

Play It Safe: Evaluating Participatory Game-Based Learning Activities for Internet Safety Among Primary and Secondary School Students

Marinela Schatten

School of Construction, Natural Sciences and Mining Varaždin
Hallerova aleja 3, 42000 Varaždin, Croatia
marinela.schatten@skole.hr

Ljiljana Inkret-Martinčević

2nd Primary School Varaždin
Augusta Cesarca 10, 42000 Varaždin, Croatia
ljiljana.inkret-martincevic1@skole.hr

Martina Koščak

Vocational High School Varaždin
Božene Plazzeriano 4, 42000 Varaždin, Croatia
martina.koscak3@skole.hr

Abstract. *The Croatian Safer Internet Day theme, “Play Safe – Together for a Better Internet,” promoted safe online interaction with a focus on gaming. In two secondary and one primary school, students ($n = 168$) created educational games about internet safety and shared them with peers. Surveys revealed high motivation ($M = 4.02/5$) and perceived learning ($M = 4.01/5$). Motivation strongly correlated with learning ($r = 0.739$), and participation in game creation significantly increased motivation ($p = 0.002$). Regression analysis identified motivation and enjoyment as predictors of perceived safer online behavior. The study highlights participatory game-based learning as an effective approach to fostering digital safety awareness.*
Keywords. gamification, game based learning, internet safety

1 Introduction

Last year’s Safer Internet Day theme in Croatia, “Play Safe – Together for a Better Internet,” emphasized the importance of safe online interaction, with a special focus on the world of online games. In two secondary schools (School of Construction, Natural Sciences and Mining Varaždin and Secondary Vocational School Varaždin) and one primary school (2nd Primary School Varaždin), joint activities were conducted with a shared objective: to shift young people’s attention from passive gaming to active participation in designing games themselves. The activities included introducing students to game development techniques, followed by education on internet safety aspects through interaction with games created by their peers. The evaluation of the activities was carried out through two surveys, utilizing digital tools such as Wordwall, Google

Forms, and Google Sites (Marinela Schatten, Inkret-Martinčević, and Koščak, 2024).

In the digital age, where video games have become an integral part of everyday life for many young people, online safety emerges as a crucial topic in education and upbringing. Time spent playing video games presents challenges both for children and adults, creating dilemmas for parents and professionals striving to address issues associated with uncontrolled gaming (Veočić et al., 2024). Challenges include regulating screen time and ensuring that children fulfill their educational responsibilities. Experts are focusing on safety within gaming environments, the consequences of excessive gaming, potential risks, and strategies for preventing addiction.

Video games provide exciting adventures, the satisfaction of overcoming challenges, and instant virtual rewards, making them highly appealing. Rewards that are quickly achieved in virtual environments often lead students to neglect long-term goals such as education, replacing books with the instant gratification games provide. This is why it is important to guide young people toward understanding and balancing their digital activities, encouraging them to create and understand technology rather than merely consume it (Veočić et al., 2024).

A growing body of research has demonstrated that *game-based learning* (GBL) and *gamification* can significantly enhance engagement and learning outcomes in primary and secondary education (Ratinho and Martins, 2023; Videnovik et al., 2023). GBL generally refers to using games as structured learning tools, whereas gamification involves applying game design elements—such as points, badges, or competition—to non-game contexts to motivate learners (Ratinho and

Martins, 2023). Studies have shown that these approaches can foster intrinsic motivation and deeper learning, particularly when the games are meaningfully integrated into curricular objectives (Wang et al., 2023).

Recently, attention has turned toward participatory game design, where students are not only consumers of educational games but also co-designers (Saiger et al., 2023). This participatory approach is theorized to increase learners' sense of agency and ownership, potentially leading to more sustained engagement and higher perceived relevance of learning activities (Henriksen-Bulmer et al., 2024). However, most existing studies have focused on digital games played in the classroom rather than those created by students themselves. Our study aims to address this gap by examining how active involvement in designing internet safety games affects students' motivation, perceived learning, and attitudes toward safer online behavior.

In this study, we conducted a comprehensive analysis of students' experiences and perceptions related to the conducted activity. Descriptive statistics, correlation analyses, and multiple regression were used to explore motivation, perceived learning, and the impact of participation in game creation on attitudes toward online safety.

The paper is structured as follows: in Section 2, we describe the design and tools used in the study; in Section 3, we present the main findings; in Section 4, we interpret these results in the context of existing literature; and in Section 5, we summarize key insights and outline recommendations for practice.

2 Methodology

The study was conducted in two secondary schools and one primary school in Varaždin, Croatia, as part of activities marking Safer Internet Day 2024. Activities included firstly the creation of educational games using Wordwall by students for students. These games were then collected on a dedicated website together with links to the prepared surveys (see Fig. 1).

The intervention aimed to engage students in creating and evaluating educational games focused on online safety. Data collection involved two online surveys distributed to participating students via Google Forms. The first survey collected ratings of individual games, while the second assessed students' experiences, motivation, and perceived learning outcomes.

A total of 168 students participated in the evaluation (ages 9 - 14 primary schools students, and 14 - 18 secondary schools students, due to privacy concerns gender was not recorded, but a normal distribution can be assumed), providing both quantitative ratings (on a five-point Likert scale) and open-ended feedback. Game ratings were matched with metadata about the game type and the school of the authoring students.

The following hypotheses were formulated to guide



Figure 1. Screenshot of dedicated gaming website

the analysis:

H1: Students who participated in the creation of educational games will report significantly higher motivation to learn through games compared to students who did not participate.

H2: There is a positive correlation between students' perceived enjoyment of playing peer-created games and their perception of the educational value of those games.

H3: Motivation to learn through games and enjoyment of gameplay are significant positive predictors of students' perceived improvement in online safety behavior.

H4: Primary school students will rate the quality of peer-created games significantly higher than secondary school students.

H5: The correlation between motivation to learn through games and perceived learning outcomes is positive and of at least moderate strength ($r > 0.5$).

H6: Participation in game creation does not signifi-

cantly predict perceived improvement in online safety behavior when controlling for motivation and enjoyment of gameplay.

H7: Students' intention to change their online gaming habits is positively associated with their perceived understanding of online risks.

To test these hypotheses, several statistical methods were applied: (1) Descriptive statistics (means, standard deviations) were computed for all survey items, (2) Independent samples *t*-tests and Mann–Whitney U tests were used to examine differences in motivation and perceived quality of games between subgroups (H1, H4); (3) Pearson and Spearman correlation coefficients were calculated to assess associations between motivation, perceived learning, enjoyment, and attitudes towards safety (H2, H5, H7); (4) Multiple regression analysis was conducted to identify predictors of perceived safer behavior after participation (H3, H6); (5) A correlation heatmap was generated to visualize relationships among the main evaluation variables.

All analyses were performed using Python (pandas, scipy, statsmodels, seaborn) and results were interpreted with a significance threshold of $p < 0.05$.

To ensure transparency of the evaluation, both surveys included closed-ended items measured on a five-point Likert scale (e.g., motivation, enjoyment, perceived learning, intention to change behavior) and several open-ended questions for qualitative feedback. Prior to participation, students were informed that the activity was part of Safer Internet Day, that the goal was to reflect on safe online behavior, and that responses would remain anonymous. Teachers introduced the task sequence in the following order: (1) creation of educational games by student groups using Wordwall, (2) sharing of games on the central website, (3) gameplay by peers, and (4) completion of the evaluation surveys. Instructions for filling in the questionnaires were read aloud and displayed on the website, and teachers supervised students while answering to ensure understanding and attention. No formal attention-check items were included, but teachers monitored engagement during data collection. As the primary aim of the study was to capture students' motivation, perceived learning, and attitudes toward online safety, we intentionally focused on self-perceptions rather than objective knowledge tests; future research could complement this with simple pre–post exercises to directly measure learning gains.

3 Results

This section presents the findings of the study structured around the research hypotheses and main research questions. The results include descriptive statistics of game evaluations, differences among groups, correlation analyses, and regression models assessing predictors of perceived impact.

Table 1 shows the descriptive statistics for students'

ratings of each game's interest and educational value. The mean interest ratings ranged from 2.80 to 4.15 across different games. The highest-rated games in terms of interest were Game 10 ($M=4.15$), Game 9 ($M=4.11$), and Game 6 ($M=4.02$). The variability in ratings indicates that students perceived substantial differences in the attractiveness and educational potential of individual games.

Further analyses aggregated ratings by game type and by the school of the creator. As shown in Table 2, games in the "Memory" and "Plane" categories received the highest average interest ratings (both $M=3.88$), while "Moles" games were rated lowest on average ($M=3.42$). Educational value ratings were generally lower than interest ratings across all categories.

Table 3 presents the average ratings based on whether the game was created by primary or secondary school students. Games created by secondary school students received slightly higher mean interest ratings ($M=3.63$) compared to those created by primary school students ($M=3.33$), while educational ratings were similar across groups.

To examine Hypothesis 1, which posited that students who participated in the creation of educational games would report higher motivation to learn through games, mean ratings of the statement "I feel more motivated when learning through games" were compared between students who did and did not participate in game development. As shown in Table 4, the group that took part in creating games reported substantially higher motivation ($M=4.45$) than those who only played peer-created games ($M=3.83$). This difference was statistically significant according to the Mann–Whitney U test ($p = 0.002$). The finding provides strong support for Hypothesis 1 and indicates that engaging students in the process of designing educational content can meaningfully increase their intrinsic motivation for learning.

Hypothesis 2 proposed that there would be a positive correlation between students' perceived enjoyment of playing peer-created games and their perception of the educational value of these games. To test this hypothesis, Pearson and Spearman correlation coefficients were calculated between interest ratings and educational ratings across all evaluated games. As presented in Table 8, the analyses revealed a moderate positive association (Pearson $r = 0.535$, Spearman $\rho = 0.545$). This suggests that games perceived as more enjoyable were also more likely to be considered educationally valuable by students. The results confirm Hypothesis 2 and support the notion that engagement and perceived learning are closely intertwined in game-based learning contexts.

Hypothesis 3 stated that motivation to learn through games and enjoyment of gameplay would be significant positive predictors of students' perceived improvement in online safety behavior after the activity. To evalu-

Table 1. Descriptive statistics of game interest and educational ratings

Game	Number of ratings	Interest				Educational value			
		Mean	SD	Min	Max	Mean	SD	Min	Max
1	103	2.91	1.64	1	5	2.67	1.62	1	5
2	59	4.02	1.28	1	5	3.17	1.54	1	5
3	56	3.82	1.25	1	5	3.21	1.44	1	5
4	56	3.43	1.44	1	5	3.09	1.39	1	5
5	56	3.38	1.42	1	5	3.30	1.49	1	5
6	42	4.02	1.26	1	5	3.60	1.31	1	5
7	35	3.54	1.34	1	5	3.34	1.41	1	5
8	50	3.84	1.25	1	5	3.24	1.44	1	5
9	47	4.11	1.05	1	5	3.60	1.17	1	5
10	40	4.15	1.42	1	5	3.95	1.54	1	5
11	36	3.22	1.59	1	5	3.17	1.72	1	5
12	19	3.58	1.26	1	5	2.95	1.31	1	5
13	39	3.74	1.33	1	5	3.00	1.40	1	5
14	28	3.71	1.24	1	5	3.36	1.31	1	5
15	23	3.87	1.25	1	5	3.39	1.31	1	5
16	49	3.98	1.28	1	5	3.27	1.48	1	5
17	28	3.50	1.58	1	5	3.46	1.45	1	5
18	27	3.59	1.15	1	5	3.26	1.23	1	5
19	15	2.80	1.47	1	5	2.87	1.36	1	5
20	34	3.97	1.22	1	5	3.38	1.30	1	5
21	17	3.24	1.44	1	5	3.18	1.59	1	5
22	62	3.58	1.45	1	5	3.40	1.37	1	5
23	49	3.08	1.51	1	5	3.12	1.42	1	5
24	49	3.41	1.44	1	5	3.06	1.55	1	5
25	54	3.46	1.45	1	5	3.30	1.35	1	5
26	41	2.95	1.53	1	5	3.10	1.51	1	5

Table 2. Average ratings of game interest and educational value by game type

Game type	Mean interest rating	Mean educational rating	Number of ratings
Memory	3.88	3.55	75
Plane	3.88	3.21	205
Quiz	3.48	3.23	520
Balloons	3.43	3.28	115
Moles	3.42	3.08	199

ate this, a multiple regression analysis was conducted with perceived safer behavior as the dependent variable and motivation, enjoyment, and participation in game creation as predictors. As shown in Table 9, both motivation (coefficient = 0.407, $p < 0.001$) and enjoyment (coefficient = 0.488, $p < 0.001$) were significant predictors of perceived safer behavior. In contrast, participation in creating games did not significantly contribute to the model ($p = 0.890$). These findings provide clear support for Hypothesis 3, highlighting the central role of students' subjective engagement experiences in fostering perceived improvements in online safety practices.

Hypothesis 4 predicted that primary school students would rate the quality of peer-created games significantly higher than secondary school students. To test this, ratings of the statement "The quality of the peer-created games was high" were compared between the two groups. As shown in Table 7, primary school students reported a higher mean rating ($M=3.98$) compared to secondary school students ($M=3.59$). This difference reached statistical significance according to the Mann-Whitney U test ($p = 0.033$). No significant differences were observed between groups in perceived enjoyment or perceived learning from games. These

results support Hypothesis 4 and indicate that younger students may perceive peer-created educational content more positively in terms of quality.

Hypothesis 5 stated that the correlation between motivation to learn through games and perceived learning outcomes would be positive and of at least moderate strength ($r > 0.5$). This relationship was examined using both Pearson and Spearman correlation coefficients. As presented in Table 8, the analyses revealed a very strong positive association: Pearson $r = 0.739$ and Spearman $\rho = 0.767$. These coefficients substantially exceed the threshold specified in the hypothesis and indicate that higher motivation was closely linked to stronger perceptions of having learned. The results therefore provide strong evidence in favor of Hypothesis 5, underscoring the connection between motivation and perceived educational impact in the context of game-based learning.

Hypothesis 6 proposed that participation in game creation would not significantly predict perceived improvement in online safety behavior when controlling for motivation and enjoyment of gameplay. This hypothesis was evaluated within the multiple regression model presented in Table 9. While both motivation and enjoyment emerged as significant predictors

Table 3. Average ratings of game interest and educational value by the school of the game creator

School of the game creator	Mean interest rating	Mean educational rating	Number of ratings
Primary school	3.33	3.21	255
Secondary school	3.63	3.23	859

Table 4. Differences in motivation and perceived usefulness between students who participated in creating the games and those who did not

Statement	Mean (participated)	Mean (did not participate)	p-value (Mann-Whitney)
I feel more motivated when learning through games	4.45	3.83	0.002**
The information is useful for my peers	4.24	3.91	0.054

** $p < 0.01$ indicates a highly significant difference.

($p < 0.001$), participation in creating games was not a statistically significant factor (coefficient = -0.024 , $p = 0.890$). This result confirms Hypothesis 6 and suggests that merely contributing to the development of games did not independently influence perceptions of safer behavior once subjective engagement variables were taken into account.

Hypothesis 7 stated that students' intention to change their online gaming habits would be positively associated with their perceived understanding of online risks. This relationship was examined through correlation analysis of the relevant survey items. As visualized in the correlation heatmap in Fig. 2, the association between perceived understanding of risks and intention to change habits was among the strongest observed in the dataset, with Pearson and Spearman coefficients both exceeding 0.70. This finding provides robust support for Hypothesis 7, suggesting that when students recognize online risks, they are more likely to report intentions to adjust their behavior accordingly.

4 Discussion

The present study contributes to the growing body of research exploring the role of participatory game-based learning in fostering motivation, perceived learning, and online safety awareness among school students. The findings provide empirical support for several theoretical propositions regarding the interplay of engagement, co-creation, and educational outcomes in gamified learning environments.

First, the results demonstrate that students who actively participated in designing educational games reported significantly higher motivation to learn compared to those who only consumed peer-created content. This aligns with prior research indicating that co-design and participatory approaches can substantially enhance learners' sense of agency, ownership,

and intrinsic motivation (Bamford and Moschini, 2024; Markus Schatten and Marinela Schatten, 2019). Bamford and Moschini (Bamford and Moschini, 2024) highlight that involving students as co-creators fosters a "third space" of learning, where enjoyment and empowerment converge to sustain engagement. Our data confirm that such involvement can be a decisive factor in shaping motivational attitudes.

Second, the moderate to strong correlations between enjoyment of gameplay, perceived educational value, and motivation echo the findings of recent meta-analyses and empirical studies showing that fun and perceived usefulness are interdependent drivers of learning in gamified settings (Nadeem et al., 2023; Videnovik et al., 2023). In particular, Videnovik et al. (Videnovik et al., 2023) emphasize that enjoyment acts as a catalyst for sustained participation and deeper cognitive involvement, a dynamic mirrored in our observed associations ($r > 0.5$) between these constructs.

Third, the regression analysis revealed that perceived safer behavior was primarily predicted by students' motivation and enjoyment, rather than by their mere participation in game creation. This suggests that while participatory design can boost motivation, it is the subjective experience of engagement during gameplay that ultimately shapes attitudes toward behavioral change. This finding is consistent with observations from Schatten and Schatten (Marinela Schatten and Markus Schatten, 2020) who reported variability in outcomes across student groups depending on how gamified experiences were perceived and enacted.

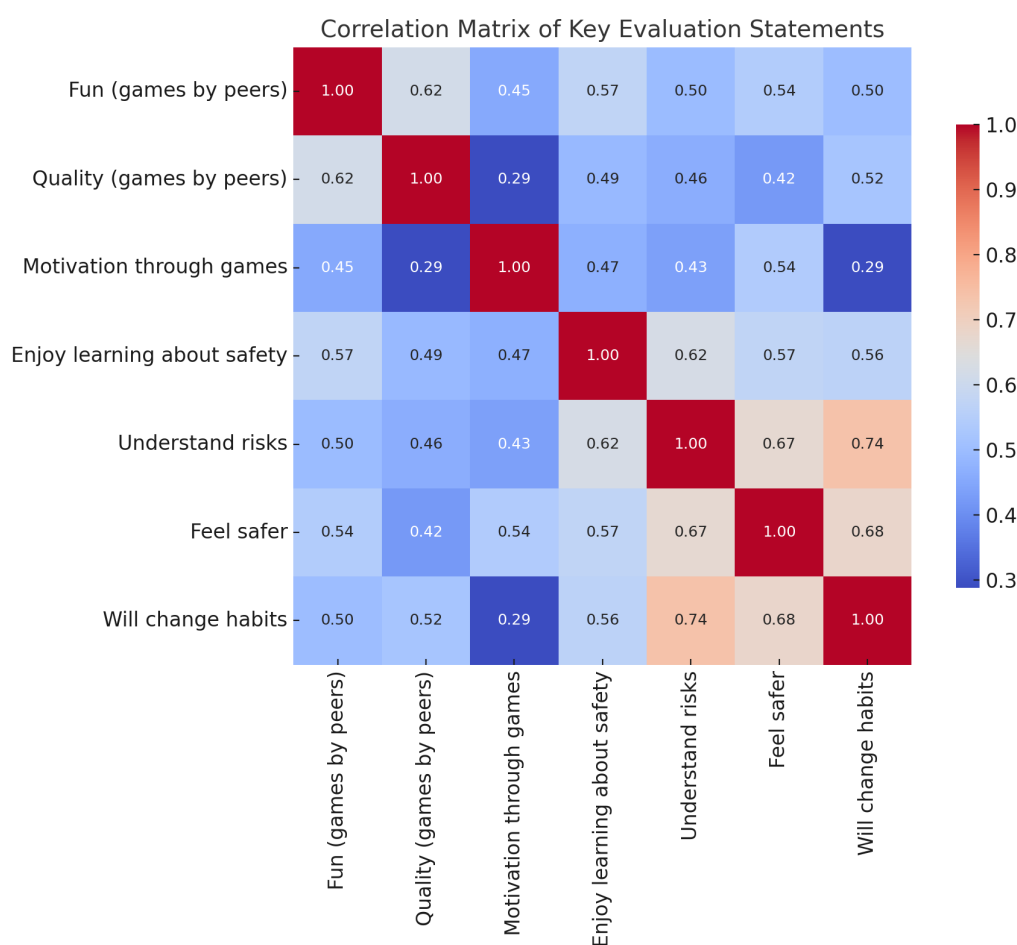
Interestingly, primary school students evaluated the quality of peer-created games more positively than secondary school students. This pattern may reflect developmental differences in expectations, critical thinking, or familiarity with game mechanics. Tomičić and Schatten (Tomičić and Markus Schatten, 2020) have noted that primary students often demonstrate greater openness and satisfaction with gamified learning tools,

Table 5. Correlations between selected statements

Association	Pearson r	Spearman ρ
Motivation and perceived learning	0.739	0.767
Perception of educational value and motivation	0.466	0.440

Table 6. Multiple regression – predictors of perceived safer behavior after the activity

Predictor	Coefficient	p-value
Constant	-0.061	0.861
Motivation for learning through games	0.407	<0.001
Enjoyment of playing the games	0.488	<0.001
Participation in game creation	-0.024	0.890

**Figure 2.** Correlation Matrix of Key Evaluation Statements. The matrix shows pairwise Pearson correlations between main evaluation items.

whereas older students may apply more critical criteria in their evaluations.

Finally, the high ratings of creativity and perceived usefulness of the Wordwall platform underscore the relevance of accessible, user-friendly tools in fostering participatory educational practices. Schatten et al. (Markus Schatten, Đurić, and Ređep, 2022) observed similar patterns of satisfaction with gamified survey

platforms in primary education, suggesting that the intuitive design and immediate feedback typical of such tools are instrumental in supporting positive learner experiences.

Overall, this study reinforces the notion that participatory game-based learning is not merely an engaging pedagogical novelty but a robust approach that can meaningfully enhance motivation and perceived learn-

Table 7. Differences in ratings between primary and secondary school students

Statement	Mean (primary)	Mean (secondary)	p-value (Mann-Whitney)
Playing games created by peers was fun	3.90	3.83	0.750
The quality of the peer-created games was high	3.98	3.59	0.033*
I learn more through games than from books	3.98	4.03	0.959

*p<0.05 indicates a statistically significant difference.

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ing while promoting critical awareness of online safety. Future research should further explore how specific design elements like cognitive agents (Markus Schatten, 2022) and adaptive personalization strategies can optimize the impact of such interventions across diverse educational contexts.

5 Conclusion

This study examined the effects of participatory game-based learning on student motivation, perceived learning, and awareness of online safety risks. The results provide strong evidence that actively engaging students in the creation of educational games can substantially enhance their motivation to learn and their perceptions of the educational value of such activities. Moreover, subjective enjoyment of gameplay emerged as a critical factor predicting students' intention to adopt safer online behaviors.

The findings contribute to a growing consensus that participatory gamification strategies are effective tools for cultivating not only engagement but also meaningful learning outcomes in both primary and secondary educational contexts. The positive correlations observed between motivation, enjoyment, and perceived learning underscore the interdependence of affective and cognitive dimensions of game-based education.

While the present work focused primarily on self-reported measures and relatively short-term outcomes,

future research should explore longitudinal effects of participatory game-based interventions and their impact on actual behavior change. Additionally, there is considerable potential in integrating emerging technologies such as artificial intelligence to further personalize and enrich the learning experience. In particular, the deployment of intelligent cognitive agents in educational games may offer new opportunities for adaptive scaffolding, dynamic feedback, and authentic problem-solving experiences (Markus Schatten, 2022).

Continued investigation into the convergence of gamification, educational game co-design, and AI-driven interactivity promises to yield innovative pedagogical models capable of addressing the evolving challenges of digital literacy and safety education.

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