



Quiz Game using the Fisher-Yates Shuffle Algorithm

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ABSTRACT

Learning training at the Creative Media State Polytechnic after developing, especially in the entertainment innovation thinking program environment, is carried out using blended learning. Blended learning exercises can be very effective and productive to use if the learning handles are well organized. Furthermore, this research aims to create a test using the Fisher-Yates Shuffle algorithm in a 2-dimensional programming learning application which is used as a module for assessing student learning freedom after reviewing the learning structure. The approach taken is the ADDIE progress strategy. ADDIE's performance improvement consists of five stages, namely special inspection, planning, development, implementation and assessment. This application was tested on 30 students of the 3rd semester transfer innovation consideration program. This research was carried out from October to March 2024. From this research, the results of application testing showed that each student got different results from questions when taking quizzes, tests on applications created for supports learning in the 2D game programming course at the Creative Media State Polytechnic.

Keywords: Development Research, Game Programming, Fisher-Yates Shuffle, Learning Module.

INTRODUCTION

The integration of technology into education has transformed traditional learning environments, creating opportunities for innovative teaching methods that cater to diverse learning styles. Blended learning, which combines face-to-face instruction with digital tools, has emerged as an effective approach to enhance engagement and learning outcomes (Garrison & Vaughan, 2008). Within this framework, gamification and algorithm-driven solutions have gained prominence for their ability to provide interactive and personalized learning experiences.



One such algorithm, the Fisher-Yates Shuffle, is widely recognized for its ability to produce unbiased randomization, a critical feature in the design of educational tools and assessments. Randomization ensures fairness, reduces predictability, and promotes critical thinking by presenting learners with varied problem-solving scenarios (Durstensfeld, 1964). This study applies the Fisher-Yates Shuffle algorithm to create a quiz game module for 2D game programming students at the Creative Media State Polytechnic, Indonesia. By incorporating this algorithm, the research seeks to improve the fairness and adaptability of assessments, addressing the unique needs of individual learners.

To achieve this, the study adopts the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model as a framework for designing and developing the quiz game. The ADDIE model is a widely used instructional design method that facilitates a structured approach to educational tool development, ensuring iterative refinement and alignment with learning objectives (Branch, 2009). This research demonstrates how the integration of algorithmic solutions with instructional design methodologies can create engaging, adaptive, and effective learning experiences.

In an era where personalization and interactivity are key drivers of educational success, this study contributes to the growing body of research on technology-enhanced learning. By leveraging the Fisher-Yates Shuffle algorithm, it showcases the potential of gamified learning tools to foster critical thinking, enhance engagement, and improve knowledge retention among students in technology-focused disciplines.

RESEARCH METHODS

This This study employs a development research approach to design and implement a quiz game using the Fisher-Yates Shuffle algorithm, aimed at supporting learning in a 2D game programming course. The research methodology follows the ADDIE framework, a systematic instructional design process comprising five stages: Analysis, Design, Development, Implementation, and Evaluation (Branch, 2009). Each phase is carefully executed to ensure the effective integration of the algorithm into the learning environment.



Analysis

The first phase involves identifying the educational needs and challenges of 3rd-semester students in the transfer innovation program at the Creative Media State Polytechnic. The analysis includes a review of the existing curriculum and learning structures, with a focus on how a gamified approach can improve learning outcomes and engagement in 2D programming courses. Needs assessment highlights the importance of randomization in quizzes to reduce biases and enhance critical thinking skills.

Design

In the design phase, the researchers outline the technical and pedagogical specifications of the quiz game. The Fisher-Yates Shuffle algorithm is selected for its ability to generate unbiased and unpredictable question sequences, ensuring fairness and diversity. The user interface is designed to be simple and intuitive, tailored to the students' familiarity with digital tools. The instructional goals align with the broader learning objectives of the 2D game programming course.

Development

During the development phase, the quiz game module is programmed and tested using the Fisher-Yates Shuffle algorithm. The algorithm's implementation ensures that each quiz session generates a unique set of randomized questions, minimizing repetition and predictability. The module is built using programming techniques suitable for 2D environments and tested for technical reliability and user-friendliness.

Implementation

The quiz game is deployed to a group of 30 students as part of their coursework. The researchers provide a detailed introduction to the application and its functionalities, followed by hands-on usage sessions. This phase gathers real-time feedback from students to identify potential improvements in the module's design and functionality.



Evaluation

The final phase involves assessing the effectiveness of the quiz game in achieving its educational objectives. Data is collected on student performance, engagement, and feedback. The evaluation focuses on the impact of the Fisher-Yates Shuffle algorithm on learning outcomes, as well as the usability and educational value of the module. Results are analyzed to determine the success of the intervention and inform future improvements.

By employing the ADDIE model, this study integrates algorithmic innovation with educational design to create a dynamic and effective learning tool. The methodology provides a replicable framework for similar applications in technology-enhanced education.

RESULTS AND DISCUSSION

The implementation of the Fisher-Yates Shuffle algorithm in the quiz game for the 2D game programming course yielded notable outcomes, highlighting its effectiveness in promoting equitable assessments and improving learning engagement. The results are discussed in the context of the ADDIE framework to align with the study's systematic approach.

Results

Randomization and Fairness

The Fisher-Yates Shuffle algorithm successfully generated randomized question sets for each quiz session, ensuring that no two students received identical sequences of questions. This randomization minimized biases and predictability, fostering an equitable assessment environment. The application demonstrated the algorithm's robustness in handling various question banks without compromising the quality of randomization.

Student Engagement

Feedback from the 30 participating students indicated a high level of engagement with the quiz game. The randomized nature of the questions kept students attentive and challenged, contributing to an interactive and enjoyable learning experience. The gamified approach



motivated students to actively participate, enhancing their understanding of 2D game programming concepts.

Learning Outcomes

Analysis of quiz performance data showed that students were better able to retain and apply programming concepts when tested using the randomized question sets. The variability in question sequences encouraged critical thinking and problem-solving, leading to improved academic outcomes.

Usability and Functionality

The user interface of the quiz game received positive feedback for its simplicity and ease of use. Students reported minimal technical issues, and the application functioned seamlessly across multiple devices. This usability contributed to the overall effectiveness of the learning tool.

Discussion

The results underscore the potential of algorithm-based solutions like the Fisher-Yates Shuffle in enhancing educational tools. The algorithm's ability to produce unbiased randomization aligns with the principles of equitable learning, making it a valuable addition to technology-enhanced education. By integrating this algorithm into a gamified learning module, the study demonstrates how digital tools can create personalized and adaptive learning experiences.

The success of the module also highlights the importance of using structured instructional design models like ADDIE. Each phase of the framework contributed to the refinement of the application, ensuring its alignment with educational goals. The positive reception from students validates the effectiveness of combining algorithmic innovation with instructional design principles.

While the results are promising, the study identifies opportunities for improvement. For instance, expanding the question bank and integrating adaptive difficulty levels could further



enhance the quiz game's educational value. Additionally, incorporating analytics features to track student progress and provide personalized feedback could elevate the learning experience.

In conclusion, this research demonstrates the feasibility and benefits of leveraging algorithms like Fisher-Yates in education. The study provides a replicable model for developing innovative, engaging, and effective learning tools, paving the way for further advancements in educational technology.

CONCLUSION

The study successfully demonstrates the application of the Fisher-Yates Shuffle algorithm in developing a quiz game module for 2D game programming students, addressing the need for equitable and engaging assessment tools in blended learning environments. By utilizing the ADDIE framework, the research systematically developed a dynamic learning module that not only enhances student engagement but also fosters critical thinking and personalized learning experiences.

Key findings reveal that the Fisher-Yates Shuffle algorithm effectively ensures unbiased randomization, creating a fair assessment environment that reduces predictability and enhances learning outcomes. The gamified approach of the quiz game motivated students to actively participate and contributed to improved retention and application of programming concepts.

The study highlights the importance of integrating algorithmic solutions with structured instructional design methodologies to achieve educational objectives. The positive feedback from students and the measurable improvement in their performance underscore the potential of technology-driven learning tools to transform traditional educational practices.

While the results are promising, future developments should focus on expanding the question bank, integrating adaptive learning mechanisms, and incorporating analytics for tracking and enhancing individual student progress. These advancements could further elevate the effectiveness and applicability of the learning module.



In conclusion, the research provides a replicable model for leveraging algorithms like Fisher-Yates to create innovative, engaging, and impactful educational tools, contributing to the ongoing evolution of technology-enhanced learning.

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