testing students' cognitive and affective aspects. Methodologically, this research uses the ADDIE development model approach, which includes five systematic stages: Analysis, Design, Development, Implementation, and Evaluation (Alodwan & Almosa, 2018). The development process was based on curriculum needs, student characteristics, and the shortcomings of previous learning approaches. Validation was conducted by material and media experts to assess product feasibility, while practicality and effectiveness testing were conducted through direct teacher and student engagement. Media effectiveness was tested using a pretest-posttest design with N-Gain analysis, independent t-tests, and observations of student attitudes to measure engagement, cooperation, empathy, and critical reflection on technology use.

The contributions of this research are specific and measurable. First, the developed board game media has improved students' cognitive competency in DSI material. Second, this media encourages the development of wise digital character and social responsibility in students through value-based simulations and narratives. Third, the inclusive learning approach can be implemented in various educational contexts, including schools with limited digital infrastructure. Fourth, this research strengthens the academic literature on the importance of integrating ethical and social values in Informatics learning, which has received little attention. This research discusses developing, validating, and testing the effectiveness of a GBL-based educational board game media

for learning the Social Impact of Informatics. The primary focus is on the media's contribution to improving students' cognitive competency and developing social attitudes. The findings in this article are expected to serve as a pedagogical reference in developing Informatics learning that focuses not only on technical skills but also on digital literacy, ethical character, and social awareness in sustainably facing the challenges of the digital era.

Overall, the results of this research indicate that the developed Game-Based Learning board game media have proven feasible, practical, and effective for use in learning the Social Impact of Informatics. Material and media experts validated the media and placed it in the "very feasible" category. At the same time, practicality testing showed positive responses from teachers and students regarding ease of use, clarity of instructions, attractiveness, and usefulness in the learning process. Effectiveness testing through pretest-posttest showed a significant increase in students' cognitive abilities, supported by observation results that strengthened aspects of social attitudes such as cooperation, empathy, and digital responsibility. These results indicate that the developed media can bridge abstract conceptual learning with concrete, reflective, and character-based learning experiences in the context of today's digital lives of students..

METHODS

The research used a Research and Development (R&D) approach, adapting the ADDIE (Analysis, Design, Development, Implementation, Evaluation) development model. This study used this model because it is systematic and flexible in designing and evaluating learning media appropriate to student needs and targeted learning outcomes. The research subjects were high school students taking Informatics courses, specifically on the Social Impact of Informatics. The stages carried out in this study are as follows:

1. Analysis

The initial steps in this research were identifying student needs, the characteristics of the Informatics subject, and the challenges in teaching the Social Impact of Informatics material. Data was obtained in this initial stage through literature review, curriculum analysis, and initial learning observations. The analysis results indicate that the Social Impact of Informatics learning remains highly abstract and lacks real-world contexts relevant to students' digital lives.

2. Design

After the analysis phase, the next step is designing learning media in the form of an educational board game that includes content on digital ethics, data security, hoaxes, and the impact of social media. The design includes game flow, question cards, a game map, and a scoring system, and is aligned with the learning outcomes of the Independent Curriculum and the Pancasila Student profile.

3. Development

This development stage involved creating a board game media prototype using graphical aids. A content expert and a learning media expert tested its validity using a five-point Likert scale to assess content suitability, visual appearance, interactivity, and pedagogical suitability. Validation results indicated that the media fell into the "very suitable" category.

4. Implementation

This implementation phase involved limited media trials with small groups of students in Informatics classes. Learning activities using board games were conducted over two sessions. During implementation, the teacher acted as a facilitator to ensure students' active involvement in understanding the material and completing the game's challenges.

5. Evaluation

The evaluation stages in this study were conducted using formative and summative methods. Formative evaluation included observations of student engagement and the teacher's practicality with the media. Summative evaluation included measuring the media's effectiveness through a pretest-posttest using a 20-item multiple-choice instrument to measure cognitive achievement. Effectiveness testing was conducted using N-Gain analysis and an independent t-test using SPSS software. Students' social attitudes and digital character were also observed using an observation sheet containing cooperation, empathy, responsibility, and digital ethics indicators.

6. Research Instrument

The assessment instruments used in this study consisted of four instruments: 1) Media and material expert validation sheet; 2) Practicality questionnaire for teachers and students; 3) Cognitive test questions (pretest and posttest); 3) Social attitude and digital character observation sheet. Before all these instruments were used in the trial, an assessment of the instruments' feasibility was carried out using expert judgment. The assessment results, which were carried out by three expert judgments, resulted in the instrument being rated "very suitable" for use in the data collection process of this study.

7. Data Analysis Techniques

Qualitative data from validation and practicality were analyzed descriptively. Quantitative data from cognitive tests were analyzed using the N-Gain formula to measure score improvement and a t-test to determine the significance of differences in scores before and after learning. Meanwhile, attitude observation data were analyzed quantitatively by calculating percentages and categorizing the development of students' social attitudes.

RESULTS AND DISCUSSION

Result

1. Media Validation Research

The developed educational board game-based learning media has been validated by a material expert and a media expert. The validation results by the material expert showed an average score of 87.3%, which is categorized as "very appropriate." The assessment includes the appropriateness of the content, suitability with learning outcomes, and the depth of the material on the Social Impact of Informatics. Meanwhile, the validation by the media expert obtained an average score of 91%, which is also included in the "very appropriate" category, with assessment aspects including visual design, clarity of instructions, interactivity, and suitability to student characteristics. These two validation results indicate that the board game media has high quality in content and visual appearance and is suitable for use in the learning process.

2. Practicality Test Results

The practicality of the media was tested through a questionnaire with teachers and students. Teachers gave a practicality score of 91%, which falls into the "convenient" category, with positive assessments of the clarity of the instructions, the easy-to-understand gameplay, and the relevance of the content to the learning. Students gave a practicality score of 87.3%, which also falls into the "convenient" category. They stated that the game was fun and easy to follow, and it helped them understand the DSI material more realistically and engagingly. Both results indicate that the board game is easy to use, engaging, and appropriate for real-life classroom situations.

3. Cognitive Effectiveness Test Results

To test the effectiveness of the media on students' cognitive achievement, a pretest and posttest consisting of 20 multiple-choice questions was conducted. The results of the analysis using the N-Gain test showed an increase in the average score from 61.46 (pretest) to 83.75 (posttest), with an N-Gain score of 0.58, which is included in the "moderate" category. The independent t-test showed a significance value of 0.00 <0.05, which indicates a significant difference between the values before and after the treatment. These results prove that the use of board game media has a positive and significant impact on increasing understanding of the concept of the Social Impact of Informatics. The results of the pretest protest conducted can be illustrated in Figure 1 below.

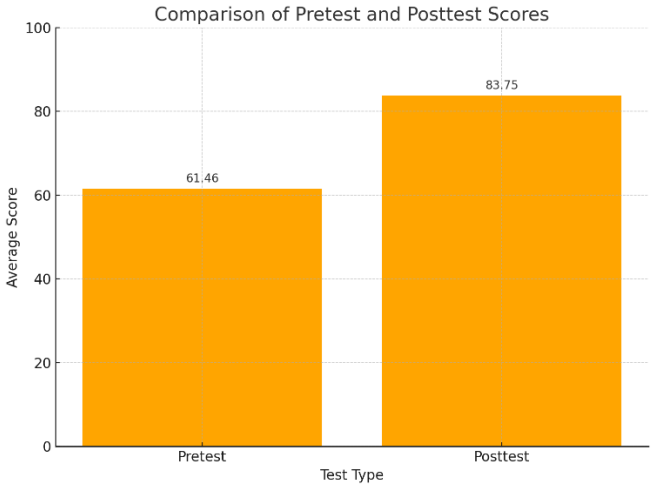

Figure 1. Comparison Chart of Pretest and Posttest Average Scores

4. Results of Observations on Social Attitudes and Character

In addition to cognitive development, students' social attitudes and digital character were observed during the learning process. Observations were based on four primary indicators: cooperation, empathy, responsibility, and ethical reflection on technology use. Observations showed that:

- Cooperation significantly improved as group dynamics developed during the game.

- Empathy emerged through interactions between players in solving simulated digital social challenges.
- Responsibility was evident in students' awareness of adhering to game rules and making decisions within digital ethics.
- Ethical reflection was evident when students discussed the impacts of online actions depicted in the game's scenario cards.

Thus, this board game is effective in cognitive aspects and encourages the development of social character aligned with the values of responsible digital citizens. These values are essential to equip students for the real world of work, which includes essential soft skills (Sudana, I.M., Apriyani, D., & Suryanto, A., 2019).

5. Additional Findings: Enthusiasm and Interaction

While implementing the board game learning media, researchers conducted direct observations, demonstrating the differences in classroom dynamics compared to conventional learning. Students demonstrated high levels of enthusiasm from the start of the game. They appeared motivated to follow instructions, actively engaged in group discussions, and enthusiastically responded to the challenges or scenarios presented on the game cards. The playful activity generated excitement and encouraged students' cognitive and emotional engagement in understanding social issues surrounding information technology.

Student interaction significantly improved in terms of verbal communication and collaborative problem-solving within the game. Students who had tended to be passive in previous lessons began to take the initiative to speak up, discuss, and express their opinions. Some students even demonstrated critical and reflective thinking skills when asked to respond to the consequences of fictional digital actions outlined in the game scenario cards. The Informatics teacher also noted that the classroom atmosphere became more lively, structured around collaborative activities, and minimized distractions. The off-task behavior that typically occurs in passive learning sessions was absent. This active engagement facilitated meaningful learning because students could connect the game content to their own real-world digital experiences.

Another observation was that the post-game discussion became an important reflective space. Students began to understand that their actions in the digital world have social impacts, both personally and on others. Some students responded, such as, "It turns out that if we just post something, it can hurt other people," or "I just realized that digital footprints can be dangerous if we are not careful." These statements indicate that the learning process through games improves cognitive understanding and fosters awareness of values and ethical attitudes as digital citizens. These additional findings strengthen the evidence that educational board games can create an interactive, fun, and reflective learning environment. This approach provides a strategic alternative for delivering abstract material such as the Social Impact of Informatics. It encourages the strengthening of relevant soft skills to face the challenges of the digital era.

Discussion

Using educational board game-based learning media in Informatics learning, particularly the Social Impact of Informatics material, significantly impacts how students understand concepts and absorb the digital values taught. This aligns with Tan & Mogali (2022) and Tonda et al. (2025). Games as a pedagogical approach create a more enjoyable learning atmosphere and provide a space for value exploration, social interaction, and contextual learning close to students' digital lives (Zheng, Y., et al., 2024). One of the advantages of this approach is its ability to transform learning that has tended to be abstract and theoretical into something more concrete and applicable. Materials such as digital ethics, personal data security, and digital footprints are not easily digested by students through conventional lectures or discussions (Kos, Ž., & Mažgon, J., 2025). However, when these concepts are packaged as game challenges that must be solved together, students can more easily understand their daily digital actions' meaning and real-world impact (Biletska, I. O., et al., 2021).

Furthermore, group gaming experiences provide significant opportunities for students to build collaboration, practice empathy, and make decisions that involve moral considerations (Jia, K., et al., 2025). The interactions that occur during gameplay demonstrate how students support each other, discuss openly, and respond to digital social situations simulated in the game. The learning environment becomes more dynamic and inclusive, providing equal participation, even for students who are typically passive learners.

This game trains cognitive skills and indirectly encourages the development of strong digital character. Values such as responsibility, integrity, and awareness of the social consequences of online actions become important elements internalized in the gameplay for life in the workplace (Kyambade, M., et al., 2025). Thus, learning does not stop at mastering the material but extends to forming attitudes and values.

Interestingly, students demonstrated high enthusiasm for participating in this activity. They not only actively followed the gameplay but were also able to reflect on their playing experiences in real-life contexts. This demonstrates that learning media such as board games are effective in conveying material and can be a powerful tool for developing students' critical awareness in facing the challenges of a complex and ever-evolving digital world.

However, the use of this media certainly has room for further development. For further research, it is necessary to develop game media that integrates digital technology without eliminating the social interaction

aspect, which is the main strength of board games. Furthermore, it would be very beneficial if future research involved a broader and more diverse student population and examined the long-term impact of game-based media use on digital character formation and ethical literacy in students' daily lives. With a broader and more sustainable approach, the contribution of game-based learning media to digital character education can be developed more comprehensively.

CONCLUSION

This research shows that developing educational board game-based learning media for the Social Impact of Informatics topic improves the quality of Informatics learning in secondary schools. This media is effective in helping students understand abstract concepts and develop social attitudes and digital character relevant to the challenges of the times. Through the game, students actively participate in discussions, collaboration, and decision-making that reflect digital ethical values. Learning becomes more lively, enjoyable, and meaningful because it presents a real-world context closely related to students' experiences as digital citizens.

Furthermore, students' emotional and social engagement during the learning process demonstrates that this media can bridge the cognitive and affective aspects in a balanced manner. Validation and implementation results indicate that the developed board game media is highly feasible and practical to use and positively impacts learning outcomes. These findings reinforce the importance of innovation in Informatics learning design, particularly those that integrate contextual and values-based approaches. Thus, game-based learning media can be a strategic alternative for strengthening digital literacy, building social character, and making learning more adaptive to the needs of the 21st-century generation. This research is expected to be a foundation for developing other innovative learning media in various fields of education.

REFERENCES

Alodwan, T., & Almosa, M. (2018). The effect of a computer program based on Analysis, Design, Development, Implementation and Evaluation (ADDIE) in improving ninth graders' listening and reading comprehension skills in English in Jordan. *English Language Teaching*, 11(4), 43. https://doi.org/10.5539/elt.v11n4p43

Biletska, I. O., Paladieva, A. F., Avchinnikova, H. D., & Kazak, Y. Y. (2021). The use of modern technologies by foreign language teachers: developing digital skills. *Linguistics and Culture Review*, *5*(S2), 16-27. https://doi.org/10.37028/lingcure.v5nS2.1327

Chen, C. H., & Chang, C. L. (2024). Effectiveness of AI-assisted Game-Based Learning on science learning outcomes, intrinsic motivation, cognitive load, and learning behavior. *Education and Information Technologies*, 29(14), 18621–18642. https://doi.org/10.1007/s10639-024-12553-x

Ding, A. C. E., & Yu, C. H. (2024). Serious game based learning and learning by making games: Types of game-based pedagogies and student gaming hours impact students' science learning outcomes. *Computers & Education*, 218, 105075. https://doi.org/10.1016/j.compedu.2024.105075

George, A. S., Baskar, T., & Srikaanth, P. B. (2024). *The erosion of cognitive skills in the technological age: How reliance on technology impacts critical thinking, problem-solving, and creativity*. Partners Universal Innovative Research Publication. https://doi.org/10.5281/zenodo.11671150

Jia, K., Kang, R., Wang, Y., Ma, L., & Liu, X. (2025). Constructing an empathy education system: Values, principles, and approaches. *Journal of Moral Education*, 1-29. https://doi.org/10.1080/03057240.2024.2416686.

Jobert, N., & Sanchiz, M. (2025). In-service teachers' perceptions of board games in teaching: Impact of the level of seriousness of the games and teachers' characteristics. *Teaching and Teacher Education*, 157, 104951. https://doi.org/10.1016/j.tate.2025.104951

Kemdikbudristek. (2022). *Kurikulum Merdeka: Capaian Pembelajaran Informatika Fase F*. Jakarta: Direktorat Jenderal PAUD, Dikdas, dan Dikmen.

Kos, Ž., & Mažgon, J. (2025). The challenges of using large language models: Balancing traditional learning methods with new technologies in the pedagogy of sociology. *Education Sciences*, *15*(2), 191. https://doi.org/10.3390/educsci15020191

Kyambade, M., Namatovu, A., Ssentumbwe, A. M., & Tushabe, M. (2025). Work from home can be distracting: Exploring the moderation role of transformational leadership on teleworking and cyber-slacking. *Cogent Education*, *12*(1), 2450115. https://doi.org/10.1080/2331186X.2025.2450115

Liu, X., Alotaibi, K. A., & Hashemifardnia, A. (2025). Serious game-based learning: Its impact on happiness, motivation, self-compassion, and vocabulary development in EFL learners. *European Journal of Education*, 60(1), e70030. https://doi.org/10.1111/ejed.70030

Lujan, H. L., & DiCarlo, S. E. (2025). The paradox of knowledge: Why medical students know more but understand less. *Medical Science Educator*, 1–6. https://doi.org/10.1007/s40670-025-02379-8

Mikrouli, P., Tzafilkou, K., & Protogeros, N. (2024). Applications and learning outcomes of Game-Based Learning in education. *International Educational Review*, 2(1), 25–54. https://doi.org/10.58693/ier.212

Nel, D., & Taeihagh, A. (2024). The soft underbelly of complexity science adoption in policymaking: towards addressing frequently overlooked non-technical challenges. *Policy Sciences*, *57*(2), 403-436. https://doi.org/10.1007/s11077-024-09531-y

Putri, D., et al. (2024). Pemanfaatan Quizziz dalam pembelajaran Informatika. *Jurnal Pendidikan Informatika*, 8(1), 12–20.

Rebecchi, K., Todd, L., & Hagège, H. (2024). Teaching responsible creativity: A path to ethical innovation. *Discover Education*, 3(1), 103. https://doi.org/10.1007/s44217-024-00164-0

Rosenzweig, E. Q., Chen, X. Y., Song, Y., Baldwin, A., Barger, M. M., Cotterell, M. E., ... & Lemons, P. P. (2024). Beyond STEM attrition: Changing career plans within STEM fields in college is associated with lower motivation, certainty, and satisfaction about one's career. *International Journal of STEM Education*, 11(1), 15. https://doi.org/10.1186/s40594-024-00475-6

Sampson, D., Kampylis, P., Moreno-León, J., & Bocconi, S. (2025). Towards high-quality informatics K-12 education in Europe: Key insights from the literature. *Smart Learning Environments*, 12(1), 14. https://doi.org/10.1186/s40561-025-00366-5

Sudana, I. M., Apriyani, D., & Suryanto, A. (2019, November). Soft Skills evaluation management in Learning processes at Vocational school. In *Journal of Physics: Conference Series* (Vol. 1387, No. 1, p. 012075). IOP Publishing. doi:10.1088/1742-6596/1387/1/012075

Tabaghdehi, S. A. H. (2024). Ethical governance of digital footprint data: a journey towards a responsible society. In *Business Strategies and Ethical Challenges in the Digital Ecosystem* (pp. 369-379). Emerald Publishing Limited. https://doi.org/10.1108/978-1-80455-069-420241017

Tan, J. W., Ng, K. B., & Mogali, S. R. (2022). An exploratory digital board game approach to the review and reinforcement of complex medical subjects like anatomical education: Cross-sectional and mixed methods study. *JMIR Serious Games*, *10*(1), e33282. doi:10.2196/33282

Tonda, A., Gómez-Cambronero, Á., Miralles, I., & Remolar, I. (2025). A Virtual Reality Application and an Interactive Board Game for Students Learning to Program. *IEEE Access*.

Vettriselvan, R. (2025). Empowering Digital Education: The Future of Value-Based Learning in the Digital Era. In *Empowering Value Co-Creation in the Digital Era* (pp. 199-228). IGI Global Scientific Publishing. DOI: 10.4018/979-8-3373-1742-7.ch009

Videnovik, M., Trajkovik, V., & Vlahu-Gjorgievska, E. (2023). A review of Game-Based Learning for K–12 education: Trends and opportunities. *International Journal of STEM Education*, 10(1), 22. https://doi.org/10.1186/s40594-023-00431-4

Yunus, N., & Ismail, M. N. (2025). The mediating effect of ethical values in smart sustainable library development. *IFLA Journal*. https://doi.org/10.1177/03400352251331446

Zheng, Y., Zhang, J., Li, Y., Wu, X., Ding, R., Luo, X., ... & Huang, J. (2024). Effects of digital game-based learning on students' digital etiquette literacy, learning motivations, and engagement. *Heliyon*, *10*(1). https://doi.org/10.1016/j.heliyon.2023.e23490