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Innovative Educational Game: Designing and Developing Interactive Web-Based Memory Card Games as an Educational Media for Children

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ABSTRACT

In the dynamic landscape of children's education, innovation plays a pivotal role in shaping engaging and effective learning experiences. This research focuses on the design and development of an interactive web-based memory card game as an innovative educational tool. Grounded in the waterfall method, the development process prioritizes sequential stages to ensure robustness. Performance testing, using PageSpeed Insights, evaluates the game's speed and efficiency, aiming to enhance user experience. The results, showcased by a remarkable score of 99, affirm the careful consideration given to optimization techniques. This research not only contributes to the broader understanding of game-based learning but also provides concrete insights for developers. The memory card game stands as a testament to the seamless integration of technological innovations into children's education, promising enduring contributions to the future of learning.

Keywords: *Educational Games, PageSpeed Insights, User Experience, Waterfall Method, Web Based Memory Card Games*

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INTRODUCTION

In In the ever-evolving landscape of children's education, marked by its dynamic development, the pivotal role of innovation cannot be overstated (Alcivar dkk., 2020). As we strive to cultivate more engaging and effective learning experiences, innovation emerges as the cornerstone of progress (Asadi dkk., 2021). An exemplary manifestation of this innovation is found in the realm of educational games, seamlessly integrated as captivating and interactive learning tools (Bassey dkk., 2020). Specifically, within this

expansive domain, the spotlight falls on interactive web-based memory card games, presenting themselves as a prospective solution poised to elevate and enrich the educational journey of children (Conversano, 2014).

The efficacy of game-based approaches in augmenting children's cognitive abilities has been substantiated by prior studies, including the noteworthy research conducted by Smith et al. (2019) published in the Journal of Educational Technology (Bond et al., 2. Similarly, the exploration by Johnson and Brown (2021) in the Journal of Child Psychology underscores the role of digital games in sustaining children's interest in learning (Ejike dkk., 2017). However, these studies, while contributing significantly to the broader understanding of game-based learning, do not delve into the nuanced aspects of memory card games (Forstner dkk., 2013).

In this context, the primary objective of the present research is to conceptualize, design, and develop an innovative educational game—specifically, an interactive web-based memory card game (Hodhod dkk., 2011). Positioned as an educational tool, this game seeks to not only stimulate but also sustain learning interest in children (Rustina dkk., 2018). The meticulous detailing of the design and development process of this interactive web-based memory card game aims to bridge existing knowledge gaps, providing a tangible and valuable addition to the education literature (Shirsekar, 2019).

Furthermore, the research endeavors to go beyond the conceptualization and development phase, extending its focus to the assessment of the memory card game's performance speed (Siqueira dkk., 2020). Recognizing the potential impact of performance speed on user experience and the overall performance of web-based games, this aspect becomes a crucial dimension of evaluation (Smeureanu & Isăilă, 2017).

By delving into the untapped potential and far-reaching impact of interactive web-based memory card games, this research aspires to make a significant and enduring contribution to the trajectory of children's education (Solorzano Alcivar dkk., 2021). It is envisioned as a catalyst, laying a robust foundation for the seamless integration of technological innovations into the learning process, thereby shaping the future of education for generations to come (Van De Pol dkk., 2014).

RESEARCH METHODOLOGY

This research adopts the waterfall method as the foundation for designing and developing an innovative web-based educational game (Villanueva & Vaidya, 2021). Through the application of this method, each stage of game development will be carried out sequentially, ensuring the robustness and smoothness of the creative process. Meanwhile, performance testing of the game is conducted using PageSpeed Insights, a leading tool for evaluating the speed and efficiency of websites (Zaug dkk., 2022).

In pursuit of its main objectives, this research aims to gain an in-depth understanding of how well the website can achieve its optimal performance (Almeida & Simoes, 2019). Through an assessment of speed and efficiency, the research specifically

strives to enhance the user experience, using the test results as a roadmap for significant performance improvements (Alpala dkk., 2022).

The results of these tests are expected to be more than just numerical data but valuable insights that can provide concrete guidance for developers (Makri dkk., 2021). This research serves as a crucial milestone in the effort to refine the interactive memory card game, with the hope that the findings will lead to the optimization of features and functions that comprehensively support the vision of the research title, namely "Innovative Educational Game: Designing and Developing Interactive Web Based Memory Card Games as an Educational Media for Children."

RESULT AND DISCUSSION

Development of Educational Web

The development process of web-based educational games using the waterfall method has been successfully executed (Tomé & Coelho, 2023). Each stage, from design to implementation, is meticulously carried out, integrating Figma as the primary design tool and utilizing Visual Studio Code for advanced development stages (Alam, 2022). The design process using Figma enables developers to detail the user interface, depict game elements, and align the design with educational curriculum requirements (Cain, 2019). Considering input from teachers and educational experts ensures that the game design aligns with the goals of children's learning. Figure 1 below displays the design results on Figma.

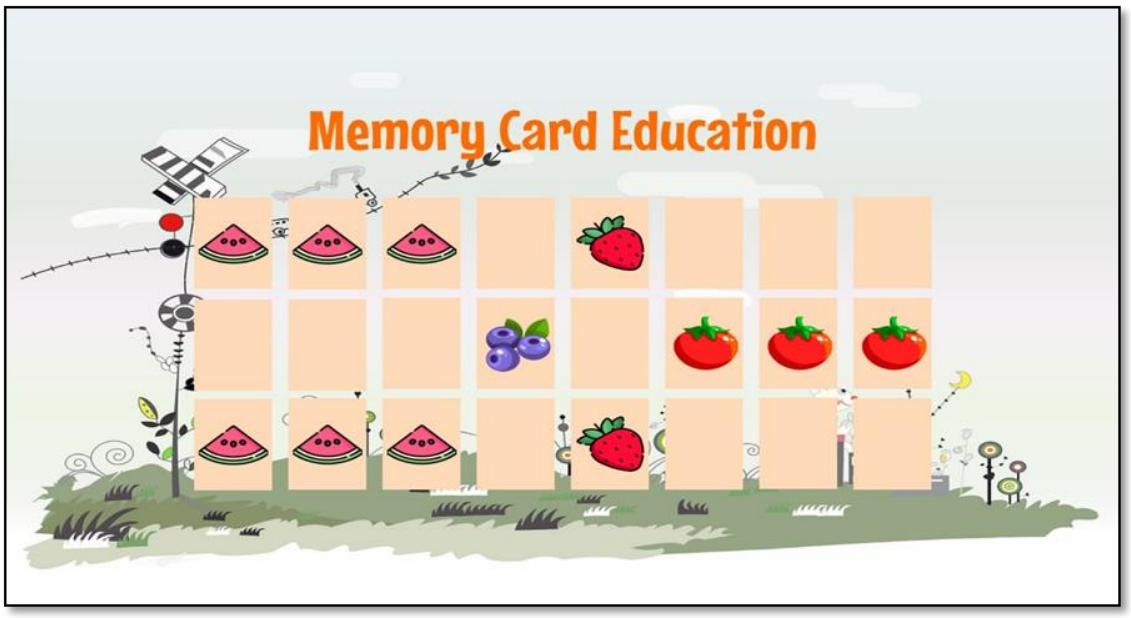

Figure 1. Designing a web-based educational memory card game on Figma

Following the design stage, game implementation is conducted using Visual Studio Code, where developers leverage collaboration features and debugging tools to ensure robustness and optimal functionality. The generated code is optimized to support responsiveness and game performance across various devices, ensuring that this educational game meets high standards in both design and functionality. Figure 2 below illustrates the development outcomes.

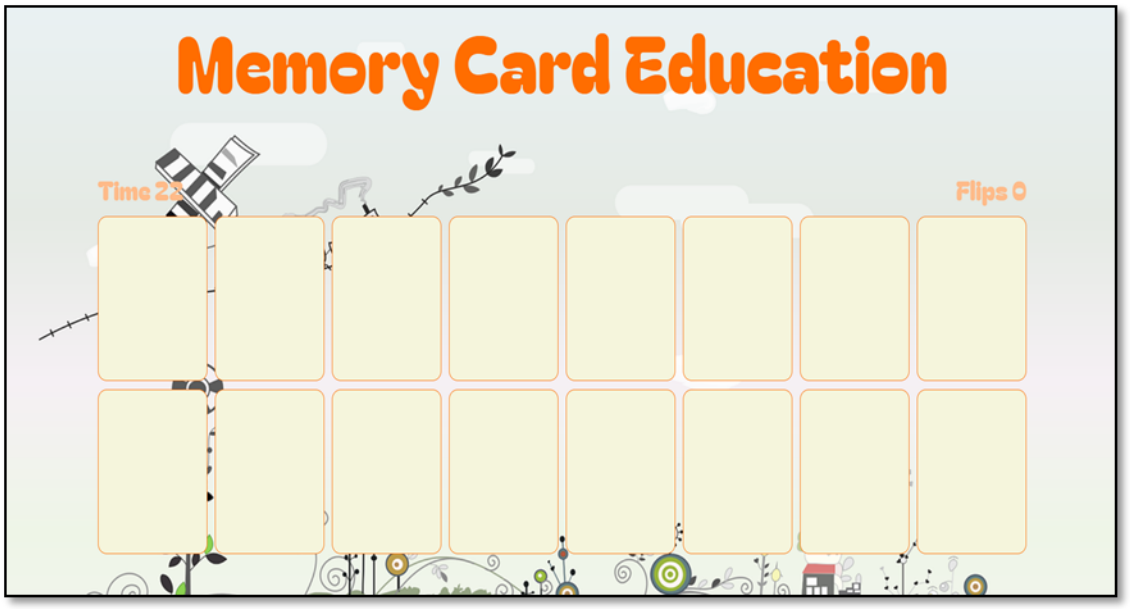

Figure 2. The interface of the web-based educational memory card game development

Measure Performance with PageSpeed Insights

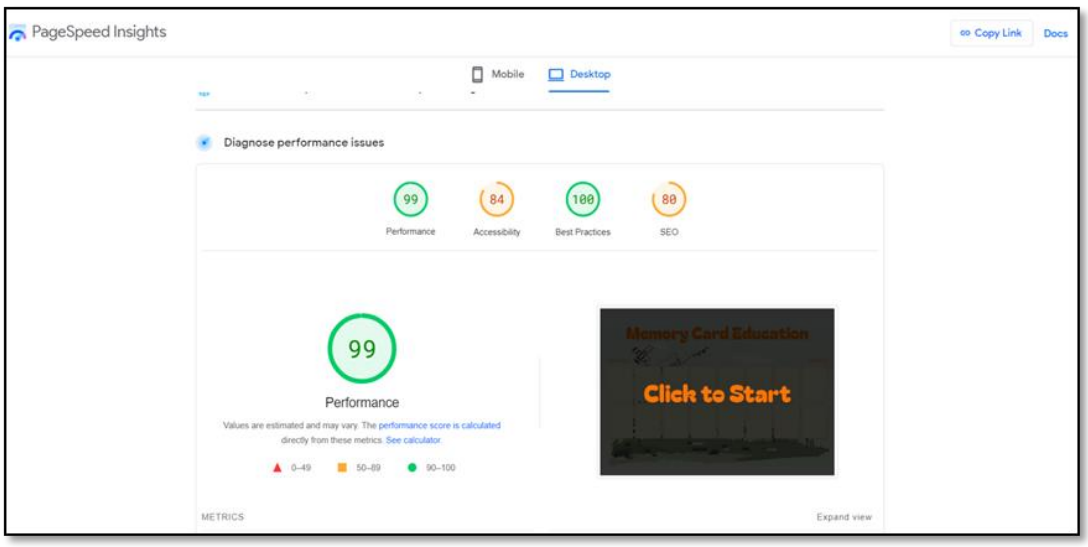

Figure 3. The score of the educational memory card game on PageSpeed Insights

Measuring the performance of the web-based memory card game as an educational tool with PageSpeed Insights provides insights into the efficiency and quality of user experience in the online learning environment. Achieving a score of 99, as seen in Figure 3 above, the game demonstrates excellent optimization in terms of speed and performance.

This high score implies that the memory card game has been designed and developed with careful consideration of factors such as image optimization, efficient caching, effective server request management, and the use of other web optimization techniques. Therefore, the game offers users a responsive gaming experience, free from delays or disruptions that could compromise the quality of the learning experience.

The PageSpeed Insights score of 99 also reflects a commitment to the quality of online educational media. A game with optimal performance can enhance user engagement, facilitate effective learning, and increase appeal for learners. Thus, this memory card game not only presents valuable educational content but also provides an optimal and satisfying user experience.

CONCLUSION

The development process, encompassing meticulous design and responsive implementation, coupled with performance enhancements based on PageSpeed Insights measurements, has resulted in an innovative and effective web-based educational game for children. These steps not only ensure the game's quality in terms of design and functionality but also provide a strong foundation for improving overall performance and user experience.

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