E-BOOK OF EXTENDED ABSTRACT

THE 14TH INTERNATIONAL INVENTION, INNOVATION & DESIGN COMPETITION 2025

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OTAK-OTAK EDUGAMES: PHYGITAL LEARNING

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ABSTRACT

This article examines the integration of phygital gamification into Malaysian primary education through the development of two games: "Solar Adventure" and "Time Travel." Using the System Development Life Cycle (SDLC) model, these games combine digital interactivity with physical gameplay to provide engaging, curriculum-aligned educational experiences. "Solar Adventure" immerses students in solar system exploration, while "Time Travel" deepens understanding of Malaysia's historical events, cultivating national pride. Both games feature interactive puzzles, quizzes, and coding elements, enhancing student engagement and learning outcomes. The structured SDLC approach ensures systematic alignment with educational objectives, supported by educator feedback and validated through competitions. This initiative demonstrates phygital gamification's effectiveness in transforming learning environments and promoting critical thinking.

Keyword: Gamification, primary school, phygital

1. INTRODUCTION

The continuous evolution of educational technology underscores the importance of integrating digital and physical gaming elements—termed "phygital gamification"—to enhance educational outcomes. Phygital gamification effectively combines digital interactivity with hands-on physical engagement, significantly increasing student motivation and comprehension. However, aligning games with curricular objectives remains a substantial challenge, as digital games often entertain without fully meeting educational standards (Sadera et al., 2014); (Ibrahim et al., 2019); (Walkington, 2021); (Manesis, 2020). Additionally, digital and physical components frequently lack seamless integration, resulting in fragmented educational experiences (Videnovik et al., 2020). The absence of structured frameworks further complicates educational game design, highlighting the need for a sophisticated synthesis of educational theories and game design principles (Ramos et al., 2022); (Hayak & Avidov-Ungar, 2023)

This article discusses the creation of Otak-Otak EduGames, which currently consist of two phygital games, "Solar Adventure" and "Time Travel", developed specifically for primary school students in Malaysia. Both games incorporate physical board games and digital components, aligned meticulously with educational curricula using the System Development Life Cycle (SDLC) model, to promote immersive and interactive learning.

2. METHODOLOGY

The development of Otak-Otak EduGames follows the System Development Life Cycle (SDLC) model, providing a structured approach consisting of seven distinct phases:

Phase 1: Planning (Needs Analysis)
Both "Solar Adventure" and "Time Travel" were developed to address specific curricular requirements within Malaysian primary education. "Solar Adventure" targets the Year 4 solar system syllabus, while "Time Travel" focuses on significant historical events relevant to national identity. Both games were also motivated by the need for versatile educational solutions capable of supporting classroom and remote learning (Sadera et al., 2014).

Phase 2: Analysis (Conceptual Design)
"Solar Adventure" transitioned from a race-based board game into a narrative-driven digital adventure where players follow an astronaut and his cat exploring the solar system, emphasizing Pluto's reclassification. Similarly, "Time Travel" engages students through a storyline where a child journeys through Malaysia's historical milestones, such as the Penang Bridge opening, Commonwealth Games 1998, and the establishment of the Sepang Formula One circuit, enhancing historical understanding and national pride (Walkington, 2021).

Phase 3: Design (Content Development)
Both games were designed to align closely with their respective curricular standards as suggested by (Manesis, 2020). "Solar Adventure" features detailed content about the solar system, enriched with quizzes and interactive puzzles. "Time Travel" integrates historical facts with puzzles and quizzes to actively engage students in learning about Malaysian history, reinforcing retention and interest.

Phase 4: Development (Technical Development)
The digital components of both games were developed using Scratch, enabling students to engage in interactive learning while acquiring foundational coding skills, aligning with additional curricular requirements. The development processes involved consistent reference to educational textbooks and standards to ensure academic rigor and relevance.

Phase 5: Testing
Initial testing and structured teacher evaluations provided critical feedback for both games. Validation through competitions, including district and state-level successes, significantly guided refinements, enhancing the educational effectiveness and gameplay quality of both "Solar Adventure" and "Time Travel".

Phase 6: Implementation
Following validation, both games were introduced into classrooms, with educators facilitating interactions between physical board games and digital counterparts. This blended learning approach leveraged each medium's strengths, providing comprehensive educational experiences (Ramos et al., 2022).

Phase 7: Maintenance (Feedback and Iteration)
Ongoing teacher feedback remains critical to the iterative improvement of both games. Continuous refinement ensures that the games consistently align with pedagogical goals, maintaining student engagement and enhancing learning outcomes (Hayak & Avidov-Ungar, 2023).

3. CONCLUSION

The development of Otak-Otak EduGames exemplifies the significant opportunities and challenges associated with integrating phygital gamification into education using the SDLC model. Both projects highlight the critical importance of aligning game mechanics with curricular objectives through

rigorous methodological frameworks, encompassing needs analysis, conceptual design, content development, technical production, testing, implementation, and iterative refinement.

The successes of these games demonstrate how structured phygital gamification, guided by the SDLC model, can effectively support educational objectives, enhance student engagement, and facilitate versatile learning environments. By continuously integrating stakeholder feedback and competition-based validation, these initiatives underscore the value of innovative educational technology solutions capable of adapting to evolving educational needs, ultimately fostering critical thinking, problem-solving skills, and deepened curricular understanding among young learners.

REFERENCES

Hayak, M., & Avidov-Ungar, O. (2023). Knowledge and planning among teachers integrating digital game-based learning into elementary school classrooms. *Technology, Pedagogy and Education*, *32*(2), 239-255. https://doi.org/10.1080/1475939X.2023.2175719

Ibrahim, R., Yusoff, R. C. M., Zainudin, N. M. M., Sjarif, N. N. A., & Yahya, Y. (2019). Educational Games Quality Framework for Learning Islamic History in Primary School. *International Journal of Learning and Teaching*, *5*(4), 313-317. https://doi.org/doi: 10.18178/ijlt.5.4.313-317

Manesis, D. (2020). Digital Games in Primary Education. In I. Deliyannis (Ed.), *Game Design and Intelligent Interaction*. IntechOpen. https://doi.org/10.5772/intechopen.91134

Ramos, D. K., Brito, C. R., Pimentel, F. S. C., Anastácio, B. S., & Silva, G. A. d. (2022). Integration of Digital Games Into Pedagogical Practice: Contributions and Challenges to Teacher Training. In A. Afonso, L. Morgado, & L. Roque (Eds.), *Impact of Digital Transformation in Teacher Training Models* (pp. 73-92). IGI Global Scientific Publishing. https://doi.org/10.4018/978-1-7998-9538-1.ch004

Sadera, W. A., Li, Q., Song, L., & Liu, L. (2014). Digital Game-Based Learning. *Computers in the Schools*, *31*(1-2), 1-1. https://doi.org/10.1080/07380569.2014.879801

Videnovik, M., Trajkovik, V., Kiønig, L. V., & Vold, T. (2020). Increasing quality of learning experience using augmented reality educational games. *Multimedia Tools and Applications*, *79*(33), 23861-23885. https://doi.org/10.1007/s11042-020-09046-7

Walkington, C. (2021). Intrinsic integration in learning games and virtual instruction. *Educational Technology Research and Development*, *69*(1), 157-160. https://doi.org/10.1007/s11423-020-09886-y

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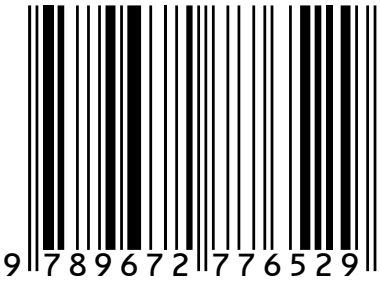

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