Comprehensive Needs Analysis for Development Teaching Model Based on Gamification in Environmental Education

Nor Zaitul Shahira Zakaria, Hanifah Mahat

Faculty of Human Science, Universiti Pendidikan Sultan Idris, Tanjung Malim, 35900, Malaysia

ABSTRACT

Teacher-led gamification in the teaching and learning process allows students to become more creative, critical, more engaged, and improves their current achievement and performance. Geography teachers also play an important role in teaching and learning within environmental education. This study is a needs analysis in the first phase of Design and Development Research (DDR). The purpose of this is to identify the need for the development of a gamification-based teaching model in environmental Geography education. The study was conducted qualitatively using interviews. Five informants were involved, consisting of Geography experts, including excellent Geography teachers with over 10 years of experience. The interview data was analyzed using thematic techniques, including transcription, and verbatim themes. The findings of this study show that there is a need for researchers to develop gamification-based teaching in environmental Geography education. Emphasizing gamification elements in this teaching model is seen as highly relevant to enhance the quality of teaching and learning, ensuring that students excel holistically in academics and are motivated in an increasingly sophisticated and modern teaching and learning process.

Keywords: Gamification, Environmental Education, Teaching and Learning

INTRODUCTION

In the rapidly evolving digital era, traditional approaches to education often fall short in addressing the needs and interests of the younger generation. According to Fauville et al. (2021), today's youth are growing up in environments saturated with digital technology and interactivity, making conventional educational methods less engaging and less effective. Passive learning through lectures is no longer sufficient to capture students' interest or foster their active engagement in the learning process. As a result, the integration of gamification elements in teaching has emerged as an innovative approach aimed at enhancing student engagement and motivation. Alhammad and Moreno (2021) assert that gamification—defined as the application of game elements in non-game contexts—holds significant potential in improving both motivation and engagement. Features such as reward systems, challenges, leaderboards, and avatars not only captivate students' interest but also encourage them to persist in learning and achieve their educational goals.

This article aims to analyze the need for developing a teaching model based on gamification elements, particularly in the context of environmental education. Environmental education is crucial for fostering awareness of environmental issues and proactive action among students. According to Jong et al. (2020), awareness and understanding of environmental issues such as climate change, biodiversity conservation, and natural resource management are critical in shaping a responsible and proactive younger generation. However, traditional teaching approaches often fail to engage students effectively. Methods focused on passive, one-way information delivery do not meet the needs of students who prefer interactivity and dynamic learning experiences. Gamification in teaching offers an innovative approach that can enhance student engagement and motivation (Zainuddin et al., 2020). Klock et al. (2020) further emphasize that gamification involves the use of game elements in non-game settings to foster increased engagement and motivation.

Furthermore, gamification-based teaching and learning has proven to be an effective approach in enhancing creativity, critical thinking, interest, as well as student achievement and performance. Sailer and Homner (2020)

demonstrated in their study that students engaged in gamified learning exhibit increased intrinsic and extrinsic motivation. Intrinsic motivation, driven by interest and enjoyment in learning, is fostered through engaging and enjoyable game elements. Meanwhile, extrinsic motivation, driven by external rewards such as badges and points, also plays a role in encouraging students to achieve their learning objectives. In the context of Geography education, teachers play a vital role in ensuring the effectiveness of the process. Kim et al. (2020) argue that teachers need to design learning activities that are relevant and appropriate to students' comprehension levels. Teachers must also actively monitor and guide students during gamification activities to ensure that learning objectives are met.

Additionally, incorporating gamification elements in Geography teaching can enrich the learning experience and ensure that students remain motivated. Nguyen and Luu (2022) found in their study that students engaged in gamified learning exhibit higher interest and are more likely to take initiative in their learning. The learning experiences gained through gamification also help students better understand and apply geographical concepts (Hanifah et al., 2020). Through thorough needs analysis, a gamification-based teaching model can be developed to address these needs and support the formation of a more responsible and proactive generation in addressing environmental challenges.

LITERATURE REVIEW

Traditional teaching approaches in Geography education may fail to engage students effectively, leading to low motivation and poor academic performance. Gamification elements have the potential to transform this situation by enhancing student engagement and interest

However, there is a lack of comprehensive research on the development of gamification-based teaching models specifically within the context of environmental Geography education. Traditional approaches often focus on one-way information delivery with minimal interaction between teachers and students (Ahmad & Said, 2020). This passive learning environment results in disinterest and ultimately contributes to low academic achievement (Zakaria et al., 2019). Such methods are inadequate in meeting the evolving needs of students in today's digital era, where interactive and student-centered approaches are essential to sustain interest and motivation.

Gamification elements, such as reward systems, challenges, and the use of interactive technology, have been proven to effectively increase student motivation and engagement across various educational fields (Deterding et al., 2011). Gamification not only makes the learning process more enjoyable but also aids students in better understanding and applying concepts through interactive and engaging learning experiences (Kim et al., 2020). However, research on the application of gamification in environmental Geography education remains limited. Existing studies often focus on other subjects or broader aspects of gamification without addressing its specific implementation in environmental Geography education (Breuer et al., 2021).

Previous studies highlight that student engagement and motivation can be enhanced through the incorporation of game elements in learning (Dichev & Dicheva, 2017). Nonetheless, the application of gamification in Geography education, particularly in environmental contexts, requires more in-depth research to ensure the relevance and effectiveness of the chosen elements. There is a pressing need for a teaching model that not only enhances student interest but also enriches the learning experience in measurable and impactful ways.

Therefore, this study seeks to identify the requirements for developing a gamification-based teaching model in environmental Geography education. Through qualitative methods, this needs analysis aims to gather insights and feedback from experienced Geography teachers to ensure that the developed model is both relevant and effective in improving the quality of Geography teaching and learning. The study will focus on the application of appropriate and relevant gamification elements in the context of Geography education, with the goal of enhancing student engagement, motivation, and academic performance.

METHODOLOGY

This study employed a design and development approach (Richey & Klein, 2007; 2014) with the aim of developing a gamification-based teaching model in environmental Geography education. The needs analysis was

conducted using qualitative methods to gather direct insights from Geography teachers regarding the necessity of developing a teaching model incorporating gamification elements. An interview protocol was designed based on themes identified through a literature review.

The study's instructors comprised five individuals selected through purposive sampling, including Geography experts with over ten years of teaching experience by recognize them P1-P5. Thus, Semi-structured, open-ended interview questions were prepared to elicit in-depth information. Examples of interview questions included:

a. How can gamification elements enhance student motivation in Geography and environmental education?

b. What impact do gamification elements have on students' creativity and critical thinking in Geography education?

c. To what extent can gamification elements increase students' awareness of environmental issues?

d. How can gamification help overcome challenges in teaching Geography?

e. In what ways can gamification empower teachers in the digital era?

f. How suitable are gamification elements for Geography subjects and students' cognitive levels to ensure maximum impact?

g. How can a gamification-based teaching model improve academic outcomes and foster positive attitudes towards learning and environmental stewardship?

This demographic information highlights the diverse backgrounds and teaching experiences of the geography teachers interviewed. Such information is essential for understanding their perspectives and views regarding the use of gamification elements in Geography teaching.

DISCUSSION:

Need Analysis of Gamification Elements in Environmental Education

The findings from the interviews indicate that gamification elements can significantly enhance students' interest and motivation in environmental education within Geography. Elements such as reward systems, challenges, and leaderboards have proven to engage students and increase their enthusiasm for learning. Moreover, the use of digital technology in gamification helps students better understand and apply geographical knowledge more effectively. The interview results reveal several key needs for the development of a gamified teaching model in Geography education.

How Can Gamification Elements Enhance Student Motivation in Geography and Environmental Education?

Student motivation is a crucial aspect of the learning process. Several informants in this study emphasized that the inclusion of game elements in teaching can capture students' interest and make them more eager to learn. For instance, P1 stated, "I believe the use of game elements in teaching is very beneficial. It attracts students' interest and makes them more excited to learn." This suggests that reward systems such as badges, points, and levels can provide effective incentives for students. P3 added, "Students are more excited to learn and find it easier to understand concepts taught through fun activities." This demonstrates that students involved in gamified activities are not only more motivated but also find it easier to grasp the concepts being taught.

Motivation is enhanced through rewards that recognize students' efforts. A well-structured reward system can drive students to achieve more as they receive immediate recognition and experience satisfaction in their learning. This aligns with the study by Hamari et al. (2014), which found that gamification consistently enhances student motivation and engagement across various educational contexts.

What Impact Do Gamification Elements Have on Students' Creativity and Critical Thinking in Geography Education?

Gamification also plays a significant role in fostering students' creativity and critical thinking. Creativity and critical thinking are essential skills in education. Informants highlighted that gamification encourages students to think outside the box and approach problems creatively. For example, P2 mentioned, "Gamified activities require students to use their imagination and think critically to solve challenges." This indicates that game elements can stimulate students' creative and analytical skills, making learning more dynamic and engaging. P3 suggested, "Gamification elements can make students more engaged and interested in environmental topics. By using games, students can learn while having fun." This illustrates that games in education can spark students' interest and encourage them to engage more deeply with the learning materials. P4 added, "Students are more interested and excited when we incorporate game elements in teaching. It also helps in simplifying the understanding of difficult concepts." This highlights that through gamification, students can develop critical thinking skills as they work through challenges presented in game form.

Elements of gamification involving problem-solving and challenges can encourage students to think outside the box and find creative solutions. This not only improves their understanding of the topics being taught but also builds essential skills that can be applied in other contexts. Research by Cheng et al. (2019) supports that gamification in education can enhance critical thinking and creativity in students through activities that require deep thinking and innovative problem-solving.

To What Extent Can Gamification Elements Increase Students' Awareness of Environmental Issues?

Environmental education requires approaches that enhance students' awareness and understanding of environmental issues. Raising environmental awareness is a key objective in education. Informants noted that gamification can effectively increase students' understanding of environmental issues. P4 stated, "Using game elements to teach environmental topics makes students more aware of the impact of their actions on the environment." This suggests that gamified learning can foster a deeper appreciation and proactive attitude towards environmental conservation.P2 stated, "By using games, we can show them how their actions can impact the environment. This can increase their awareness and understanding of environmental issues." This suggests that gamification elements can be used to simulate real-world situations, helping students understand cause-and-effect relationships in the context of the environment. P3 further added, "Gamification elements can make students more aware of the importance of the environment." This emphasizes that gamification can raise students' awareness about the significance of conservation and proactive actions to protect the environment.

The use of simulations in gamification allows students to see the consequences of their actions in a safe and controlled context, helping them understand the effects of their decisions without real-world risks. This is consistent with the study by Wu and Lee (2019), which found that using gamification in environmental education can more effectively raise students' awareness and understanding of environmental issues compared to traditional approaches.

How Can Gamification Help Overcome Challenges in Teaching Geography?

Despite the many benefits, the implementation of gamification in education also faces several challenges. Educational challenges such as lack of interest and poor academic performance can be addressed through gamification. Informants reported that gamified teaching methods make learning more enjoyable and effective. P4 observed, "Students who are usually disengaged become more involved when game elements are introduced." This demonstrates that gamification can transform the learning experience and improve academic outcomes. P1 stated, "One of the main challenges is time and technology constraints. Sometimes, we don't have enough time to plan and implement gamified activities." This indicates that teachers need sufficient time to plan effective gamified activities, which often becomes a major barrier. Additionally, P5 added, "We also need to ensure that all students can participate, especially if they do not have access to the required technology." A lack of access to sufficient technology can hinder the full and fair implementation of gamification.

To overcome these challenges, teachers need adequate support in terms of time and technological resources.

Research by Breuer et al. (2021) shows that time and resource constraints are among the major barriers to implementing gamification in education and suggests that providing sufficient resources and support is critical for the success of gamification.

What Ways Can Gamification Empower Teachers in the Digital Era?

Teachers play a vital role in ensuring the effectiveness of gamification in teaching. The role of teachers in the digital era is evolving. Informants emphasized the need for comprehensive training and support to effectively implement gamification. P3 noted, "Teachers need proper training to integrate game elements into their lessons successfully."P5 suggested, "I think we need to ensure that the game elements used match the students' level of understanding." This suggests that teachers need to choose and adapt gamification elements appropriate for the students' abilities and knowledge. P4 added, "Teachers play an important role in ensuring the effectiveness of gamification in teaching." This highlights that teachers not only need to plan but also monitor and guide students during their engagement in gamified activities.

The role of the teacher is critical in ensuring that elements are tailored to students' needs and levels. Teachers need to understand how to motivate students using appropriate game elements and provide the necessary guidance to help students achieve their learning objectives. According to Sailer and Homner (2020), the active role of teachers in implementing gamification is essential for ensuring its effectiveness and success in education.

How Suitable Are Gamification Elements for Geography Subjects and Students' Cognitive Levels to Ensure Maximum Impact?

For successful gamification implementation, teachers require adequate training and support. P2 stated, "I think we need more training and support for teachers in using gamification." This suggests that continuous training is important to ensure that teachers can effectively use gamification in their teaching. P4 further added, "The school should also provide adequate technological facilities to support these activities." This indicates that, in addition to training, support in terms of technological resources is also essential to ensure that all students can participate in gamified activities. The suitability of gamification elements for different subjects and cognitive levels is crucial. Informants stressed that game elements must align with the curriculum and students' abilities. P1 mentioned, "It's important to choose game elements that are appropriate for the subject matter and the students' cognitive levels." This ensures that gamification is both relevant and effective in enhancing learning.

Adequate training and support are crucial for enabling teachers to integrate gamification effectively into their teaching. According to Nguyen and Luu (2022), training focused on the use of technology and gamification strategies can improve teachers' confidence and competence in implementing gamification in the classroom.

How Can a Gamification-Based Teaching Model Improve Academic Outcomes and Foster Positive Attitudes Towards Learning and Environmental Stewardship?

Gamification elements to the learning content are essential to ensure its effectiveness. P3 suggested, "I think we need to make sure that the game elements used are appropriate for the students' level of understanding." This indicates that the selection of gamification elements should align with students' knowledge and ability levels. P1 also added, "Moreover, we also need to involve students in the learning process, such as by giving them opportunities to create their own games." This suggests that involving students in the creation of games can enhance their sense of ownership of the learning process and increase their motivation to learn. P5 stated, "Students are more enthusiastic about learning and achieve better results when game elements are used." This underscores the potential of gamification to enhance both academic performance and students' attitudes towards education.

The relevance of gamification-based teaching model or teacher's guideline is important to ensure that students are actively engaged in learning. Game elements that align with students' abilities can help them better understand and apply the concepts being taught. Research by Cheng et al. (2019) indicates that relevant gamification elements can enhance student engagement and achievement by ensuring that they are actively involved in the learning process.

CONCLUSION

Developing a gamification-based teaching model for environmental education, particularly in Geography, represents a timely and crucial innovation. Integrating game elements such as reward systems, challenges, and digital technology into teaching enhances student engagement, motivation, and understanding, while fostering awareness and proactive action on environmental issues. Traditional Geography teaching methods often struggle to sustain student interest, resulting in disengagement and poor academic performance. Gamification offers a dynamic alternative, making learning more interactive, enjoyable, and effective. Feedback from experienced Geography teachers underscores the potential of gamification to not only captivate students but also improve their comprehension and application of concepts.

Key themes identified in this study include the need for increased student motivation, creativity, critical thinking, and environmental awareness, alongside addressing challenges like limited time and technological resources. Teachers play a pivotal role in the success of gamification and require adequate training and support to ensure its effective implementation. Moreover, gamification elements must align with the subject matter and students' cognitive levels to maximize impact. This model not only enhances academic outcomes but also cultivates positive attitudes toward learning and environmental stewardship. In the long term, it holds the potential to nurture more informed, motivated, and environmentally responsible students, essential for addressing global environmental challenges.

REFERENCES

1. Aronoff, S., (1989). Geographic Information Systems: A Management Perspective. Ottawa: WDL Publications.
2. Alhammad, M. M., & Moreno, A. M. (2021). Gamification in software engineering education: A systematic mapping. Journal of Systems and Software, 131-150.
3. Altschuld, J. W., & Kumar, D. D. (2021). Needs assessment: An overview. SAGE Publications.
4. Anderson, L. W., Krathwohl, D. R., & Airasian, P. W. (2020). A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives. Longman.
5. Breuer, J., Schmid, K., & Ritterfeld, U. (2021). Gamification in environmental education: Challenges and opportunities. Journal of Environmental Education, 52(2), 123-135.
6. Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness: Defining "gamification". In Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments. 9-15.
7. Dichev, C., & Dicheva, D. (2017). Gamifying education: what is known, what is believed and what remains uncertain: A critical review. International Journal of Educational Technology in Higher Education, 14(1), 9.
8. Fauville, G., McHugh, P., Domegan, C., Mäkitalo, Å., & Frias, K. (2021). Visualizing the ocean: Marine education using digital tools. Environmental Education Research, 27(1), 120-136.
9. Granić, A., & Aaboen, L. (2021). Gamified learning for environmental awareness: A systematic review of serious games in environmental education. Environmental Education Research, 27(1), 89-105.
10. Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does gamification work?--A literature review of empirical studies on gamification. In 2014 47th Hawaii international conference on system sciences. 3025-3034 . Ieee.
11. Hmad, A., & Said, N. (2020). The impact of traditional teaching methods on student motivation. Journal of Education and Practice, 11(4), 45-50.
12. Mahat, H., Arshad, S., Saleh, Y., Aiyub, K., Hashim, M., & Nayan, N. (2020). Penggunaan dan penerimaan bahan bantu mengajar multimedia terhadap keberkesanan pembelajaran Geografi. Malaysian Journal of Society and Space, 16(3). https://doi.org/10.17576/geo-2020-1603-16
13. Jong, M. S. Y., Tai, H. T., & Tam, V. W. L. (2020). Gamification in environmental education: A review of recent trends and future directions. Educational Technology & Society, 23(2), 66-77.
14. Kim, S., Song, K., Lockee, B., & Burton, J. (2020). Gamification in learning and education: Enjoy learning like gaming. Educational Media International, 57(4), 1-13.
15. Richey, R. C., & Klein, J. D. (2020). Design and development research: Methods, strategies, and issues. Routledge.
16. Sahin, E., & Erdem, M. (2021). The effect of gamification on environmental behavior: An educational intervention with university students. International Journal of Educational Technology in Higher Education,

18(1), 1-19.

17. Sailer, M., & Homner, L. (2020). The gamification of learning: A meta-analysis. Educational Psychology Review, 32(1), 77-112.

18. Sánchez-Mena, A., Martí-Parreño, J., & Aldás-Manzano, J. (2020). The effect of age on the use of gamification and serious games: Context of environmental education. Higher Education, Skills and Work-Based Learning, 10(3), 579-592.

19. Wu, M. L., & Lee, J. J. (2019). Gamified participatory sensing for learning about biodiversity in secondary education. Journal of Science Education and Technology, 28(5), 423-436.

20. Zainuddin, Z., Chu, S. K. W., & Lee, T. H. (2023). Empowering students with gamified learning: A study on the impact of gamification on environmental education. Computers & Education, 183, 104517.

21. Zainuddin, Z., Chu, S. K. W., Shujahat, M., & Perera, C. J. (2020). The impact of gamification on learning and instruction: A systematic review of empirical evidence. Educational Research Review, 30, 100326.

22. Zakaria, N., Rahman, A. A., & Ahmad, N. (2019). The role of teacher-student interaction in improving students' motivation and achievement. International Journal of Learning and Teaching, 11(1),1-