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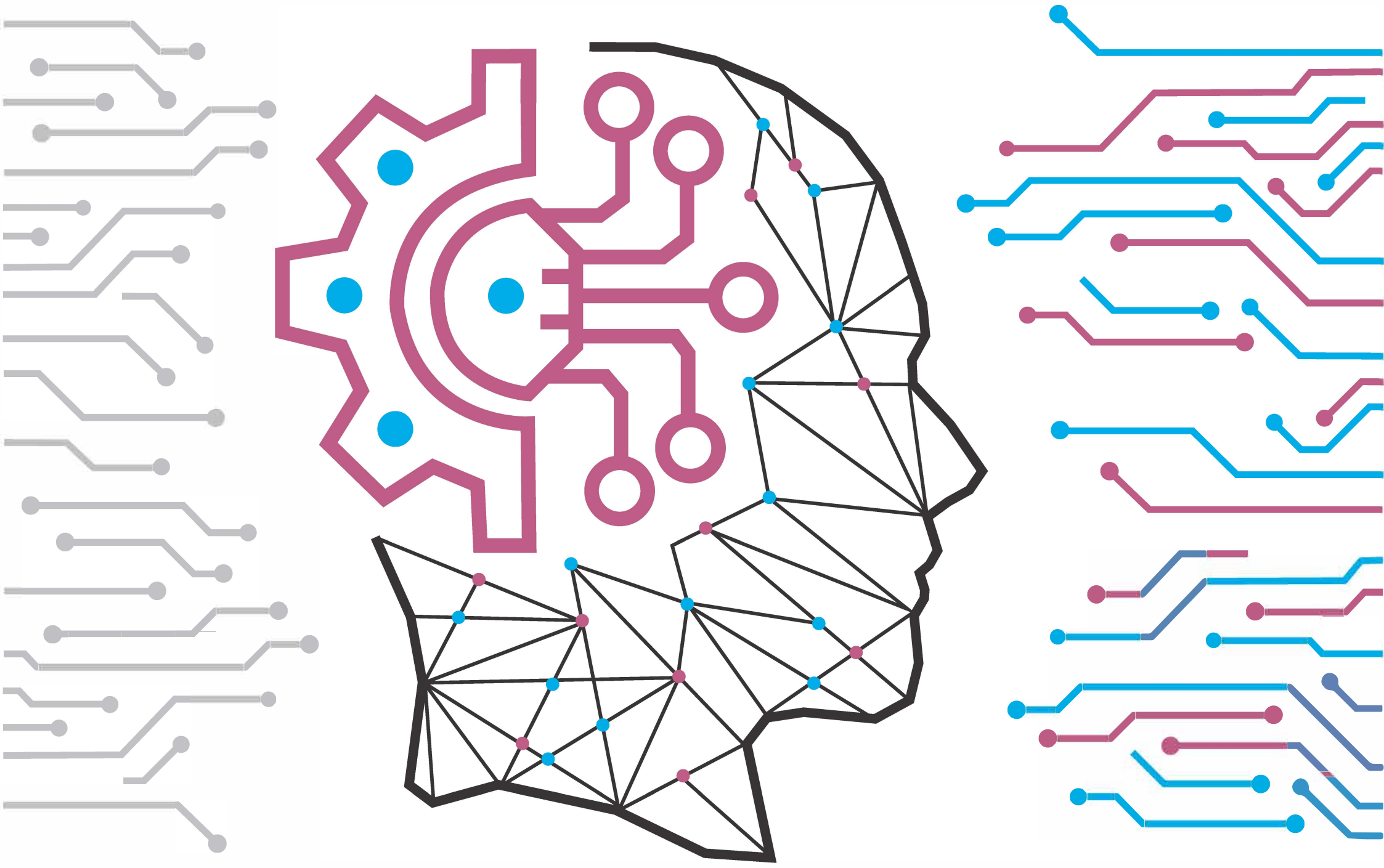

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THE 13TH INTERNATIONAL INNOVATION, INVENTION & DESIGN COMPETITION 2024

## EXTENDED ABSTRACTS

e-BOOK

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# SOLAR ADVENTURE: INNOVATING EDUCATION THROUGH PHYGITAL GAMEPLAY

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## ABSTRACT

This article explains the development of "Solar Adventure," a digital educational game derived from the board game "Solar Race," targeted at primary school students aged 9 to 11. The game combines physical and digital elements, known as "phygital" gaming, to align with the educational curriculum and enhance learning experiences in both classroom and remote settings. The process encapsulates a comprehensive methodology involving needs analysis, conceptual design, content development, technical development, testing, implementation, and iterative feedback to ensure the game's alignment with educational objectives and its effectiveness in delivering curriculum-based content. "Solar Adventure" transitions from a traditional board game format to a digital platform, featuring a narrative-driven adventure where players explore the solar system, integrating engaging educational tasks like mazes and quizzes. The game development used Scratch, a child-friendly coding platform, and was refined through feedback from students and teachers, including participation in the Gami-code Competition. This initiative highlights the importance of integrating digital innovations with traditional educational methods to create immersive and impactful learning experiences. It underscores the challenges and potential of phygital gaming in education, demonstrating that such approaches, when thoughtfully implemented, can significantly enhance learning outcomes and student engagement in a dynamic educational landscape.

***Keyword:*** *Gamification, primary school, phygital, solar system*

## 1. INTRODUCTION

Within the rapidly changing field of educational technology, the combination of digital and physical game materials - a practice known as "phygital" gaming - offers potential ways to improve learning outcomes by combining the dynamic features of digital platforms with the hands-on engagement of physical elements. The main obstacle to effective implementation in educational settings is the lack of alignment between educational syllabi and game design. Digital games are known to increase student motivation and engagement, but they frequently do not directly match educational standards. As a result, some games are entertaining but not educational falling short of curriculum objectives or failing to significantly improve learning outcomes (Sadera, Li, Song, & Liu, 2014; Fiorella, Kuhlmann, & Vogel-Walcutt, 2018; Ibrahim et al., 2019; Walkington, 2020; Manesis, 2020). Furthermore, pedagogical objectives and game mechanics are often not seamlessly integrated when physical and digital elements are integrated; this leads to a fragmented educational experience (Videnovik et al., 2020). The lack of established frameworks that guide the creation of physical games complicates their implementation and design, making it difficult for creators to produce engaging and educationally valid experiences. This dual requirement calls for a sophisticated understanding of theories of education and game design, a synthesis that is currently lacking in practice (Gibson & Bell, 2013; Ramos et al., 2022; Hayak & Avidov-Ungar, 2023). To overcome these obstacles, dedicated efforts must be made to create

frameworks and guidelines to ensure that game design is in line with educational objectives and that digital and physical game components are seamlessly integrated to create a holistic learning environment. This article seeks to clarify the creation process of "Solar Adventure," a digital game based on the board game "Solar Race," intended for students in primary school (ages 9 to 11). The game is set up so that students can play the board game in class and its digital version online, in accordance with school curricula, providing a dual gaming experience that supports learning goals.

## 2. METHODOLOGY

**Phase 1: Needs Analysis**

"Solar Adventure" evolved from the board game "Solar Race," tailored to align with the Year 4 syllabus in Malaysia on the solar system. Originally designed for classroom interaction, the transition to a phygital format was catalyzed by the need for remote learning options during the pandemic, supporting both in-class and at-home learning seamlessly (Sadera, Li, Song, & Liu, 2014).

**Phase 2: Conceptual Design**

Shifting from a race-based board game to a narrative-driven digital adventure, "Solar Adventure" introduces players to an astronaut and his cat exploring the solar system to discover why Pluto was reclassified. This story enriches the educational journey, embedding learning within engaging, context-driven challenges (Walkington, 2020).

**Phase 3: Content Development**

The game content, infused with detailed information about the solar system, adheres to the Year 4 curriculum and is enhanced with additional knowledge to spark student curiosity. Interactive elements like mazes and quizzes ensure the content delivery is both engaging and educational (Manesis, 2020).

**Phase 4: Technical Development**

Developed using Scratch, a child-friendly coding platform, "Solar Adventure" not only supports learning objectives from the curriculum but also integrates coding skills, which are part of a separate syllabus. The content was repeatedly aligned with textbook standards to ensure educational effectiveness (Gibson & Bell, 2013).

**Phase 5: Testing and Evaluation**

Initial testing by five students and subsequent teacher evaluations provided critical feedback, which was further validated through success in the Gami-code Competition at district and state levels, informing subsequent refinements to enhance gameplay and educational alignment (Fiorella, Kuhlmann, & Vogel-Walcutt, 2018).

**Phase 6: Implementation**

Post-competition, "Solar Adventure" was rolled out to classrooms, where teachers facilitated the integration of both the board and digital games, providing a blended learning environment that leveraged the strengths of both physical and digital educational tools (Ramos et al., 2022).

**Phase 7: Feedback and Iteration**

Ongoing feedback from teachers' post-implementation is instrumental for continuous improvement. The game's design and educational content will be iteratively refined based on this feedback to better meet educational goals and enhance student engagement (Hayak & Avidov-Ungar, 2023).

## 3. CONCLUSION

The development of "Solar Adventure" exemplifies the potential and challenges of integrating phygital gaming within educational settings. Through a carefully structured methodology that spans needs analysis, conceptual design, content development, technical production, testing, implementation, and iterative feedback, this project highlights the critical importance of aligning game design with educational objectives to create enriching, educational experiences. By transitioning from the traditional board game "Solar Race" to the interactive, narrative-driven digital game "Solar Adventure," the project addresses key educational goals while catering to the evolving needs of students and educators. The game successfully merges the physical interaction of traditional board games with the dynamic and engaging elements of digital media, providing a robust model for educational technology that supports both classroom learning and remote educational environments.

This initiative has demonstrated that with the right approach – incorporating rigorous testing, stakeholder feedback, and competition-based validation – the barriers of traditional educational settings can be overcome, offering students a seamless educational experience that is both engaging and informative. The ongoing feedback from educators will continue to refine "Solar Adventure," ensuring that it remains relevant and effective in fostering not only knowledge but also critical thinking and problem-solving skills among young learners. Thus, "Solar Adventure" stands as a compelling case study of how digital innovation, when effectively aligned with educational standards and creatively implemented, can enhance learning outcomes and adapt to the diverse needs of students in a rapidly changing educational landscape.

## REFERENCES


Fiorella, L., Kuhlmann, S., & Vogel-Walcutt, J. J. (2018). Effects of playing an educational math game that incorporates learning by teaching. Journal of Educational Computing Research, 57(6), 1495-1512. https://doi.org/10.1177/0735633117727599

Gibson, D., & Bell, T. (2013). Evaluation of games for teaching computer science. Journal of Computer Science Education, 51-60. https://doi.org/10.1080/08993408.2013.832022

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. Z., 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/10.18178/ijlt.5.4.313-317

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

Ramos, D., Brito, C. R., Pimentel, F. S. C., Anastácio, B., & Silva, G. M. D. (2022). Integration of digital games into pedagogical practice. Impact of Digital Transformation in Teacher Training Models. https://doi.org/10.4018/978-1-7998-9538-1.ch004

Sadera, W., 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., & Vold, T. (2020). Increasing quality of learning experience using augmented reality educational games. Multimedia Tools and Applications, 79, 23861-23885. https://doi.org/10.1007/s11042-020-09046-7

Walkington, C. A. (2020). Intrinsic integration in learning games and virtual instruction. Educational Technology Research and Development, 69, 157-160. https://doi.org/10.1007/s11423-020-09886-y

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