International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 6 Issue 21 (June 2024) PP. 352-358
DOI: 10.35631/IJMOE.621025

INTERNATIONAL JOURNAL OF MODERN EDUCATION (IJMOE)
www.ijmoe.com

THE IMPACT OF "PERISIK KECIL" A GAME-BASED LEARNING ON STUDENT'S SELF-EFFICACY TOWARDS SCIENCE LEARNING

Marina Mokhtar[1*], Nor Aziyah Bakhari[2], Nurul Izza Husin[3], Nor Aimi Abdul Wahab[4]

[1] Faculty of Applied Sciences, Universiti Teknnologi MARA, Cawangan Pulau Pinang, Pulau Pinang
Email: mmarina@uitm.edu.my
[2] Faculty of Applied Sciences, Universiti Teknnologi MARA, Cawangan Pulau Pinang, Pulau Pinang
Email: noraziyah140@uitm.edu.my
[3] Faculty of Applied Sciences, Universiti Teknnologi MARA, Cawangan Pulau Pinang, Pulau Pinang
Email: nurulizza.husin@uitm.edu.my
[4] Faculty of Applied Sciences, Universiti Teknnologi MARA, Cawangan Pulau Pinang, Pulau Pinang
Email: noraimi108@uitm.edu.my
[*] Corresponding Author

Article Info:

Article history:
Received date: 18.04.2024
Revised date: 13.05.2024
Accepted date: 15.06.2024
Published date: 30.06.2024

To cite this document:

Mokhtar, M., Bakhari, N. A., Husin, N. I., & Wahab, N. A. A. (2024). The Impact Of "Perisik Kecil" A Game-Based Learning On Student's Self-Efficacy Towards Science Learning. *International Journal of Modern Education, 6* (21), 352-358.

DOI: 10.35631/IJMOE.621025

Abstract:

Self-efficacy plays a crucial role in academic success and overall well-being. This study investigated the potential of game-based learning (GBL) to enhance self-efficacy in Form Four students from a secondary school in Seberang Perai Selatan, Pulau Pinang. By gaining insight into students' self-efficacy profiles, educators can adapt their teaching strategies, provide targeted support and create a positive learning environment that promotes self- confidence and performance in science tasks. The collected data were analysed using descriptive statistics and, Pearson's correlation. Following a GBL activity, 59 students completed a general self-efficacy (GSE) survey. Descriptive analysis revealed an average GSE score (M = 3.10, SD = 0.65), indicating that students have average self-efficacy when trying to solve the game's problems. Pearson's correlation analysis identified significant positive correlations between items focussing on confidence in academic and non-academic tasks, suggesting a holistic strengthening of self-efficacy through GBL. This study lays the groundwork for further research exploring how specific GBL design elements impact different aspects of self-efficacy and contribute to long-term learning outcomes.

Keywords:

Descriptive Analysis, Game-Based Learning, Self-Efficacy, Secondary School

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 6 Issue 21 (June 2024) PP. 352-358
DOI: 10.35631/IJMOE.621025

Introduction

Self-efficacy research has become a cornerstone for understanding students' academic capabilities in science. While studies have shown that self-efficacy plays a crucial role in shaping students' attitudes, motivation, and performance in game-based learning (GBL) environments (Lei et. al., 2022), there's a growing need to explore nuances in this relationship. For instance, how does the specific design of GBL activities or the targeted science concepts influence the impact of self-efficacy on student engagement and problem-solving strategies? Exploring general self-efficacy (GSE) amongst secondary school students can help improve the education system, as students with high self-efficacy beliefs are more likely to persevere through difficult tasks, actively seek solutions, and demonstrate a growth mindset that encourages continuous learning and improvement (Justus et. al., 2023). According to Kilag et. al. (2023), a supportive and empowering learning environment that enhances students' confidence and skills will enable teachers to promote students' intrinsic motivation, academic achievement, and overall enjoyment of science learning. Understanding these moderating factors can help educators tailor GBL experiences to maximise impact for different student populations.

This study aims to contribute to this growing body of research by investigating the impact of a specific GBL program targeting science basic knowledge on the self-efficacy of secondary school students at rural area. By examining how student self-efficacy profiles interact with the GBL design and the science concepts covered, this research seeks to provide insights for developing more effective and targeted GBL experiences that can foster science learning and student confidence.

Research Background

Self-efficacy, a core concept of social cognitive theory, refers to a person's belief in their ability to successfully perform certain tasks or cope with challenging situations (Bandura, 1986). This construct plays a crucial role in the academic environment, particularly in science education. Studies have shown that students' self-efficacy beliefs in science have a significant impact on their approach to learning and their subsequent performance (Zimmerman et. al., 1992).

High school students with high science self-efficacy show more engagement, effort and achievement in science tasks (Pajares & Miller, 1994). They are more likely to believe in their ability to understand complex scientific concepts (Tschannen-Moran & Hoy, 2001), conduct successful experiments (Britner & Pajares, 2006), and persevere through challenges to solve problems (Zimmerman, 2000). These students exhibit a "growth mindset" (Dweck, 2006) and view intelligence and ability as malleable and nurtured through effort and learning.

In contrast, students with low self-efficacy in science tend to shy away from challenging tasks, are anxious when confronted with uncertainty, and give up easily despite difficulties (Schunk, 1991). This self-doubt can lead to underachievement and affect the overall learning experience of students in science (Pintrich & Schunk, 2002). Therefore, it is crucial for educators to understand students' self-efficacy in science. By fostering a supportive learning environment that encourages a growth mindset and addresses self-perceived limitations, educators can empower students to approach science with confidence and realise their full academic potential.

Traditional methods of teaching science often struggle to fully engage students, particularly in rural areas where resources and access to technology can be limited (Trahar, 2020). In this

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 6 Issue 21 (June 2024) PP. 352-358
DOI: 10.35631/IJMOE.621025

context, innovative approaches such as GBL offer a promising way to improve student engagement and learning outcomes (Martín-Hernández, 2021). GBL utilises game mechanics and elements such as challenges, competition, collaboration and immediate feedback to promote a deeper understanding of the subject matter (Kapp, 2012). Studies have shown that GBL can be particularly effective in science education as it promotes inquiry-based learning, problem-solving skills and scientific thinking (Noroozi et. al., 2020).

Theoretical Framework

Albert Bandura's Social Cognitive Theory (SCT) provides a powerful framework for understanding how students' beliefs about their capabilities (self-efficacy) influence their learning and academic performance in science (Bandura, 1986). SCT emphasizes that human behavior, including learning behaviors, are shaped by a triadic reciprocal interaction between personal factors (cognitive, affective, self-perceptions), behavioral patterns, and environmental influences (social and situational contexts).

Self-efficacy, a central construct within SCT, refers to an individual's belief in their ability to successfully learn new concepts, acquire skills, and persevere through challenges (Bandura et al., 1999). In the context of science education, students with high self-efficacy are more likely to approach science learning with a growth mindset, believing they can develop their understanding through effort and learning strategies.

Game-based learning (GBL) environments offer a unique opportunity to foster self-efficacy through SCT principles. By incorporating elements like immediate feedback, opportunities for collaboration, and a sense of accomplishment in overcoming challenges, GBL can create a supportive learning environment that promotes positive self-perceptions and motivates students to persist in their learning endeavors.The theoretical framework of this study are displayed in Figure 1, which illustrate the impact of game-based learning throughout the behaviour change process.

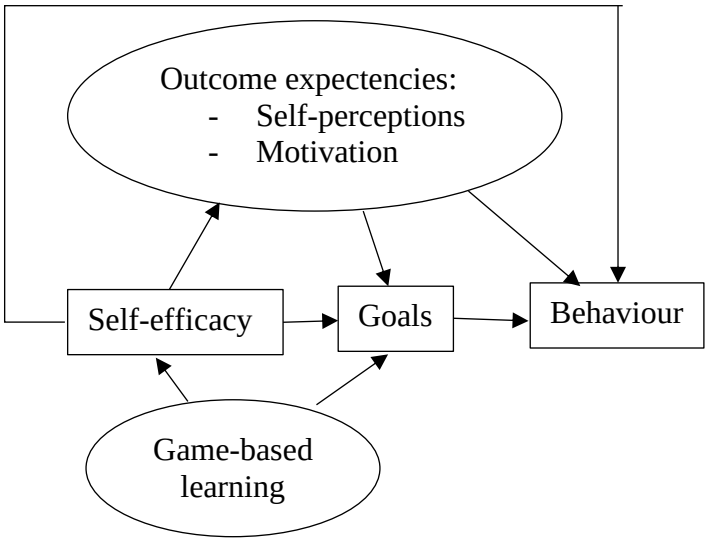

Figure 1: An Illustration of the Theoretical Framework.

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 6 Issue 21 (June 2024) PP. 352-358
DOI: 10.35631/IJMOE.621025

Methodology

The study was conducted at a school serving higher secondary students located in a rural area in Seberang Perai Selatan, Pulau Pinang. This particular school serves students who represent the surrounding community, who come from farmer's families. Participants were 59 form four students, with 16 boys and 43 girls. All participants were Malays. Students were randomly assigned to the ten groups before playing the game.

Students played game-based learning, or the Perisik Kecil game, after they had been exposed to the curriculum of the Malaysian standard course of study for lower secondary science. Perisik Kecil is an explorace game concept that consists of four science tasks with the objective of solving a criminal problems. Each task requires the group to collaboratively identify the answer from the given evidence, thus fostering teamwork and decision-making skills. The game operates in a real time, adding an element of excitement and urgency. The group that not only correctly identifies the criminal but also does so in the fastest time emerges as the winner.

After the students finish playing the Perisik Kecil, they are required to answer the general self-efficacy question. For the current study, students' science self-efficacy was measured by adapting items from the General Self-Efficacy (GSE) (Schwarzer & Jerusalem, 1995). The GSE contains 10 items, which are mixed at random into a larger pool of items that have the same response format. Responses were made on a 4-point likert scale.

Descriptive analyses were used to assess the mean and standard deviation of GSE (total) using SPSS, ver. 26. The mean scores for the individual self-efficacy items ranged from 2.88 (SD = .721) to 3.29 (SD = .645), indicating a generally positive self-efficacy perception among participants. Cronbach's alpha was computed to assess the reliability of the questions. The analysis revealed a reliability coefficient of $\alpha = .78$, which suggests acceptable internal consistency for the self-efficacy measure.

Results

Table 1 presents the descriptive statistics for the 10 self-efficacy items measured in the study. The table shows the mean score and standard deviation (SD) for each item on a scale of 1 (strongly disagree) to 4 (strongly agree). Table below also shows the correlation of each item with the scale's total. It allows visualising an adequate correlation for each of them.

Table 1: Scores Obtained In Each GSE' s Items and Correlation With Total Score

Item	Mean	SD	r
I can always manage to solve difficult problems if I try hard enough.	3.17	.647	.632
If someone opposes me, I can find the means and ways to get what I want.	3.15	.665	.635
It is easy for me to stick to my aims and accomplish my goals.	3.08	.651	.568
I am confident that I could deal efficiently with unexpected events.	2.95	.600	.593
Thanks to my resourcefulness, I know how to handle unforeseen situations.	3.10	.635	.670
I can solve most problems if I invest the necessary effort.	3.29	.645	.477

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 6 Issue 21 (June 2024) PP. 352-358
DOI: 10.35631/IJMOE.621025

I can remain calm when facing difficulties because I can rely on my coping abilities.	3.02	.754	.575
When I am confronted with a problem, I can usually find several solutions.	3.10	.607	.680
If I am in trouble, I can usually think of a solution.	3.22	.589	.732
I can usually handle whatever comes my way.	2.88	.721	.623
Overall Mean	3.10	.650	

Table 1 presents the descriptive statistics and correlations for the 10 self-efficacy items. The mean scores ranged from 3.02 (SD = .754) for '*I can remain calm when facing difficulties because I can rely on my coping abilities*' to 3.29 (SD = .645) for *'I can solve most problems if I invest the necessary effort*'. These relatively high means suggest that students generally agreed with the self-efficacy statements. Standard deviations were moderate, ranging from .589 to 0.754, indicating some variability in student responses.

The correlations between the items and the total self-efficacy score were all positive and statistically significant ($p < .05$). Items with the strongest correlations (above .70) included '*If I am in trouble, I can usually think of a solution*' (r = .732) and *'Thanks to my resourcefulness, I know how to handle unforeseen situations*' (r = .670). These items appear to strongly align with the overall concept of general self-efficacy in this student sample. Conversely, the item '*I can solve most problems if I invest the necessary effort*' (r = .477) had a lower correlation, suggesting that it might be less representative of the broader self-efficacy construct measured in this study.

Discussions

This study presented the effects of incorporating GBL Perisik Kecil's GBL student self-efficacy. Generally, the results suggest that students tend to agree with the self-efficacy statements presented to them. After participating in GBL activities, students seem to have more confidence in their ability to deal with problems, participate in collaborative efforts and find a solution when difficulties arise. The high mean score demonstrates a positive aspect of self-efficacy that is consistent with the goals of GBL, which aim to empower students and promote their self-efficacy through immersive and interactive experiences via the concept of exploration. These findings are consistent with previous research showing that interactive learning through GBL positively influences students' self-efficacy (Bilgin et al., 2015; Lu & Lien, 2020; Yang et al., 2016). The results of this study demonstrate the effectiveness of GBL in enhancing students' self-efficacy.

These findings could contribute to the idea of integrating GBL into the curriculum to enhance student self-efficacy and create dynamic learning environments that promote active engagement and foster the development of students' confidence and competence. Educators should be encouraged to integrate GBL approaches in the classroom as it motivates problem solving and adaptive thinking and helps students become independent and engaged learners.

While our study provides valuable insight into the impact of self-efficacy among students, several limitations should be acknowledged. First, the study sample was limited to students from a single school and cannot fully represent the learning experience of all form four

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 6 Issue 21 (June 2024) PP. 352-358
DOI: 10.35631/IJMOE.621025

students. Future research is necessary to extend the inclusivity of the sample by conducting a more comprehensive study encompassing more students from different schools and backgrounds. Next, this study mainly focused on short term outcomes and did not thoroughly examine the long-term effects. Thus, there is a necessity for a follow-up study to assess the long-term effects of integrating GBL in classroom on student's self-efficacy. Finally, this study exclusively employed quantitative methods, potentially constraining the depth of understanding regarding the effect of GBL towards self-efficacy among students. Future research could incorporate qualitative data techniques such as interview to enhance and complement quantitative findings.

Future research is suggested to look at comparing the impact of different types of GBL on self-efficacy and investigate whether specific game design elements are more effective at enhancing self-efficacy than others. Longitudinal studies are also needed to examine the sustainability of the observed effects over time and across different academic contexts. Furthermore, investigating how individual differences, such as prior gaming experience, learning styles, or personality traits, moderate the relationship between game-based learning and self-efficacy. Understanding these individual differences could inform personalized approaches to game-based learning.

Conclusion

In conclusion, game-based learning through the concept of explorace offers a promising approach to enhance student's self-efficacy in rural areas. The results showed that the objective of this study has been achieved where an acceptable level of self-efficacy can positively affect students' behaviour. Self-efficacy plays a critical role in shaping high school students' performance in science tasks and academic achievement. Educators, parents, and policymakers should recognise the importance of fostering students' self-beliefs, providing opportunities for success, and creating supportive learning environments that nurture self-efficacy in science education. By empowering students to believe in their abilities and potential, we can inspire a new generation of confident, capable, and successful scientists and innovators. By integrating gamification elements with real-world problem-solving tasks, Perisik Kecil can engage students, foster critical thinking skills, and promote a deeper understanding of scientific concepts. Educators and policymakers should explore the potential of game-based learning initiatives like explorace to create engaging and impactful learning experiences that inspire curiosity, creativity, and scientific inquiry among students in rural high schools.

Acknowledgements

The researcher would like to express his appreciation to the Universiti Teknologi MARA Penang Branch for permission to conduct this research.

References

Bandura, A. (1986). Social foundations of thought and action. Englewood Cliffs, NJ, 1986(23-28), 2.

Bandura, A., Freeman, W. H., & Lightsey, R. (1999). Self-efficacy: The exercise of control.

Bilgin, C. U., Baek, Y., & Park, H. (2015). How debriefing strategies can improve student motivation and self-efficacy in game-based learning. Journal of Educational Computing Research, 53(2), 155-182.

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 6 Issue 21 (June 2024) PP. 352-358
DOI: 10.35631/IJMOE.621025
Britner, S. L., & Pajares, F. (2006). Sources of science self-efficacy beliefs of middle school students. Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching, 43(5), 485-499.

Dweck, C. S. (2006). Mindset: The new psychology of success. Random house.

Justus, K., Arghode, V., & Barker, D. (2023). Principal self-efficacy, mindset and performance outcomes: exploring the connection. European Journal of Training and Development, 47(5/6), 565-585.

Kapp, K. M. (2012). The gamification of learning and instruction: game-based methods and strategies for training and education. John Wiley & Sons.

Kilag, O. K., Tokong, C., Enriquez, B., Deiparine, J., Purisima, R., & Zamora, M. (2023). School Leaders: The Extent of Management Empowerment and Its Impact on Teacher and School Effectiveness. Excellencia: International Multi-disciplinary Journal of Education (2994-9521), 1(1), 127-140.

Lei, H., Chiu, M. M., Wang, D., Wang, C., & Xie, T. (2022). Effects of game-based learning on students' achievement in science: a meta-analysis. Journal of Educational Computing Research, 60(6), 1373-1398.

Lu, Y. L., & Lien, C. J. (2020). Are they learning or playing? Students' perception traits and their learning self-efficacy in a game-based learning environment. Journal of Educational Computing Research, 57(8), 1879-1909.

Martín-Hernández, P., Gil-Lacruz, M., Gil-Lacruz, A. I., Azkue-Beteta, J. L., Lira, E. M., & Cantarero, L. (2021). Fostering university students' engagement in teamwork and innovation behaviors through game-based learning (GBL). Sustainability, 13(24), 13573.

Noroozi, O., Dehghanzadeh, H., & Talaee, E. (2020). A systematic review on the impacts of game-based learning on argumentation skills. Entertainment Computing, 35, 100369.

Pajares, F., & Miller, M. D. (1994). Role of self-efficacy and self-concept beliefs in mathematical problem solving: A path analysis. Journal of educational psychology, 86(2), 193.

Pintrich, P. R., & Schunk, D. (2002). Motivation in education: Theory, research, and applications (2nd ed.). Upper Saddle, NJ: Prentice-Hall, Inc.

Trahar, S., Timmis, S., Lucas, L., & Naidoo, K. (2020). Rurality and access to higher education. Compare: A Journal of Comparative and International Education, 50(7), 929-942.

Tschannen-Moran, M., & Hoy, A. W. (2001). Teacher efficacy: Capturing an elusive construct. Teaching and teacher education, 17(7), 783-805.

Schunk, D. H. (1991). Self-efficacy and academic motivation. Educational psychologist, 26(3-4), 207-231.

Schwarzer, R., & Jerusalem, M. (1995). Generalized Self-Efficacy scale. In J. Weinman,S. Wright, & M. Johnston, Measures in health psychology: A user's portfolio. Causal and control beliefs (pp. 35-37). Windsor, UK: NFER-NELSON.

Yang, J. C., Quadir, B., & Chen, N. S. (2016). Effects of the badge mechanism on self-efficacy and learning performance in a game-based English learning environment. Journal of Educational Computing Research, 54(3), 371-394.

Zimmerman, B. J. (2000). Self-efficacy: An essential motive to learn. Contemporary educational psychology, 25(1), 82-91.

Zimmerman, B. J., Bandura, A., & Martinez-Pons, M. (1992). Self-motivation for academic attainment: The role of self-efficacy beliefs and personal goal setting. American educational research journal, 29(3), 663-676.