

The Impact of Gamification on Maths Learning: A Case Study of "Maths Fun Train Builder"

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ABSTRACT: This research paper explores the influence of gamification on mathematics learning through the case study of "Maths Fun Train Builder," an educational game developed by the author. The study investigates the effects of gamification elements integrated into this digital tool on student engagement, motivation, and learning outcomes in mathematics. Results indicate that gamification can significantly enhance the learning experience and improve mathematical skills acquisition.

I. INTRODUCTION

- **Background on Gamification in Education**

Gamification is a strategy that implements game-like elements into non-gaming activities to enhance engagement and motivation. It leverages the captivating and entertaining aspects of video games to create an engaging learning environment. The primary goal of gamification in education is to encourage intrinsic motivation, making learning a fun and enjoyable experience.
- **Purpose of the Study**

The purpose of this study is to evaluate the effectiveness of gamification in mathematics education and analyze the impact of "Maths Fun Train Builder" on student learning. This game was created to help students master math skills through interactive and engaging gameplay.
- **Overview of "Maths Fun Train Builder"**

"Maths Fun Train Builder" is a free educational game designed for younger elementary school children, specifically targeting students in grades 3-5. The game involves dragging a boggy to the train and completing math problems to let the train depart from the station. It covers various levels of addition, subtraction, multiplication, and division, aiming to make math skills more fluent and increase general knowledge.

II. LITERATURE REVIEW

- **Defining Gamification**

Gamification involves incorporating game design elements such as points, levels, progress bars, challenges, and competitions into non-game contexts to enhance engagement and motivation. It is built to encourage intrinsic motivation and make learning a fun experience.
- **Theoretical Foundations of Gamification in Education**

The theoretical foundations of gamification in education include self-determination theory, which emphasizes the importance of autonomy, competence, and relatedness in motivating learners. Flow theory suggests that gamification can create an optimal learning experience by balancing challenge and skill levels. Cognitive load theory highlights the potential of gamification to reduce cognitive overload by making learning more interactive and engaging.
- **Previous Studies on Gamification in Mathematics Learning**

Previous research has shown that gamification can significantly improve student engagement, motivation, and learning outcomes in mathematics. Studies have demonstrated that students who learn via gamified education methods score higher marks than those who do not. Gamification can also make students feel more in control of their education and encourage them to persist after failing.

III. METHODOLOGY

- **Research Design**

This study employs a mixed-methods approach, combining quantitative and qualitative

data collection techniques to evaluate the impact of "Maths Fun Train Builder" on student learning.

- **Participants**

The study involved 40 students from a local elementary school, divided into two groups: a control group receiving traditional math instruction and an experimental group using "Maths Fun Train Builder" as part of their learning.

- **Data Collection Methods**

Data collection methods included pre- and post-tests to measure learning outcomes, surveys to assess engagement and motivation, interviews with students and teachers, and observation of gameplay sessions.

Implementation of "Maths Fun Train Builder"

The game was integrated into the regular mathematics curriculum over a four-month period. Teachers received training and support to effectively incorporate the game into their lessons.

Data Analysis Techniques

Quantitative data were analyzed using statistical methods to compare pre- and post-test scores, while qualitative data were analyzed thematically to identify patterns and insights from student and teacher feedback.

IV. RESULTS

- **Student Engagement Levels**

Students in the experimental group showed increased time spent on mathematics tasks and higher participation rates in class activities compared to the control group.

- **Motivation and Attitude Towards Mathematics**

The experimental group reported improved self-efficacy in mathematics and greater enjoyment of the learning process.

- **Learning Outcomes and Skill Improvement**

Post-test scores for the experimental group were significantly higher, indicating enhanced understanding of mathematical concepts. Specific areas of mathematics, such as addition and multiplication, showed the most improvement.

Qualitative Feedback from Students and Teachers

Students perceived the game as an effective and enjoyable way to learn math, while

teachers observed positive changes in classroom dynamics and learning progress.

V. DISCUSSION

Interpretation of Results

The results suggest that gamification can effectively enhance student engagement, motivation, and learning outcomes in mathematics. The game-like elements of "Maths Fun Train Builder" successfully increased student interest and participation in math activities.

Comparison with Previous Research Findings

The findings of this study are consistent with previous research on the benefits of gamification in education. Similar to other studies, this research demonstrates that gamification can improve learning outcomes and make learning more enjoyable.

Implications for Mathematics Education

The study highlights the potential for wider implementation of gamification in mathematics classrooms. Educators should consider incorporating gamified learning strategies to enhance student engagement and motivation.

VI. CONCLUSION

- **Summary of Key Findings**

The case study of "Maths Fun Train Builder" demonstrates the positive impact of gamification on student learning in mathematics. The game increased student engagement, motivation, and learning outcomes, making math learning more enjoyable and effective.

Limitations of the Study

The study has several limitations, including the small sample size and the specific context of the research. Further studies with larger and more diverse samples are needed to generalize these findings.

Recommendations for Future Research and Practice

Future research should explore the long-term effects of gamification and replicate the study in different educational domains. Educators should design games aligned with specific learning objectives and curriculum standards to maximize the benefits of gamification.

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Appendix

- Screenshots and descriptions of the levels and challenges in "Maths Fun Train Builder."

