

THE MULTIPLAYER CLASSROOM – IS MULTIPLAYER MODE PRODUCING BETTER RESULTS THAN SINGLE MODE?

Ani Atanasova

Pixelhunters FZ-LLC UAE / ECPD, ani@pixelhunters.com

Abstract: The incorporation of interactive and game-based tools into education has garnered significant attention among educators, as evidenced by the increasing popularity of video gaming across diverse age groups. Concepts like 'serious games' and 'gamification' have been subjects of discussion in gaming communities, exploring their potential to transform education and complement traditional learning approaches. The primary goal of integrating gaming into education is to enhance student motivation and engagement, improve visual skills, and foster interaction and collaboration among peers. However, it's crucial for educational technology to align closely with the curriculum to effectively impact student achievement. Teachers face the challenge of integrating games into their curriculum in a manner that aligns with learning objectives and standards, necessitating careful planning, game selection, and integration into lesson plans to ensure that gaming experiences complement and reinforce classroom instruction.

Despite the popularity of formative assessments through game-based solutions, there is a noticeable absence of a multiplayer classroom tool offering a wide range of gameplay mechanics and content integration for creative learning. Further research into the motivational aspects of the multiplayer approach, the influence of varied gameplay dynamics on learning outcomes, and a comparison of multiplayer versus single-game play versus traditional approaches are areas worth exploring.

Our study introduces a novel multiplayer game-based platform (Multiplayer Team Training Platform or MTT) addressing the challenges of uniform gameplay, offering a variety of gameplay dynamics and automated tracking of student performance in both single and multiplayer modes. A comparison between traditional assessment and game-based assessment in similar settings was undertaken with different classes, subjects, and age groups, and a comparative study was conducted to analyse the results of both experiments. Detailed investigations and observations were made in comparing the results between single and multiplayer modes.

The findings revealed a complex and context-dependent relationship between player types and success rates, varying across different games and experimental groups. Regarding student preferences, our data breakdown showed that 18% of students prefer single-mode play, 40% prefer multiplayer games, and 42% prefer both types of gameplay. This diversity highlights the need for adaptable approaches to accommodate various player preferences within the student population. The preference for games over traditional assessment and practicing indicated that students find games more engaging. Additionally, the inclination of extroverted students towards multiplayer modes suggested the positive impact of social interaction and competition on engagement and performance.

Keywords: game-based learning, multiplayer learning, quiz game-based assessment

1. INTRODUCTION

The rise of interactive and game-based tools in education has captured the interest of educators, challenging the belief that gaming is only for the younger generation. Recent surveys (TechJury, 2024) indicate that in 2023, the average age of gamers was 34 years old, with 70% being adults aged 18 and above, and a notable portion being 65 years and older. Additionally, 56% of frequent gamers participate in multiplayer games, signalling a growing interest in collaborative gaming experiences. Furthermore, 70% of parents recognize the positive impact of video games.

Immersive game-based platforms are emerging as a novel trend in contemporary online education (Deterding, S., 2011; Ibáñez, M.B., 2020; Fauvelle, G., 2021), presenting the opportunity to seamlessly incorporate curricula and function within multiplayer environments. These platforms ensure equal engagement for both students and teachers, while also augmenting test outcomes beyond the confines of gaming environments.

Numerous platforms for game-based learning, including Kahoot, Quizziz, Quizzlet, and others, have demonstrated their effectiveness and motivational impact on learning through numerous research through the years (Siegle, D. (2015); Wang et al., 2016; Wang & Lieberoth, 2016; Jones, S., 2019; Altawalbeh, K., 2023). However, these platforms face limitations when it comes to accommodating a wide range of content, such as an entire semester's worth of material. Teachers must create multiple games, each with its own set of questions, which complicates practical use and efficiency. Users must navigate between different rooms or games to access specific content, and if varying gameplay dynamics are desired, teachers must utilize different platforms, each with its own operational rules. This practical inconvenience restricts the utility of such tools for extensive learning material.

Our research presents an innovative multiplayer game-based platform designed to overcome the obstacles associated with standardized gameplay. This platform provides diverse gameplay dynamics and automated tracking of student progress in both single and multiplayer formats, seamlessly integrating all content into various gameplay styles. It accommodates different player preferences and varying question volumes without necessitating teachers to create individual games or adjust content configurations. Our investigation delves into the motivational aspects of multiplayer gaming, evaluates how different gameplay dynamics affect learning outcomes, and compares outcomes between multiplayer and single-player modes.

2. MATERIALS AND METHODS

For this study, we employed a mixed-methods approach, collecting both quantitative and qualitative data (convergent mixed methods), which we subsequently integrated. The stages of the experiment were as follows:

1. Quantitative Study:

- We conducted experiments using gameplay with a variety of custom-designed multiplayer classroom games to assess performance under different gameplay dynamics. We also investigated the differences between single and multiplayer modes of play, measuring the outcomes.

2. Qualitative Study:

- Surveys were administered both before and after the experiment.
- Group discussions and interviews.

Our data collection through the MTT games relied on an in-game reporting system capable of measuring individual game performance, group performance, tracking player history, and monitoring progress. In addition to assessing acquired knowledge, we observed user behavior during gameplay and preferences for certain types of gameplay.

The study aimed to provide insights into which games, and with what parameters, are most suitable for both in-class and out-of-class practice and assessment. We focused on the Experimental Groups and results with different gameplay dynamics/styles. Three games were subjects of the experiment, each with different goals and objectives:

1) Time's Up: An asynchronous, online multiplayer timed testing game where players are tested on their knowledge of various topics to earn points. Players can spin the wheel of fortune to win additional benefits and prizes. The goal is to respond to as many questions as possible in 5 minutes. This game features multiple questions depending on user gameplay and is suitable for short content competitions for unlimited players at a time.

2) Snakes and Ladders: An asynchronous, online multiplayer game based on the classic board game where players must answer quiz questions correctly to move their pawn ahead. The player that reaches 100 first wins, but the game continues until one player is left. This game features multiple questions depending on user gameplay and is suitable for rich content with several questions and unsynchronized gameplay for unlimited players at a time.

3) Collab to Win: A synchronous, online multiplayer game where multiple players work together to test their team's harmony by correctly answering questions and unlocking chests. A chest is only unlocked once 60% of the group has correctly answered. Clients can customize the set of questions per chest to control the length of gameplay. Collab to Win offers synchronized gameplay for unlimited players at a time and is suitable for rich content with several questions and categories.

Part of the study focuses on player performance from two different grades (4th grade with Mathematics subject and 6th grade with Bulgarian Language subject). In total, there were 35 4th-grade students (18 in Class A and 17 in Class B) and approximately 30-35 6th-grade students across Classes A and B. Participants were deliberately chosen from diverse age groups to showcase the platform's effectiveness across different demographics. Additionally, they were randomly selected irrespective of their level of computer literacy to investigate any potential correlation between computer skills and performance outcomes. We will present data results for the two classes in two different games, along with comparative studies between three games with Mathematics content for the 4th grade.

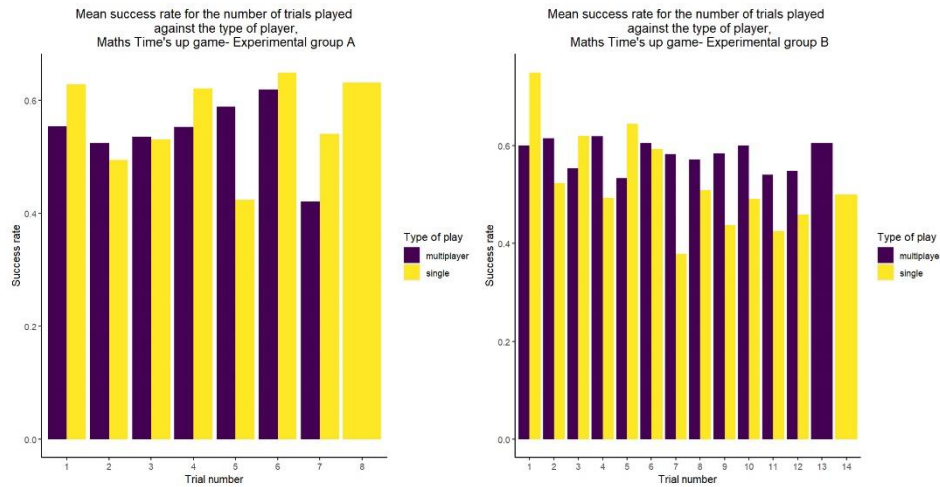
The main focus of the current publication is about the differences in results between single and multiplayer mode of play,

3. RESULTS

In this study, accessing high-speed internet proved to be a significant challenge. The games, which relied on cloud-based data, experienced connectivity issues, causing students to restart some of the games. This situation potentially led to a decrease in patience and motivation among the participants. Furthermore, teachers faced obstacles in organizing the necessary ICT infrastructure for the experiment, including securing an adequate number of mobile devices and computers, and coordinating suitable timing to gather all students without disrupting regular school activities. Despite these hurdles, both teachers and students reported a positive overall experience with the experiment. To facilitate practical implementation, both 4th and 6th-grade classes were divided into groups labeled as classes A and B.

Results for 4th grade - Time's Up Game:

Fig. 1. Results for 4th grade depending on the mode of play for Time's Up Game.

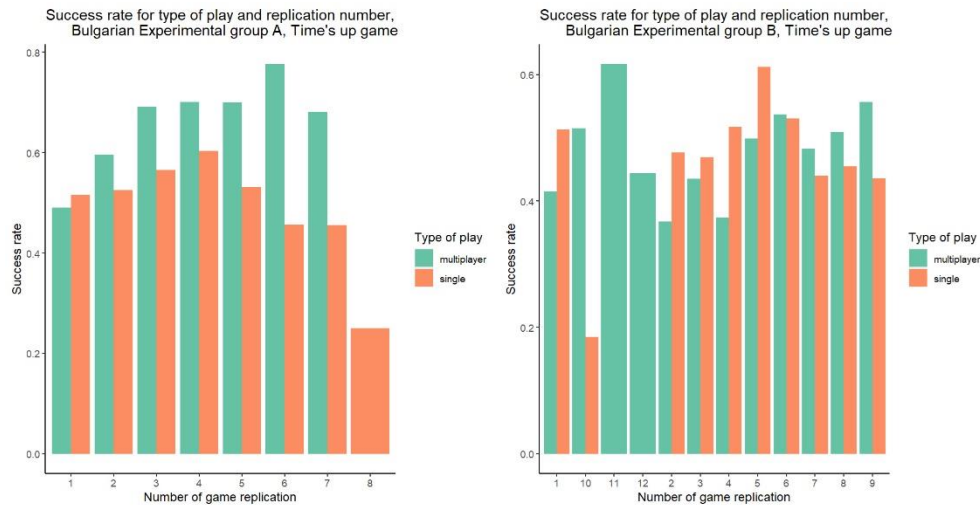


Source: Dr. Ani Atanasova, data collection is via the MTT platform.

For experimental A group on average, it can be stated that the single player and multiplayer outperform each other in different games, and it cannot be unilaterally stated that a type of play influences more success percentage in general. Experimental group B shows better performance in a multiplayer setting than experimental group A.

Results for 6th grade – Time's Up Game:

Fig. 2. Results for 6th grade depending on the mode of play for Time's Up Game.

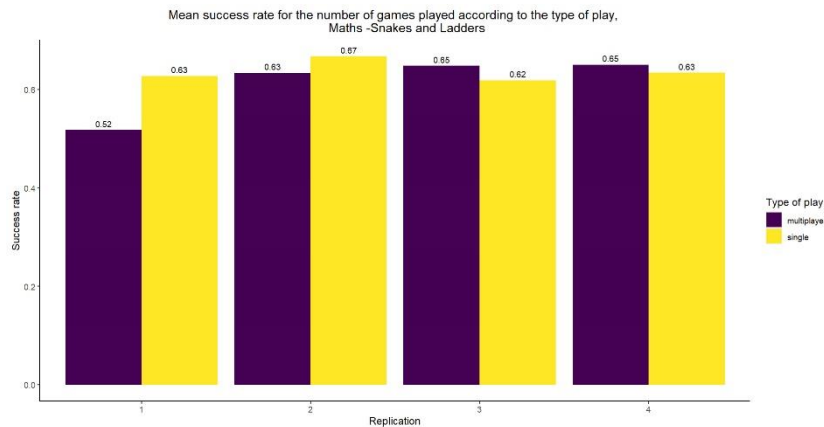


Source: Dr. Ani Atanasova, data collection is via the MTT platform.

The type of play in experimental part visibly matters for the level of success rate, as after the first game the multiplayer outperforms the single player type in all games.

Results for 4th grade – Snakes and Ladders Game:

Fig. 3. Results for 4th grade depending on the mode of play for Snakes and Ladders Game.

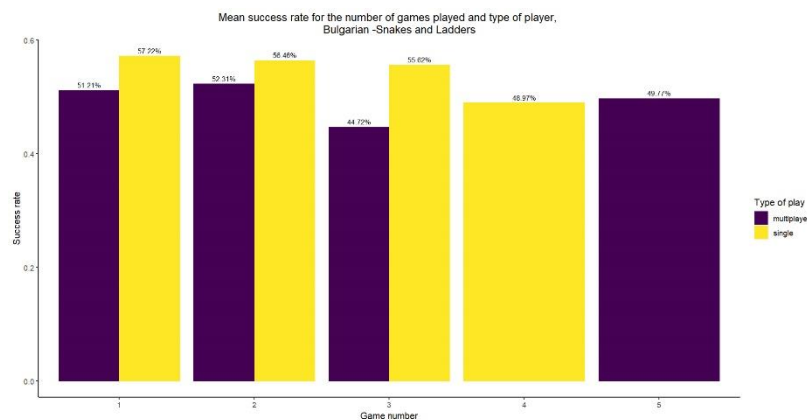


Source: Dr. Ani Atanasova, data collection is via the MTT platform.

According to the results the mean success rate is highest for the second game, single player- 0.67, followed by the third and fourth game multiplayer 0.65. It can be stated that the single type of play leads the multiplayer in the first two games and the third and fourth game gives the leading place to the multiplayer with 0.65 mean success rate in both consecutive games. Additionally, the multiplayer type has some slight progression of the success rate in the successive games pointing to attaining more enjoyment with each following game.

Results for 6th grade – Snakes and Ladders Game:

Fig. 4. Results for 6th grade depending on the mode of play for Snakes and Ladders Game.



Source: Dr. Ani Atanasova, data collection is via the MTT platform.

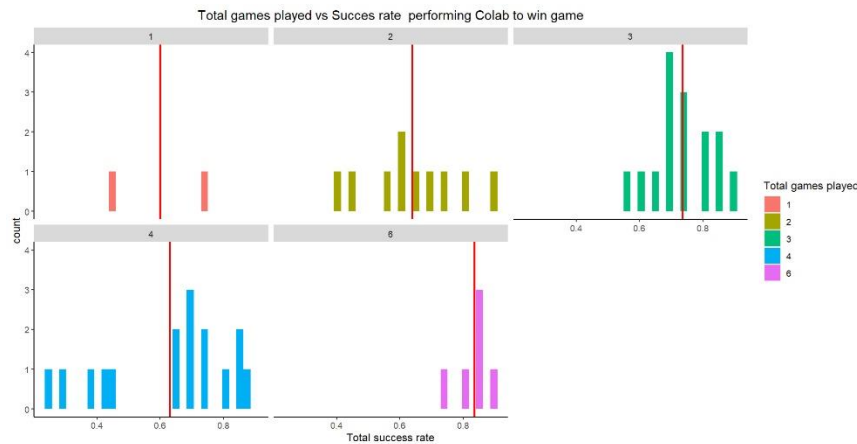
The type of play shows a pattern, as in all games where the two types of plays took part, the single type outperforms the multiplayer. Moreover, multiplayer does not show a trend in successive games and single type of players have slightly been decreasing their success rate with the number of games.

Results for 4th grade – Collab to Win Game

Collab To Win Game is a collaborative game and can only be played in a multiplayer regime. That's why we will visualize the success rate per game played.

The experimental results for the game “Collab to win” show an increase in the mean success rate of the students who played more games.

Fig.5. Total games played vs Success Rate for Collab to Win games for 4th grade.

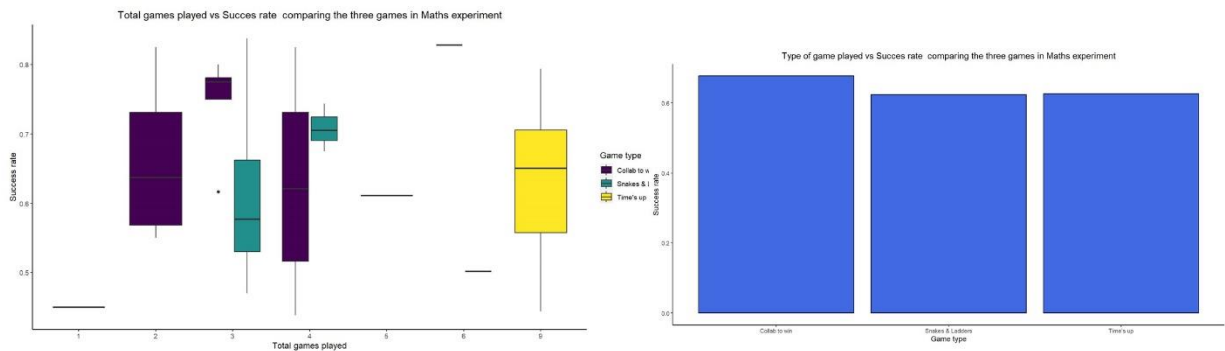


Source: Dr. Ani Atanasova, data collection is via the MTT platform.

Comparative study between 3 games and same students from 4th grade:

Judging by the measured results, the first solid statement which was made is that students playing Time's up played more games than the others. Moreover, the descriptives demonstrated that nine of the students performed best in Collab to win game, six in Snakes and Ladders and only two in Time's up. Consequently, it can be concluded that on average students playing Collab to win have the highest success rate comparing to Snakes and Ladders and Time's up. Because of this - two-way analysis of variance (ANOVA) has been deployed to test the dependence between student's performance in the three different games in Maths and the number of replications on each game type.

Fig.6. Total games played vs Success rate per type of game for 4th grade with Math content. Type of games played vs Success rate.



Source: Dr. Ani Atanasova, data collection is via the MTT platform.

It can be concluded that the students having played Snakes and Ladders have 5.9% lower success rate than Collab to win game, also Time's up on average has 4.6% lower than Collab to win and 1.34% higher success rate than Snakes and Ladders. These findings give rise to the conclusion that the best performing game of students from IVth grade in Maths experiment is Collab to win, followed by Time's up and Snakes and Ladders.

4. DISCUSSIONS

In summary, our study suggests that integrating a game-based multiplayer training platform focused on assessments could enhance the learning experience, making it more engaging and conducive to educational progress. We measured a positive response to the game-based learning approach, with students being very enthusiastic about replaying and achieving higher scores.

Regarding player types in gaming, the analysis found no statistically significant evidence supporting the idea that different player modes significantly impacted success rates. Instead, it revealed a complex and context-dependent relationship between player types and success rates, varying across games and experimental groups. This highlighted the need for a nuanced understanding of how player preferences interacted with success rates.

Approximately 50 students from various grades and age groups participated in group discussions, highlighting the value of games for homework practice and in-class engagement according to teachers.

Student preferences showed a diverse range, with 18% favoring single-mode play, 40% preferring multiplayer games, and 42% enjoying both. This diversity underscored the necessity for adaptable approaches to accommodate various player preferences.

The preference for games over traditional learning aligned with the perception of games as more engaging. Moreover, extroverted students' inclination towards multiplayer modes supported the positive impact of social interaction and competition on engagement and performance.

The high percentage of students reporting increased knowledge and improved engagement reinforced the view that gamification was effective for enhancing learning outcomes and overall engagement. These findings highlighted the potential of gamified approaches to cater to diverse student preferences and positively contribute to education.

5. CONCLUSIONS

A platform accommodating various gameplay styles and modes was essential to maximize the benefits of game-based learning. The presented game-based platform offered advantages by supporting diverse gameplay styles, durations, interactions, and single and multiplayer modes within the same content context, particularly for practicing and assessing knowledge across extensive classroom materials.

ACKNOWLEDGEMENTS

I extend my sincere gratitude to the European Centre for Peace and Development for accepting me as a PhD student and to my supervisors Prof. Sinisa Zaric and Prof. Jonathan Bradley for their unwavering support and guidance throughout the writing process. I also want to express my heartfelt appreciation to my husband, Iliya Atanasov, Gergana Krivosheva, and my team at Pixelhunters for their assistance with technical implementation and data availability, as well as to my daughter, Mariya Atanasova, for her valuable feedback and participation in testing the games. Special thanks to all the students and teachers at "St. St. Cyril and Methodius" School in Smolyan for their participation in the study, particularly to Yuksela Brahmasheva for leading the entire organization with the students.

REFERENCES

- Altawalbeh, K., & Irwanto, I. (2023). Game-Based Learning: The Impact of Kahoot on a Higher Education Online Classroom.
- Jones, S. M., Katyal, P., Xie, X., Nicolas, M. P., Leung, E. M., Noland, D. M., & Montclare, J. K. (2019). A 'KAHOOT!' Approach: The Effectiveness of Game-Based Learning for an Advanced Placement Biology Class. *Simulation & Gaming*, 50 (6), 832-847. <https://doi.org/10.1177/1046878119882048>
- Fauvelle, G., & Lesage, A. (2021). Immersive Learning Environments: The Future of Online Education. *International Journal of Educational Technology in Higher Education*, 18(1), 1-18. <https://doi.org/10.1186/s41239-021-00271-5>
- Ibáñez, M. B., Del Moral, M. E., & Villar, A. (2020). Immersive Learning Environments in Online Higher Education: A Systematic Review. *International Journal of Educational Technology in Higher Education*, 17(1), 1-24. <https://doi.org/10.1186/s41239-020-00193-9>
- Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From Game Design Elements to Gamefulness: Defining "Gamification". In *Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments* (pp. 9-15). ACM. <https://doi.org/10.1145/2181037.2181040>
- Siegle, D. (2015). Technology: Learning can be fun and games. **Gifted Child Today*, 38*(3), 192-197.
- Smith, J. W., & Francom, G. M. (2020). A Study of the Impact of Immersive Game-Based Virtual Reality Learning on Student Learning Outcomes and Engagement. *Journal of Educational Technology Systems*, 48(3), 393-410. <https://doi.org/10.1177/0047239519870553>
- TechJury. (n.d.). Video Game Demographics-Who Plays Games in 2024? Retrieved from <https://techjury.net/blog/video-game-demographics/>
- Wang et al. (2016). The effect of digitizing and gamifying quizzing in classrooms.
- Wang & Lieberoth. (2016). The effect of points and audio on concentration, engagement, enjoyment, learning, motivation, and classroom dynamics using Kahoot! *10th European Conference on Game Based Learning (ECGBL 2016)*.