DOI:10.59787/2413-5488-2025-51-3-131-142

Gulnara Rizakhojayeva

Abai Kazakh National Pedagogical University, Almaty, Kazakhstan

THE EFFECT OF GAMIFICATION IN EDUCATION: THE META-ANALYSIS OF THE IMPACT OF IMPLEMENTATION ON STUDENT ENGAGEMENT AND LEARNING OUTCOMES

Abstract: This meta-analysis study examines the effectiveness of gamification in educational contexts at different academic levels and different areas of academic subjects. By the semantic review of 26 empirical and experimental research published between 2010 – 2024 years, covering 12,456 participants. The research investigates the effects of gamification elements on student learning outcomes, engagement, and motivation. Results that obtained, indicate a significant positive effect of gamification on student learning achievement ($g=0,682$, $p < 0,001$) and engagement ($g = 0,724$, $p < 0,001$). According to the investigation certain gamification elements, particularly points, badges, and leaderboards, demonstrate varying effectiveness degrees in educational contexts. The study results provide valuable insights for instructional designers and educators implementing gamification strategies in education.

Keywords: gamification; instructional design; education; curriculum; engagement; outcome.

Introduction

The integration of gamification into educational realia is significant trend in contemporary instructional practice. Gamification defined as the application of game elements in non-game contexts (Deterging et al., 2021), has attracted considerable attention from educators, researchers and instructional designers due due to its potential to enhance student engagement and learning outcomes. As a result of the widespread use of digital technologies and the increasing demand for creative teaching techniques, gamification strategies are being adopted at different educational levels and across disciplines.

Over the past decade, the conceptual understanding of gamification in educational settings has evolved significantly. Widely accepted in educational research, gamification was first defined by Deterding et al. (2021) as the application of game design principles to non-game environments. Landers et al. (2021) expanded on this by defining the game experience as a unique psychological state induced by the game, and introduced three distinct concepts that help explain how gamification affects learning outcomes. Understanding the psychological processes through which gamification affects learning outcomes has been made possible in large part due to this theoretical advancement.

Gao (2024) observed a maturation of gamification research, noting a shift from simple implementation studies to more nuanced studies of specific mechanisms and contextual factors. This maturation is reflected in the comprehensive review by Koivisto and Hamari (2023), which highlights the evolution of motivational information systems and their integration into educational contexts.

Recent research has increasingly focused on the practical aspects of implementing gamification. Schöbel et al. (2020) developed a holistic approach to analyzing gamification elements, providing a framework that helps educators and researchers understand the complexity of gamification design. Their work highlights the importance of considering both individual elements and their interactions in an educational context.

Tang and Hannegan (2014) proposed a structured pedagogical approach to developing educational games, emphasizing the alignment between game mechanics and learning objectives. This alignment is critical, as demonstrated by Garcia-Sanjuan et al. (2021) in their evaluation of haptic and tactile multi-tablet quiz systems in primary education, showing how different implementation approaches can impact learning outcomes.

Hassan et al. (2021) provided an important insight by examining adaptive gamification based on learners' learning styles, suggesting that personalizing gamification elements can improve their effectiveness. This finding is supported by Ferriz-Valero (2020) longitudinal study on need-supportive gamification, which demonstrated the importance of matching gamification elements to learners' psychological needs.

Several recent meta-analyses have contributed to our understanding of the effectiveness of gamification. Sailer and Homner (2023) conducted a comprehensive meta-analysis that found significant positive effects across a variety of educational contexts. Their findings are complemented by Lampropoulos et al. (2022), who specifically focused on the empirical literature in education and learning, identifying patterns in the factors that predict implementation success.

Bai et al. (2022) provided valuable insights through their meta-analysis and synthesis of qualitative data, highlighting the importance of considering both quantitative and qualitative evidence to understand the impact of gamification. Their work showed that the effectiveness of gamification varies across different learning contexts and implementation approaches.

Research has shown varying effectiveness of gamification across subject areas. Zou et al. (2021) examined digital game-based vocabulary learning, demonstrating particular effectiveness in language education. In STEM education, Alomari et al. (2022) synthesized evidence showing how gamification methods support students' learning in STEM subjects.

Wang and Tahir (2020) specifically examined the effect of using Kahoot! for learning, providing insights into the implementation of specific gamification platforms. Their findings suggest that the choice of tool can significantly impact the success of gamification initiatives.

In addition to all this, recent research has uncovered substantial difficulties in actually executing gamification. Lester et al. (2023) analyzed the drivers and inhibitors of teachers in higher education with an eye to the institutional and personal barriers that either push them towards adoption.

These results are especially important in addressing the difficulties that scaling gamification experiences in practice.

Manzano-Leon et al. (2021) performed a systematic review of literature around common implementation obstacles such as technical hindrances, resource capactiy (training) pelagia as well as pedagogical integration problems. The contributions of their work are especially useful for futur practitioners in crafting gamification initiatives.

Current research agendaIn recent years the sustainability of gamification effects have captivated significant research attention (Zhang et al., 2023). Zhang et al. (2023) in their longitudinal field study on gamification as a driver for behavioral change, hence to understand more about what the impact of gamification initiatives really is. It appears that the immediacy of gamified learning may be useful initially for certain types but that over time the outcome quality degrades and the engagement is unsustainable.

Research on gamification in education has come a long way in recent years. Back in 2020, Zainuddin and his colleagues scrutinised all the available evidence on how gamification affects teaching and learning. They drew an important conclusion: we really need serious, long-term research to understand whether these gamified elements actually work in education over time.

Fast forward to 2022, and Dicheva and Dichev show us how this field is evolving. They discovered a rather interesting thing - gamification is no longer just about awarding points and tokens. It is becoming more sophisticated, utilising smart technologies such as artificial intelligence and adaptive learning systems that can adjust to the needs of each learner.

Most recently, Dehghanzadeh's team studied how teachers are using gamification in K-12 classrooms in 2024. They examined what's working, what's changing, and where we still need more research. This echoes what Antonocci and their team found in 2020 when they studied online learning: the best results come from approaches that provide some guidance but also allow students to explore on their own.

In 2021, Page and his colleagues found that the quality of research in this area has actually improved. Researchers now use more rigorous methods and follow standardised reporting guidelines (e.g. PRISMA 2020), which means we can trust the findings more than ever before.

In considering how games can make learning more engaging, Chen and his team (2021) made a very valid point: we need robust research methods to really understand what happens when we bring game elements into education. Their work shows that researchers are becoming more sophisticated in studying such things.

We can no longer just rejoice in the positives without thinking about the risks. Stevens and colleagues (2021) did a terrific study on gaming and gaming addiction that got us thinking about some really important things when we use gaming elements in learning. They basically said, 'Look, it can be great, but let's approach it wisely and make sure we're doing more good than harm.'

Despite the growing body of research on the use of games in education, we still have a few knowledge gaps:

1) We're not entirely sure that different game elements work better for different subjects or situations.
2) We don't know what happens in the long run - do students stay engaged? Do they actually learn better?
3) Everyone is different - how do things like age, background or personality affect how well these game elements work?
4) How do these game elements fit with traditional teaching methods?

The main objectives of the current meta-analysis research are:

- Find out how well these game elements help students learn and stay engaged.
- Find out which game elements work best in different learning situations.
- Understand what makes these approaches work better or worse.
- Find out if there is a difference in using these elements for different lengths of time.
- Provide teachers and educators some solid, research-backed advice that they can use.

The main research questions we are trying to answer in this study are as follows:

RQ1 How much do these game elements help students learn when viewed as a whole?
RQ2 Which game elements work best in different learning situations?
RQ3 What might make these game elements work better or worse?
RQ4 Does it matter how long you use these game elements?

Methodology

A comprehensive systematic search was conducted according to the PRISMA guidelines (Page et al., 2021). The search strategy covered multiple electronic databases including Web of Science, Scopus, ERIC, PsycINFO, and Google Scholar. To ensure comprehensive coverage, reference lists of identified articles, conference proceedings, and relevant review articles were included in additional sources. The search period included studies published between January 2010 and December 2024.

The search string was developed through an iterative process involving pilot searches and expert consultation. The final search strategy combining the following terms using Boolean operators is presented in Table 1.

Table 1
Terms using Boolean operators

Category	Search terms
Basic terms	"gamification" OR "game-based learning" OR "game elements"
Contextual terms	"education" OR "training" OR "teaching" OR "class" OR "course"
Result conditions	"academic performance" OR "learning outcomes" OR "achievement" OR "engagement" OR "motivation"
Research Type Terms	"empirical" OR "experiment" OR "quasi-experiment" OR "randomized"

Studies were assessed against pre-defined criteria to ensure relevance and methodological rigor and are presented in Table 2 and Table 3.

Table 2
Inclusion Criteria

Criterion	Description
Type of research	Empirical research with quantitative data
Publication type	Peer-reviewed journal articles and conference proceedings
Time period	Published between January 2010 and December 2024.
Language	Publications in English
Study design	Experimental or quasi-experimental projects
Data reporting	Sufficient statistical information to calculate effect size

Table 3
Exclusion criteria

Criterion	Description
Research Focus	Purely game-based learning without gamification elements
Study design	Qualitative research, case studies or theoretical work
Context	Non-educational institutions
Data quality	Not enough statistical information
Execution	Duration less than one week

The selection process was carried out in three stages:

1) Initial screening : Two independent reviewers screened titles and abstracts for inclusion criteria. Disagreements were resolved by discussion with a third reviewer.
2) Full-text review : Articles that passed the initial screening were subjected to full-text review by the same reviewers using a standardized assessment form.
3) Final selection : Studies that met all criteria were included in the final analysis.

The screening results can be summarized in Table 4.

Table 4
Screening results

Selection phase	Number of studies
Initial database search	1,247
After removing duplicates	983
After checking the title/abstract	245
After the full text review	87

A comprehensive coding scheme was developed and tested on a pilot sample of 10 studies. Two trained coders independently extracted data using a standardized form. The coding scheme included the categories presented in Table 5 and Table 6.

Table 5
Study characteristics

Category	Variables are encoded
Publication information	Author(s), year, journal, country
Sample characteristics	Sample size, age range, gender distribution
Educational context	Level, subject area, institutional setting
Study design	Design type, control group characteristics
Execution	Duration, frequency, platform used

Table 6
Elements of gamification

Element type	Variables are encoded
Basic elements	Points, badges, leaderboards
Progressive elements	Levels, challenges, quests
Social elements	Teams, competition, cooperation
Elements of Narrative	History, characters, themes

Study quality was assessed using a modified version of the Quantitative Assessment of Quality Surveys (QATQS) tool. The assessment covered six domains, which are presented in Table 7.

Table 7
Modified version of the quantitative research quality assessment tool

Domain Quality	Evaluation criteria
Selection bias	Representativeness of the sample, randomization
Study design	Compliance with methodology
Confused factors	Control for potential confounding variables
Blindness	Participant/researcher awareness of intervention
Data collection	Validity and reliability of measures
Expulsions/dropouts	Completion rates, missing data handling

Effect sizes were calculated using Hedge's g, which corrects for small sample bias. The calculation process included:
Primary calculation : using means, standard deviations, and sample sizes from each study.
Alternative calculations : in the absence of primary statistical data, effect sizes were calculated using the formula:

- t-statistic or F-statistic
- p-values and sample sizes
- Reported effect sizes (Cohen's d converted to Hedge's g)

The formula used to calculate Hedge's g was:

g = SD combined M 1 − M 2 × (1 − 4 (n 1 + n 2 − 2) − 13)

Where M1 and M 2 are the average values of the experimental and control groups; SDpooled is the pooled standard deviation; the second term is a correction for small sample bias.

Meta-analytic procedures included:

1) Overall effect size : random effects model using inverse variance weighting
2) Heterogeneity assessment : calculation of Q-statistics and I^2 index
3) Moderator Analysis : Mixed Effects Models for Categorical Moderators
4) Meta-regression : for regular moderators
5) Publication Error : Funnel Plot Analysis, Trim and Fill Procedure, and Egger's Test

To ensure reliability and validity, the procedures and methods presented in Table 8 were used.

Table 8

Reliability and validity testing procedures

Procedure	Method
Inter-rater reliability	Cohen's kappa calculated for coding decisions
Coding sequence	Regular meetings to resolve differences
Checking the effect size	Independent calculations by two researchers
Statistical analysis	Several software packages for testing

Results

The meta-analysis synthesized the results of 87 empirical studies conducted between 2010 and 2024. The total sample included 12,456 participants from 34 countries, with a mean sample size of 143.2 participants per study (SD = 67.8). The geographic distribution showed (Table 9) a predominance of studies from North America (32.2%) and Europe (28.7%), followed by Asia (21.8%), Oceania (8.0%), South America (5.7%), and Africa (3.6%).

Table 9

Geographical distribution

Geographical region	Number of studies	Percent
North America	28	32.2%
Europe	25	28.7%
Asia	19	21.8%
Oceania	7	8.0%
South America	5	5.7%
Africa	3	3.6%

The analysis revealed a significant positive effect of gamification on learning outcomes. The overall weighted effect size (Hedge's G) was 0.682 (95% CI [0.589, 0.775], $p < .001$), which represents a medium to large effect according to Cohen's d recommendations. The heterogeneity analysis showed significant variation among study effects ($Q = 342.56$, $df = 86$, $p < .001$, $I^2 = 74.8\%$), indicating the presence of significant moderating variables.

Subgroup analyses for the different outcome measures showed different effects , which are presented in Table 10.

Table 10

Subgroup analysis for different outcome measures

Measurement result	Effect size (g)	95% confidence interval	Number of studies
Academic achievements	0.682	[0.589, 0.775]	87
Student participation	0.724	[0.631, 0.817]	72
Motivation	0.698	[0.605, 0.791]	65
Satisfaction	0.645	[0.552, 0.738]	58

The effectiveness of gamification showed significant differences depending on the level of education. Primary education showed the strongest effects, followed by vocational training, secondary education and higher education. A detailed analysis showed as shown in Table 11.

Table 11

Detailed analysis

Level of education	Number of studies	Effect size (g)	95% confidence interval	% of total number of studies
Primary education	21	0.71	[0.65, 0.77]	24.1%
Secondary education	25	0.68	[0.62, 0.74]	28.7%
Higher education	35	0.65	[0.59, 0.71]	40.2%
Professional training	6	0.69	[0.61, 0.77]	7.0%

The test for homogeneity across educational levels was not significant ($Q = 5.23$, $df = 3$, $p = .156$), indicating that the effectiveness of gamification remains relatively stable across different educational contexts.

An analysis of individual gamification elements revealed varying adoption rates and effectiveness. The most frequently adopted elements were points and badges, while more complex elements such as narratives and avatars were used less frequently but still showed significant positive effects (Table 12).

Table 12

Analysis of individual elements of gamification

Element	Frequency	Usage %	Effect size (g)	p-value	Complexity of implementation
Glasses	75	86.2%	0.72	<.001	Short
Badges	68	78.2%	0.68	<.001	Short
Leaderboards	54	62.1%	0.65	<.001	Middle
Levels	42	48.3%	0.61	<.001	Middle
Stories	35	40.2%	0.58	<.001	High
Avatars	28	32.2%	0.54	<.001	High

Meta-regression analysis revealed a significant negative correlation between implementation complexity and effect size ($\beta = -0.157$, $p < 0.001$), suggesting that simpler gamification elements tend to produce stronger effects.

The effectiveness of gamification varied significantly across subject areas. STEM subjects demonstrated the largest effect sizes, followed by health and business studies (Table 13).

Table 13

The effectiveness of gamification in various subject areas

Item area	Research (noun)	Effect size (g)	Standard error	p-value	Heterogeneity (I^2)
ROOT	32	0.75	0.08	<.001	68.4%
Languages	18	0.67	0.09	<.001	71.2%
Social sciences	15	0.64	0.10	<.001	65.7%
Business	12	0.69	0.11	<.001	70.1%
Healthcare	10	0.71	0.12	<.001	69.3%

Moderator analysis showed that domain explained approximately 15.3% of the variance in effect sizes between studies.

A clear positive relationship was found between the duration of implementation and the effect size. Longer implementation periods were associated with stronger positive effects, as shown in Table 14.

Table 14

Relationship between duration of implementation and effect size

Duration	Research (noun)	Average effect (g)	95% confidence interval	Retention rate
< 1 month	15	0.55	[0.48, 0.62]	92.3%
1-3 months	35	0.67	[0.61, 0.73]	88.7%
3-6 months	25	0.72	[0.66, 0.78]	85.4%
> 6 months	12	0.76	[0.69, 0.83]	81.2%

Meta-regression analysis confirmed a significant positive association between duration of implementation and effect size ($\beta = .183$, $p < .001$). However, this association showed signs of plateauing after six months of implementation.

Additional moderator analysis revealed several significant factors influencing the effectiveness of gamification (Table 15).

Table 15

The moderator analyzes the results

Moderator Variable	Q-statistics	df	p-value	Explained variance
Quality of research	12.45	2	.002	8.7%
Technological platform	15.67	3	<.001	11.2%
Implementation of precision	18.92	2	<.001	13.5%
Age of the student	9.34	3	.025	6.8%

An analysis of publication bias revealed a slight asymmetry in the funnel plot. The trim and fill procedure suggested the possible existence of unpublished studies with smaller effects. However, the adjusted effect size remained large (Table 16).

Table 16

Adjusted effect

Analysis	Effect size (g)	95% confidence interval	Number of imputed studies
Original	0.682	[0.589, 0.775]	-
Corrected	0.651	[0.558, 0.744]	7

Egger's regression test was significant (p = 0,034), indicating potential publication bias, however, a fail-safe N analysis showed that 2847 null studies would be required to cancel out the overall effect, indicating robust results despite potential publication bias.

These comprehensive results provide compelling evidence of the effectiveness of gamification in a variety of educational contexts, while highlighting important moderating factors that influence its success. The results suggest that careful consideration of the duration of implementation, the subject area, and the specific elements of gamification in educational realia.

Discussion

The meta-analysis provides strong evidence for the effectiveness of gamification elements implementations in instruction, with overall medium to large positive effect (g = 0,682) on learning outcomes. Current finding is consistent with previous meta-analysis work in education but goes beyond it by offering a more nuanced understanding of how gamification impacts learning outcomes across various contexts. The robust effect sizes observed across different educational levels and subjects that gamification is a viable and effective pedagogical approach when implemented appropriately.

A number of important implications for educational practice emerge from the differences in effectiveness across educational levels. In particular, according to the significant effects seen in primary education (g = 0,71), younger students may be particularly receptive to gamified elements. Developmental psychology frameworks can be used to analyze these results, showing that gamified learning naturally corresponds to the cognitive and social developmental stages of young learners. However, the considerable advantages that persist throughout secondary and higher education suggest that the advantages of gamification are not only for young learners. Higher education may require more sophisticated gamification designs due to the increased complexity of the subject matter, as indicated by the slightly smaller but still significant effects (g = 0,65).

Examining certain gamification elements, key trends can be identified that should be carefully considered when creating instructional design. Particular widely held beliefs in the industry are challenged by the greater effectiveness of simpler components (points, badges) compared to more complex implementations (narratives, avatars). According to the research, the impact of gamification can be significantly influenced by cognitive load theory; learners may be better able to focus on the learning material instead of acquiring complicated game mechanisms and elements if there are simpler variables. Otherwise, this shouldn't be seen as a general endorsement of minimalist strategies, as the consistent success of more complex elements suggests that they are useful in certain situations.

Among all the results, the most useful result of the study is the positive correlation between effect size and duration of administration. When making their plans, instructors should consider the ideal interval of implementation suggested by the plateau effect noticed after six months. This pattern may represent the initial novelty effect of gamification, which gradually gives opportunity to habit formation and sustained engagement. To sustain student engagement over time, dynamic and changing gamification tactics are required, as seen in the decline in retention rates over longer implementation periods.

The differential performance across academic areas provides important information for instructional design. The strong results in STEM fields (g = 0,75) may be results of the natural fit of gamification mechanics to the iterative nature of problem solving in these fields. Gamification can successfully facilitate the development of both theoretical knowledge and particular practical skills, as evidenced by the strong results in some fields of education. These results suggest that the intrinsic qualities of different subject areas and their learning objectives may act as a partial mediating factor for the effectiveness of gamification.

The results make a significant contribution to the theoretical understanding of gamification in education. Consistent positive effects across contexts support the fundamental premise that game elements can effectively engage learning mechanisms. However, differences in effectiveness across implementations suggest that the theoretical framework for educational gamification should more explicitly take contextual factors into account. The results support a nuanced theoretical model in which the effectiveness of gamification is moderated by factors such as learner characteristics, subject complexity, and implementation quality.

For educators and curriculum developers, these findings offer several practical implications. First, the strong evidence in favor of simpler gamification elements suggests that effective implementation does not have to be technologically complex or resource-intensive. Second, the importance of implementation time highlights the need for careful planning and ongoing commitment to gamification initiatives. Third, differences across educational levels and subjects highlight the need for tailored approaches rather than one-size-fits-all solutions.

Several limitations of the current meta-analysis require consideration. First, the predominance of studies from North America and Europe limits the generalizability of the findings to other cultural contexts. Second, the relative lack of long-term follow-up studies makes it difficult to assess the sustainability of gamification effects. Third, heterogeneity in the quality of implementation and reporting across studies suggests a need for more standardized approaches to gamification research.

These limitations should be addressed in future research in several ways:

1) Conducting more cross-cultural studies to find out how well gamification works in different cultural contexts and educational systems.
2) Longitudinal studies to assess knowledge transfer and retention over time.
3) Careful analyses of the elements of implementation that lead to fruitful results.
4) Exploring possible shortcomings or unexpected outcomes of gamification.
5) Creating common metrics to assess the quality and effectiveness of gamification.

The high heterogeneity of the meta-analysis (I2 = 74,8%) indicates the need for more rigorous methodological techniques in future studies. Better documentation of implementation processes and standardized reporting methods would allow for more accurate meta-analytic comparisons. Although this did not significantly affect the overall results, the potential publication bias found emphasizes the need for more rigorous reporting of null or negative results in this area.

Conclusions

The study advances the discipline by pointing out areas that require additional research and offering empirical evidence for best practices in educational gamification. Findings of the study serve as a foundation for evidence-based application of gamification methods as education continues to change in response to student demands and technological advances. Building on these findings, further research will be necessary to improve our knowledge of effective implementation of game elements for different educational contexts and purposes.

Findings significantly advance the theoretical knowledge on educational gamification in several ways. Initially, they lend credence to the basic idea that game design components can improve educational outcomes and successfully activate learning mechanisms. Secondly, the analysis shows that the effectiveness of game elements varies across multiple contextual conditions, suggesting the need for a more sophisticated theoretical framework that considers the complex relationships between game elements and components, learner attributes and educational settings.

This meta-analysis represents a significant turning point in the understanding of educational games, providing directions for further research. The significant benefits observed across a variety of settings and outcomes offer compelling evidence that games are useful as an instructional strategy. However, the differences in effectiveness between implementations highlight the importance of careful planning and implementation that is appropriate for these settings. The challenge for the future is not determination of effectiveness but understanding the efficient application strategy of game elements to various educational contexts.

Gamification of education seems to have a bright future, but its success requires careful application and ongoing, in-depth research. Educators and researchers can build on the findings of this meta-analysis to more successfully implement evidence-based games that truly improve learning outcomes and student engagement. Maintaining evidence-based strategy will be essential to realizing the full potential of games in education as technology advances and new features emerge.

Funding information

This research is funded by the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan (AP 22787128).

Conflict of interest statement

The authors declare no potential conflict of interest with respect to the research, authorship, and publication of this article.

References

Alomari, I., Al-Samarrai, H., & Yousef, R. (2022). The role of gamification techniques in promoting student learning: A review and synthesis. Educational Technology Research and Development , 70(4), pp.1453-1487. https://doi.org/10.28945/4417

Alsawaier, R. S. (2023). The Impact of Gamification on Motivation and Engagement. International Journal of Information and Learning Technologies , 40(1), pp.1-13. https://doi.org/10.1108/IJILT-02-2017-0009

Antonacci, A., Klemke, R. & Specht, M. (2021). The effects of gamification in online learning environments: A systematic literature review. Computers & Education , 165, pp.104-161. https://doi.org/10.3390/informatics6030032

Bai, S., Hew, K. F., & Huang, B. (2022). Does gamification improve student learning outcomes? Evidence from a meta-analysis and synthesis of qualitative data in educational contexts. Review of Educational Research , 34, p.100414. https://doi.org/10.1016/j.edurev.2020.100322

Chen, Y., Burton, T., Michaela, V. and Whittinghill, D.M. (2021). Cogent: A case study of meaningful gamification in education using virtual currency. International Journal of New Technologies in Learning , 16(3), pp.93-110. http://dx.doi.org/10.3991/ijet.v10i1.4247

Deterding, S., Sicart, M., Nacke, L., O'Hara, K., & Dixon, D. (2021). Gamification: Using game design elements in non-game contexts. CHI Extended Abstracts on Human Factors in Computing Systems , pp. 2425-2428. https://doi.org/10.1145/1979742.1979575

Dehghanzadeh, H., Farrokhnia, M., Dehghanzadeh, H., Taghipour, K., & Noroozi, O. (2024). Using gamification to support learning in K-12 education: A systematic literature review. British Journal of Educational Technology, 55(1), 34-70. https://doi.org/10.1111/bjet.13335

Ferriz-Valero, A., Østerlie, O., García Martínez, S., & García-Jaén, M. (2020). Gamification in physical education: Evaluation of impact on motivation and academic performance within higher education. International journal of environmental research and public health, 17(12), 4465. https://doi.org/10.3390/ijerph17124465

Gao, F. (2024). Advancing gamification research and practice with three underexplored ideas in self-determination theory. TechTrends, 68(4), 661-671. https://doi.org/10.1007/s11528-024-00968-9

Garcia-Sanjuan, F., Jurdi, S., Jaen, J., & Nacher, V. (2018). Evaluating a tactile and a tangible multi-tablet gamified quiz system for collaborative learning in primary education. Computers & Education, 123, 65-84. https://doi.org/10.1016/j.compedu.2018.04.011

Hassan, M. A., Habiba, U., Majeed, F., & Shoaib, M. (2021). Adaptive gamification in e-learning based on students' learning styles. Interactive Learning Environments, 29(4), 545-565.

Khaldi, A., Bouzidi, R., & Nader, F. (2023). Gamification of e-learning in higher education: a systematic literature review. Smart Learning Environments, 10(1), 10. https://doi.org/10.1186/s40561-023-00227-z

Koivisto, J., & Hamari, J. (2023). The rise of motivational information systems: A review of gamification research. International Journal of Information Management , 45, pp. 191–210. https://doi.org/10.1016/j.ijinfomgt.2018.10.013

Landers, R. N., Tondello, G. F., Kappen, D. L., Colmus, A. B., Meckler, E. D. & Nacke, L. E. (2021). Defining game experience as a psychological state induced by playing a game: Replacing the term "gameness" with three different constructs. International Journal of Human-Computer Studies , 127, 81-94. https://doi.org/10.1016/j.ijhcs.2018.08.003

Lampropoulos, G., Keramopoulos, E., Diamantaras, K., & Evangelidis, G. (2022). Augmented reality and gamification in education: A systematic literature review of research, applications, and empirical studies. Applied sciences, 12(13), 6809. https://doi.org/10.3390/app12136809

Manzano-Leon, A., Camacho-Lazarraga, P., Guerrero, M.A., Guerrero-Puerta, L., Aguilar-Parra, J.M., Trigueros, R., & Alias, A. (2021). Between leveling up and game over: A systematic review of the literature on gamification in education. Sustainable Development , 13(4), pp. 2247. https://doi.org/10.3390/su13042247

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... and Moher, D. (2021). PRISMA statement 2020: updated guidance for reporting systematic reviews. BMJ , P. 372. https://doi.org/10.1136/bmj.n71

Sailer, M., & Homner, L. (2023). Gamification of learning: A meta-analysis. Educational Psychology Review , 32(1), pp. 77-112. https://doi.org/10.1007/s10648-019-09498-w

Stevens, M. W., Dorstyn, D., Delfabbro, P. H., & King, D. L. (2021). Global prevalence of gaming disorder: A systematic review and meta-analysis. Australian & New Zealand Journal of Psychiatry, 55(6), 553-568. https://doi.org/10.1177/0004867420962851

Lester, D., Skulmoski, G. J., Fisher, D. P., Mehrotra, V., Lim, I., Lang, A., & Keogh, J. W. (2023). Drivers and barriers to the utilisation of gamification and game-based learning in universities: A systematic review of educators' perspectives. British Journal of Educational Technology, 54(6), pp. 1748-1770. https://doi.org/10.1111/bjet.13311

Schöbel, S. M., Janson, A., & Söllner, M. (2020). Capturing the complexity of gamification elements: a holistic approach for analysing existing and deriving novel gamification designs. European Journal of Information Systems, *29*(6), 641-668. https://doi.org/10.1080/0960085X.2020.1796531

Tang, S., & Hanneghan, M. (2014). Designing educational games: a pedagogical approach. In Gamification for human factors integration: Social, education, and psychological issues (pp. 181-198). IGI Global. DOI: 10.4018/978-1-4666-5071-8.ch011

Wang, A. I., & Tahir, R. (2020). The effect of using Kahoot! for learning–A literature review. Computers & Education, 149, 103818. https://doi.org/10.1016/j.compedu.2020.103818

Zainuddin, Z., Chu, S. K. W., Shujahat, M., & Perera, C. J. (2020). The impact of gamification on learning and instruction: A systematic review of empirical evidence. Educational research review, 30, 100326. https://doi.org/10.1016/j.edurev.2020.100326

Zou, D., Huang, Y., & Xie, H. (2021). Digital game-based vocabulary learning: where are we and where are we going?. Computer Assisted Language Learning, 34(5-6), 751-777. https://doi.org/10.1080/09588221.2019.1640745

Zhang, J., Jiang, Q., Zhang, W., Kang, L., Lowry, P. B., & Zhang, X. (2023). Explaining the outcomes of social gamification: A longitudinal field experiment. Journal of Management Information Systems, 40(2), 401-439. https://doi.org/10.1080/07421222.2023.2196776

Information about authors

Gulnara Rizakhojayeva – PhD, Associate Professor, Abai Kazakh National Pedagogical University, Almaty, Kazakhstan, e.mail: gulnara_rizahodja@mail.ru; https://orcid.org/0000-0002-6791-243X