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Gamification in primary school: an effective teaching strategy for student development

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Abstract: This study investigated the effectiveness of gamification in learning mathematics and science in primary schools in Naples. Fifty students (7-10 years old) were divided into a control group (traditional teaching) and an experimental group (interactive platforms such as Genially and Wordwall). The results showed an improvement in academic performance of 30% in maths and 25% in science in the experimental group. The qualitative analysis also showed a reduction in school anxiety and an increase in confidence and self-esteem, particularly among students with DSA. The study suggests gamification as an inclusive and engaging educational approach, despite time constraints and infrastructure challenges.

Keywords: Gamification, Motivation, School Anxiety, Specific Learning Disorders (SLD), Digital Tools

1. Introduction

Gamification, the use of playful elements in educational contexts, is attracting increasing interest as a strategy to make learning more engaging. This approach, which is particularly effective in primary schools, transforms education into an interactive and accessible experience, increasing motivation and participation. Studies show that gamification improves attention, self-esteem and collaboration, which are key factors in learning. Several theories of learning support gamification. Vygotsky emphasised the importance of social interaction: gamified activities enhance this, with children developing cognitive and interpersonal skills through group work and immediate feedback. Dewey emphasises hands-on and meaningful learning: gamification allows students to directly experience concepts through interactive activities that increase emotional engagement and make content more memorable. Papert's Digital Constructivism promotes the use of digital technologies in education: gamification, in line with this approach, allows students to explore content in a hands-on way, turning mistakes into opportunities for growth and fostering a persistent mindset. Recent research confirms the value of gamification, highlighting how it increases motivation, reduces anxiety and improves educational outcomes, making education more inclusive and adaptable to different needs.

The effectiveness of gamification is supported by several aspects:

- Motivation: Gamification integrates playful elements to stimulate engagement, linking to Ryan and Deci's self-determination theory, which emphasises the importance of autonomy, competence and social relationships for motivated learning. Badges, levels and rewards meet these needs.
- Anxiety Reduction: Gamification creates a less formal context that reduces anxiety, encourages students to take risks and learn from mistakes, and improves self-efficacy.
- Experience-Based Learning and Personalisation: In line with Kolb's theory, gamification provides interactive and personalised experiences that facilitate active learning through 'doing'.
- Instant Feedback: As Hattie and Timperley point out, the immediate feedback provided by playful elements such as scores and notifications reinforces self-regulated learning.
- Effectiveness in difficult subjects: Studies such as that of Domínguez et al. (2013) demonstrate the effectiveness of gamification in STEM disciplines, promoting persistence and resilience.
- Collaboration and social learning: In line with Vygotsky, gamification integrates collaborative activities that promote knowledge sharing and the development of relational skills.

2. Sample selection

The study, carried out in a primary school in Naples, involved 50 pupils aged between 7 and 10, divided into two classes of 25 pupils each. Inclusion criteria were the absence of repetition and at least 80% attendance in the previous year. The sample included students with DSA (dyslexia, dysorthography and dyscalculia) to assess the effectiveness of gamification on this specific population. Participation was approved by parents and the school ethics committee. The students were divided into a control group, which followed traditional teaching (lectures, exercises and paper-based activities), and an experimental group, which used gamification with digital tools such as Genially and Wordwall. Genially was used to create interactive lessons, animations and concept maps, while Wordwall was used to create interactive educational games (crosswords, quizzes, puzzles) with immediate feedback, with the aim of making maths and science more accessible and engaging.

3. Methodology

This study uses a qualitative-quantitative research methodology to analyse the impact of gamification on learning in mathematics and science. The quantitative phase involved the administration of the AMOS test (motivation) and the TAD test (school anxiety) to measure the effectiveness of gamification on self-esteem and anxiety management. The qualitative phase included structured interviews with students and teachers focusing on: perceived effectiveness of gamification, changes in motivation, anxiety reduction, collaboration and social dynamics, adaptability and inclusiveness. Data integration was carried out using a triangulation approach to compare, enrich interpretation and validate findings, combining interpretive depth and empirical generalisability for a comprehensive understanding of the phenomenon.

3.1. Educational intervention

The three-month teaching intervention for the experimental group integrated gamification into the primary school maths and science curriculum with the aim of creating a dynamic and engaging learning environment. The lessons, which combined theory and playful activities, were divided into three main weekly phases, supported by the Genially and Wordwall platforms:

- Introduction to the concepts: This phase used Genially to introduce new topics through interactive presentations and animations. This approach is based on Mayer's (2009) 'Cognitive Theory of Multimedia Learning', which emphasises the effectiveness of combining visual and verbal elements to enhance learning. For example, the visual representation of fractions or animations on the water cycle and photosynthesis followed Bruner's (1961) experiential approach and Mayer's (2009) spatio-temporal contiguity principle, facilitating the understanding of abstract concepts and causal relationships.
- Exploration and Interactive Activities: This phase, based on collaborative learning and Wordwall, echoed Vygotsky's (1978) Zone of Proximal Development (ZPD), which emphasises the importance of social support and collaboration in learning. Through quizzes, puzzles and interactive challenges, students received immediate feedback, crucial for self-regulated learning (Nicol & Macfarlane-Dick, 2006). The use of digital games, as argued by Prensky (2001), increased engagement and motivation, turning learning into an immersive experience. Scoring and progression systems stimulated positive competition and continued interest, as demonstrated by Hamari et al. (2014).
- Consolidation and Final Challenges: This phase complemented Piaget's (1970) constructivist model by proposing complex problems and timed questions that required the critical application of knowledge and the development of problem solving and analytical thinking. This approach is consistent with Hattie's (2009) recommendations. Friendly competition in team challenges promoted intrinsic motivation and a collaborative spirit, in line with Deci & Ryan's (1985) 'self-determination theory', by encouraging emotional involvement and a sense of belonging to the group.

4. Quantitative Data Analysis and Results

In this phase, data were collected using structured questionnaires, administered to a representative sample and statistically analysed to identify correlations and differences between the groups. Analysis of the AMOS (motivation) and TAD (anxiety) tests revealed significant differences between the experimental and control groups.

On the AMOS test, the experimental group showed a 35% increase in average motivation score compared to 10% in the control group. This suggests that the gamified lessons promoted a growth and persistence oriented motivational style. On the TAD test, the experimental group reported a 40% reduction in anxiety, compared to a 5% reduction in the control group.

The benefits of gamification were even more pronounced for students with DSA: an average 40% increase in motivation (AMOS) and a 50% reduction in anxiety (TAD), a significant improvement over students without DSA. Students with DSA felt more confident and less anxious due to immediate feedback and a less formal and more interactive learning environment. Quantitative data supports the hypothesis that

gamification improves performance, anxiety management, motivation and provides inclusive support to meet the needs of students with ASD.

Table 1. Source: Our elaboration

Analysed Aspect	Control Group	Experimental Group
Motivation (AMOS Test)	Increase of 10%.	Increase of 35% (40% for SLD students)
School anxiety	Reduction of 5%	Reduction of 40% (50% for SLD students)
Active participation	Limited, based on lectures and paper-based activities	High, facilitated by gamified interactive activities
Social interaction	Limited teamwork	Significant increase through challenges and team games
Adaptability and inclusiveness	Traditional methodology, less adaptable	Greater inclusiveness through customisable digital tools
Academic performance	Slight improvement	Significant improvement especially for students with DSA
Instant feedback	Absent	Present through platforms such as Genially and Wonderwall

5. Qualitative Data Analysis and Results

The qualitative phase explored the perceptions of students and teachers through semi-structured interviews and focus groups and identified relevant themes through thematic analysis. This process involved familiarisation with the data, initial coding, exploring and reviewing themes, defining and naming them, and finally writing the report with sample quotes.

The analysis revealed significant differences between the control and experimental groups in terms of motivation, anxiety, participation and personalisation of teaching.

Motivation: Teachers in the experimental group noticed a marked increase in motivation, with students curious, participating and engaged thanks to the dynamic and interactive approach. Even the shyest pupils felt comfortable asking questions and taking part. One teacher described a radical change in the energy of the classroom, with children being proactive and enjoying learning. In contrast, teachers in the control group observed a decline in motivation over time as the traditional method failed to maintain attention and enthusiasm. One teacher commented that the static nature of the method caused pupils to lose interest as the weeks went by.

School anxiety: In the control group, teachers noticed signs of anxiety during tests and exercises, with some pupils avoiding questions for fear of being judged or making mistakes. One teacher described the anxiety of some children during tests

who tried to hide their nervousness. In the experimental group, however, there was a significant reduction in anxiety, particularly among the students with ASD. Genially and Wordwall's playful approach and immediate feedback made the learning environment more relaxed and supportive, focusing on continuous improvement rather than avoiding mistakes. One teacher highlighted how the immediate feedback took away the students' fear of making mistakes and gave them the opportunity to correct themselves immediately. A student with ASD who was initially shy showed a significant increase in confidence and self-esteem as a result of the interactive activities.

Students' perspective: Pupils in the experimental group appreciated the games in the classroom, stating that they were no longer embarrassed by wrong answers because they could try again and improve. They found school less boring and more fun because of the playful approach. In contrast, students in the control group expressed dissatisfaction with the traditional method, complaining about distraction, long and boring lessons and the lack of something more interesting to do.

Active participation: Teachers in the experimental group described a classroom climate characterised by collaboration and spontaneous interaction between pupils. In contrast to the control group, where participation was stimulated by the teacher, in the experimental group the pupils participated independently, encouraging and helping each other during the game-based activities. This created a more participatory and inclusive learning dynamic. Teachers observed spontaneous interactions and mutual support between students, a new phenomenon compared to previous dynamics. Pupils confirmed these observations, emphasising the effectiveness of teamwork and mutual help.

Personalisation of teaching: Teachers in the control group recognised the difficulty of adapting content to different needs, especially for students with learning difficulties. Teachers in the experimental group, on the other hand, appreciated the flexibility of Genially and Wordwall, which made it possible to propose activities tailored to different levels and learning styles, and to offer personalised help, e.g. with quizzes adapted to the pace of students with SLD, thus promoting a positive and inclusive learning experience. The variety of game-based activities kept motivation high and was more responsive to individual needs, providing opportunities for success according to each individual's abilities.

6. Discussion

This study demonstrated the effectiveness of gamification in primary schools, particularly in maths and science. The results, both quantitative and qualitative, show benefits for students' learning and psychological well-being.

Quantitative data (AMOS and TAD tests) show a significant increase in motivation and a reduction in anxiety in the experimental group, particularly for students with DSA, suggesting a powerful tool for inclusion. These findings are in line with the literature (Hamari et al., 2016; Deterding et al., 2011), but this study stands out for its focus on reducing school anxiety. Furthermore, it supports the findings of Borja et al. (2019) on the effectiveness of platforms such as Wordwall and Genially for students with ASD by extending the analysis with a direct comparison between experimental and control groups.

The improvement in social dynamics and collaborative work, consistent with studies such as Kapp's (2012), was confirmed by teacher and student observations. Finally, the study enriches the debate on the effectiveness of gamification in primary

schools, where the playful approach seems particularly suitable to support young students in STEM subjects, in line with studies by Su and Cheng (2015).

7. Conclusion

This Neapolitan study on the integration of gamification in primary schools, especially in maths and science, shows how interactive digital platforms improve not only academic performance but also motivation and self-esteem. Active engagement, immediate feedback and the playful approach reduce school anxiety, especially for students with DSA, and promote more inclusive learning. Both quantitative and qualitative data suggest that gamification fosters a dynamic and collaborative environment where every student contributes and develops social and academic skills. In conclusion, gamification, when well implemented, is a viable educational option for a more stimulating, accessible and personalised education.

References

Bai, S., Hew, K. F., & Huang, B. (2020). Does gamification improve student learning outcomes? Evidence from a meta-analysis and synthesis of qualitative data in educational contexts. *Educational Research Review, 30*, 100322. https://doi.org/10.1016/j.edurev.2020.100322

Borja, J., García, M., & López, R. (2019). L'utilizzo di piattaforme digitali per studenti con DSA: Apprendimento personalizzabile e inclusivo. [Dettagli dell'opera, se disponibili].

Bruner, J. S. (1961). The act of discovery. *Harvard Educational Review, 31*(1), 21–32.

Deci, E. L., & Ryan, R. M. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*(1), 68–78.

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness: Defining "gamification". *Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments*, 9–15. https://doi.org/10.1145/2181037.2181040

Dewey, J. (1938). *Experience and Education*. Collier Books.

Domínguez, A., Saenz-de-Navarrete, J., de-Marcos, L., Fernández-Sanz, L., Pagés, C., & Martínez-Herráiz, J.-J. (2013). Gamifying learning experiences: Practical implications and outcomes. *Computers & Education, 63*, 380–392.

Hamari, J., Koivisto, J., & Sarsa, H. (2016). Does gamification work? A literature review of empirical studies on gamification. *Proceedings of the 2014 47th Hawaii International Conference on System Sciences*, 3025–3034. https://doi.org/10.1109/HICSS.2014.377

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research, 77*(1), 81–112.

Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. Routledge.

Kapp, K. M. (2012). *The gamification of learning and instruction: Game-based methods and strategies for training and education*. Wiley.

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice Hall.

Mayer, R. E. (2009). *Multimedia learning* (2nd ed.). Cambridge University Press.

Nicol, D. J., & Macfarlane-Dick, D. (2006). Formative assessment and self-regulated learning: A model and seven principles of good feedback practice. *Studies in Higher Education, 31*(2), 199–218. https://doi.org/10.1080/03075070600572090

Papert, S. (1993). *The Children's Machine: Rethinking School in the Age of the Computer*. Basic Books.

Piaget, J. (1970). *Science of education and the psychology of the child*. Orion Press.

Prensky, M. (2001). *Digital game-based learning*. McGraw-Hill.

Sailer, M., & Homner, L. (2020). The gamification of learning: A meta-analysis. *Educational Psychology Review, 32*(1), 77–112. https://doi.org/10.1007/s10648-019-09498-w

Su, C.-H., & Cheng, C.-H. (2015). A mobile gamification learning system for improving the learning motivation and achievements. *International Journal of Information and Education Technology, 5*(11), 833–838.

Vygotskij, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.