GAME-BASED LEARNING: A SURVEY OF ITS ATTRACTIVENESS FOR UNIVERSITY STUDENTS

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Abstract

The labor market demands on higher education increasingly call for learning connecting theory with practice to better prepare university students for their future professional careers. One way to achieve this could be game-based learning using digital and non-digital learning games designed in the form of case studies, role-playing, and simulations to provide university students with practical and enjoyable learning experiences. The paper investigates the experience of university students with game-based learning to identify challenges, benefits, and issues of the development of game-based learning in higher education. The investigation is founded on the results of a questionnaire survey of 146 students of the bachelor's program in Economics and Management at MIAS CTU in Prague. The results show that most of the surveyed students have experienced game-based learning whether at school or work. Most of them would also welcome more game-based learning, but it must deliver topically interesting and visually attractive content that motivates learning. To enhance the development of game-based learning in higher education, it is suggested to apply various digital and non-digital learning games offering an opportunity to put theory into practice, experience social interaction, and receive performance feedback in a fun and clear way.

Keywords: game-based learning, teaching practice, learning experience, higher education, Czech Republic

JEL Code: I21, I23, I25

Introduction

University students and graduates represent a significant labor force in developed economies, which is applied in many economic sectors from agriculture, manufacturing, and construction through trading, distribution, insurance, and banking to information technology, education, healthcare, legal services, and public administration (Iriondo, 2022). Accordingly, employers have relatively high qualitative expectations of university students and graduates regarding both their hard skills, such as language and computer skills, as well as their soft skills, such as

communication skills, teamwork, critical thinking, and problem-solving. Moreover, employers often prefer applicants who already have some work experience (Green & Henseke, 2021).

The demands of potential employers on university students and graduates, including work experience, lead many students to gain some work experience already during their studies (Hojda et al., 2022). More and more students thus divide their time between work and study. This trend seems to be a great challenge for universities to attract the attention of students with useful learning content and to show them that it makes sense to combine theory with practice (Skrinjaric, 2023). One way to meaningfully combine theory with practice to better prepare university students for their future professions could be game-based learning using digital and non-digital learning games designed in the form of case studies, role-playing, and simulations (Leitner et al., 2023).

Game-based learning offers an opportunity to provide university students with practical and enjoyable learning experiences (Zhao et al., 2022). However, its effective and efficient use requires dealing with some technological and methodological issues, including active student participation (Vodenicharova, 2022). In this context, the paper investigates the experience of university students with game-based learning to identify challenges, benefits, and issues of the development of game-based learning in higher education. The investigation aims to answer three research questions:

RQ1: Have students ever experienced game-based learning?

RQ2: How do students perceive the barriers, advantages, and disadvantages of game-based learning?

RQ3: What kinds and forms of learning games would students like to experience while game-based learning?

1 Literature review

To define the research framework of the investigation on the experience of university students with game-based learning, the findings of research studies dealing with game-based learning in higher education and published in the Web of Science in recent years are presented. Emphasis is placed on defining the concept, benefits, and issues of game-based learning in the frame of higher education.

Game-based learning is generally known as an innovative educational approach using digital and non-digital learning games providing more practical and enjoyable learning experiences (Nadolny et al. 2017). Advocates of game-based learning usually argue that game-

based learning can supplement traditional educational approaches and enhance learning effectiveness, while critics of game-based learning commonly argue that the learning games used often do not meet the learning objectives and that the game-based learning is more about funny playing than valuable learning (Belova & Zowada, 2020).

Game-based learning benefits traditional lectures and seminars by using specific game elements such as cooperation, communication, and competition, which enable students to develop their creativity, critical thinking, and problem-solving (Zhao et al., 2022). Lectures and seminars founded on game-based learning principles and practices should positively affect the motivation and participation of students. For example, Crocco et al. (2016) proved a positive effect of game-based learning on the enjoyable learning experience and the improvement of learning outcomes, even in courses that raised concerns of students, such as mathematics or science. Jaaska and Aaltonen (2022) revealed a positive effect of game-based learning in project management courses where students could simulate different decision-making situations without the risk of making serious mistakes. The use of game-based learning positively influenced student motivation and engagement. However, these positive effects were determined by the active preparation and participation of both teachers and students. Similarly, Daniel et al. (2024) confirmed a positive effect of game-based learning on the development of management skills of students, whereby students with a previous game-based learning experience were more successful.

Vodenicharova (2022) sees the major challenges of using game-based learning in higher education in changing the existing attitudes and approaches of both teachers and students. Moylan et al. (2015) see the main challenge of using game-based learning in higher education in ensuring proper sources to develop advanced learning games comparable in quality to commonly used commercial games while ensuring that these games provide valuable learning content that meets the requirements of higher education. Leitner et al. (2023) argue that another great challenge for using game-based learning today is the introduction of artificial intelligence (AI) tools, the knowledge of which becomes a core competence. They see a great opportunity in combining elements of game-based learning and artificial intelligence, as problem-solving in both is based on the same foundations. To make game-based learning meaningful and motivating, Gonzalez Perez and Alvarez Serrano (2022) suggest choosing learning games according to the knowledge to be developed. At the same time, it is necessary to support interaction between students to enable them to share their knowledge.

Research findings prove that game-based learning is a progressive phenomenon in higher education, intensified both by the demand for enjoyable and practically oriented learning as well as by the development of information technologies that enable the application of interactive game elements. However, game-based learning should supplement rather than replace traditional learning methods. A potential research gap lies in knowing the interest of students in specific learning game arrangements and their impact on the development of particular knowledge and skills of students. This paper provides insight into the experience of university students with game-based learning and contributes to understanding the kinds and forms of learning games students would like to experience while game-based learning.

2 Methodology

The investigation of the experience of university students with game-based learning is founded on a questionnaire survey covering the responses of 164 students of all three years of the bachelor's program in Economics and Management at the Masaryk Institute of Advanced Studies (MIAS) of the Czech Technical University (CTU) in Prague.

The questionnaire survey was carried out in September 2024. A total of 350 students were addressed as follows: 150 first-year students, 100 second-year students, and 100 third-year students. By September 30, 2024, responses were obtained from 164 students, representing a return rate of roughly 47%. Students were addressed by email containing a link to an online questionnaire created in Google Forms. The online questionnaire used contained a total of 20 questions divided into four sections: A/ approach to learning (4 questions), B/ video game playing experience (4 questions), C/ game-based learning experience (8 questions), and D/ data on respondents (4 questions). The respondents were characterized by gender, age, year of study, and working while studying (see Table 1).

Tab. 1: The characteristics of respondents (N=164)

Gender	Male	29%
	Female	71%
Age	20 and less	41%
	21-24	59%
Year of study	First	37%
	Second	32%
	Third	31%
Working while studying	Yes	75%
	No, but I want to (I plan to)	23%
	No, and I don’t want to (I don’t plan to)	2%

Source: authors, 2024

The characteristics of the respondents by working while studying revealed that most of the students, regardless of year of study, work while studying or plan to, including first-year students. Among them, 31% of students were already working and 50% of students planned to work while studying. This confirms the trend that more and more students want to gain some work experience already during their studies.

The Microsoft Excel application was used to analyze the obtained data by calculating the relative response rates and by evaluating the dependence of responses on the year of study. To verify the dependence of responses on the year of study, the chi-square test of independence for the contingency table (χ^2) and a significance level of 0.05 was performed using Formula 1. The procedure of performing the test included the definition of null (H_0) and alternative (H_A) hypotheses, the calculation of chi-square statistics (χ^2), the determination of critical chi-square value for the significance level of 0.05 ($\chi^2_{0,05}$), the comparison of the calculated chi-square statistics (χ^2) with the determined critical chi-square values ($\chi^2_{0,05}$), and the final decision, including the rejection/non-rejection of the null hypothesis (H_0) in favor of the alternative hypothesis (H_A) if the calculated chi-square statistic (χ^2) was higher/not higher than the determined critical chi-square value ($\chi^2_{0,05}$),

$$\chi^2 = \sum \left[\frac{(O_{r,c} - E_{r,c})^2}{E_{r,c}} \right] \quad (1)$$

χ^2 – chi-square statistics;
O – observed frequencies;
E – expected frequencies;
r, c – the number of rows and columns in the contingency table.

3 Results

The responses of 164 students of the bachelor's program in Economics and Management at MIAS CTU in Prague related to their experience with game-based learning are presented in three parts: 1/ students' approach to learning, 2/ students' experience with playing video games, and 3/ students' experience with game-based learning.

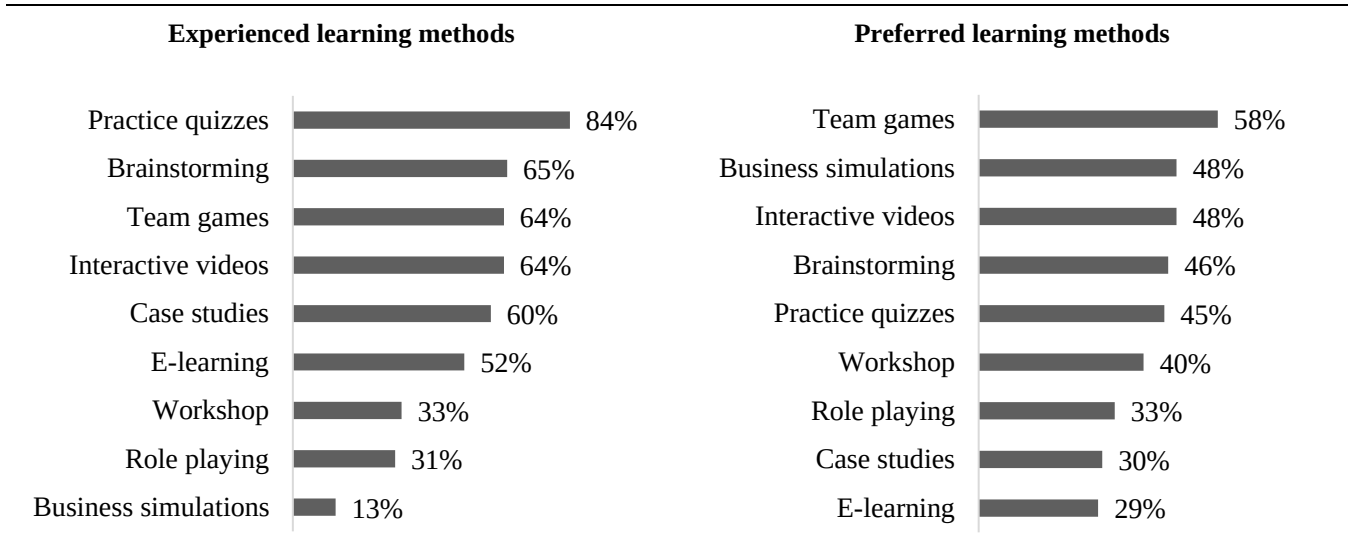
3.1 Students' approach to learning

The successful application of game-based learning requires the active participation of students. Therefore, the first four questions investigated students' approach to learning, in particular, what are the students' motives for learning and which learning methods they prefer compared to which learning methods they experience. Knowing these facts is important for choosing

the right kinds and forms of learning games for both enjoying the game and developing the required knowledge, skills, and abilities. Specifically, the first question asked students what motivates them to learn to which students most often stated such options as an interesting topic (84%), gaining knowledge (70%), and improving skills (70%). In this context, the second question asked students how often they learn something new to which students most often stated such options as several times a week (45%), several times a month (22%), and every day (18%).

Students' motivation to learn and learn something new is largely determined by the learning methods used. Therefore, the third and fourth questions asked students which learning methods they experience and which learning methods they prefer (see Figure 1). Among the preferred learning methods, interactive learning methods prevail.

Fig. 1: Experienced and preferred learning methods (N=164)



Source: authors, 2024

3.2 Students' experience with playing video games

Many learning games providing the game-based learning experience are digitally oriented and by their concept are similar to the modern video games that people normally play. Therefore, the second four questions investigated students' experience with playing video games. The assumption was that most students had experience playing video games and would also prefer learning games to be based on video games. Again, knowing these facts is important for choosing the right kinds and forms of learning games for both enjoying the game and developing the required knowledge, skills, and abilities.

Specifically, the fifth question asked students how often they play video games to which students most often stated such options as occasionally (41%), not at all (26%), several times a week (17%), several times a month (9%), and every day (7%). Most students do not play video games very often. In this context, the sixth question asked students what motivates them (or would motivate them) to play video games to which students most often stated such options as having fun (71%) and getting away from the ordinary duties (70%). Only 15% of students stated the option of playing video games to learn.

The seventh question asked students which of the game genres they find the most interesting to which students most often stated such options as adventure (22%), strategy (18%), action (14%), simulation (12%), and logic (11%). In this context, the eighth question asked students which gaming platform they find the best to which students most often stated such options as PC (54%), game console (21%), smartphone (18%), and tablet (7%).

3.3 Students' experience with game-based learning

The third eight questions investigated the experience of students with game-based learning to assess their attitude to game-based learning and perceived barriers, advantages, and disadvantages of game-based learning. The ninth question asked students whether they have ever experienced game-based learning to which students stated yes, at school (56%), yes, at school and work (14%), and yes, at work (5%). Only 25% of students have not experienced game-based learning yet. To verify the dependence of the experience of students with game-based learning on their year of study, the chi-square test of independence for the contingency table (χ^2) was performed (see Table 2).

Tab. 2: The experience of students with game-based learning (N=146)

	Have you ever experienced game-based learning?				
Year of study	**Yes, at school**	**Yes, at work**	**Yes, at school and work**	**No**	**∑**
First	37	1	6	16	**60**
Second	26	6	9	12	**53**
Third	29	1	8	13	**51**
∑	**92**	**8**	**23**	**41**	**164**
H_0: The experience of students with game-based learning does not depend on the year of study. H_A: The experience of students with game-based learning depends on the year of study.					
Chi square statistic $\chi^2 = 8.787$ Critical chi-square value $\chi^2_{0.05}(6) = 12.592$					
The H_0 was not rejected. The experience of students with game-based learning does not depend on the year of study.					

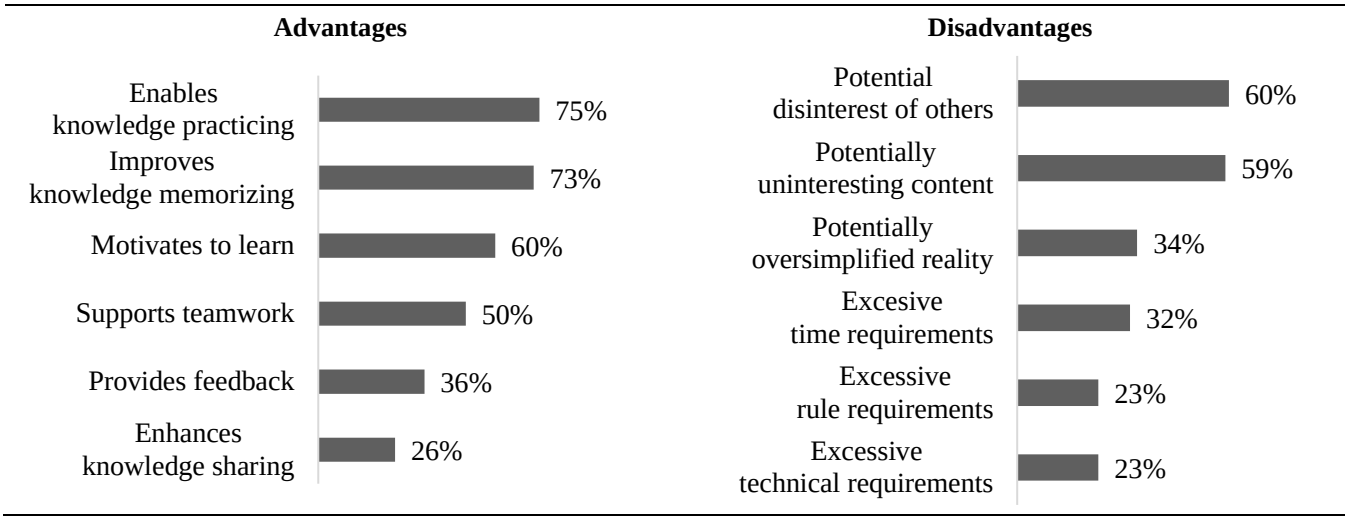
Source: authors, 2024

The null hypothesis was tested that the experience of students with game-based learning does not depend on the year of study. Since the chi-square statistic [χ^2] was lower than the critical chi-square value [$\chi^2_{0,05}(6)$], the null hypothesis was not rejected. There was no significant difference in responses depending on the year of study. This confirms that students experience learning both at school and at work, with first-year students having experienced learning already at secondary schools.

The attractiveness of game-based learning for students largely depends on the topic of the learning games applied, whether in digital or non-digital form, as well as on the game elements implemented. Therefore, the tenth question asked students which learning game would they most like to play to which students most often stated such options as the role of a starting entrepreneur trying to run an inherited hotel (27%), the role of a lone adventurer trying to survive on a desert island (14%), the role of sales manager enhancing the performance of the sales team (13%), the role of a sports coach trying to lead the team to victory in the national league (11%), and the role of a security expert trying to uncover security gaps in the bank (10%). All of these learning games are very adventurous, but most of them are near to real situations that people regularly face, either in their business or their occupation. Knowing which learning games students would most like to play is important for choosing the right kinds of learning games for both enjoying the game and developing the required knowledge, skills, and abilities. Following this, the eleventh question asked students what game elements should the game-based learning include to be fun to which students most often stated such options as gaining points and rewards (63%), advancement to higher levels (59%), and competition with others (50%).

The twelfth question asked students whether they would like to experience more game-based learning to which students stated yes (71%), don't know (24%), and no (5%). In this context, the thirteenth question asked students what barriers to game-based learning they perceive as important to which students most often stated such options as an uninteresting topic (69%), unclear assignment (59%), time-consuming going (37%), too easy or too difficult (36%), excessive competitiveness (31%), and unsatisfactory interactivity (29%). In this context, the fourteenth and fifteenth questions asked students what advantages and disadvantages of game-based learning they perceive (see Figure 2).

Fig. 2: Advantages and disadvantages of game-based learning (N=164)



Source: authors, 2024

Perceived advantages of game-based learning are mostly related to knowledge practicing and memorizing, while perceived disadvantages of game-based learning are mostly related to the potential disinterest of others and potentially uninteresting content.

The last sixteenth question asked students which forms of learning games they find the best to which students most often stated such options as a computer game (37%), interactive presentation (35%), oral assignment (15%), and written assignment (12%). The assumption is that game-based learning should be applied within regular lectures and seminars to provide students with practical and enjoyable learning experiences. Knowing preferred forms of learning games is important for choosing the right forms of learning games for both enjoying the game and developing the required knowledge, skills, and abilities.

4 Discussion

The investigation of the experience of 164 students of the bachelor's program in Economics and Management at MIAS CTU in Prague with game-based learning revealed that most of the surveyed students have experienced game-based learning both at school and at work (RQ1). The results also revealed that most of the surveyed students, regardless of year of study, work while studying or plan to, which naturally allows most of them to confront the learned theory with real practice (Hojda et al., 2022). The potentially experienced gap between what school teaches and what work requires then leads many students to demand more practical applications of theory for better preparation for practice (Skrinjaric, 2023). Similar demands are also heard from companies that employ students and graduates (Green & Henseke, 2021). One way to

provide students with more practical applications of theory is through game-based learning (Vodenicharova, 2022).

The results uncovered that most of the surveyed students would like to experience more game-based learning, although they perceive specific barriers, advantages, and disadvantages of game-based learning (RQ2). On the one hand, students recognize that game-based learning enhances the knowledge practicing and memorizing. On the one hand, students point to potential issues of using game-based learning, such as potentially uninteresting content, unclear assignments, unsatisfactory interactivity, potential disinterest of others, or excessive time and technical requirements.

To achieve effective and efficient use of game-based learning that would meet the expectations of students regarding a beneficial learning experience (Crocco et al., 2016), it is necessary to pay attention to the kinds and forms of learning games used (RQ3). The results showed that students would enjoy adventure learning games dealing with real situations, such as running an inherited hotel, enhancing the performance of a sales team, leading a sports team to victory, or uncovering security gaps in a bank. To be fun, the learning game should contain specific game elements, such as gaining points and rewards, advancement to higher levels, and competition with others. The learning game should ideally take the form of a computer game or an interactive presentation accessible through a PC, smartphone, or tablet. However, oral or written assignment of the learning game is also acceptable.

Following the results of the investigation, it can be stated that most of the surveyed students would welcome more game-based learning that delivers topically interesting and visually attractive content that motivates learning. To enhance the development of game-based learning in higher education, it is suggested to apply various digital and non-digital learning games offering an opportunity to put theory into practice, experience social interaction, and receive performance feedback in a fun and clear way.

Conclusion

The investigation on the experience of university students with game-based learning confirmed that most of the surveyed students would like to experience more game-based learning. The challenges of the development of game-based learning in higher education could be seen in delivering topically interesting and visually attractive content that motivates learning. Such content could lead to expected benefits of game-based learning such as the application of learned knowledge in practice. The issues associated with the effective and efficient use of

game-based learning are related to finding the appropriate kinds and forms of various digital and non-digital learning games that would meet the need of students to put theory into practice in a fun and clear way.

The results are limited by a small research sample including only students of one bachelor's program in Economics and Management at one institution. This limitation is somewhat compensated by the inclusion of students from all three years of study. However, the limitation should not affect the application of the suggested kinds and forms of game-based learning in other fields or educational levels. The essence is to find a balance between what students enjoy and what they need to learn. The chosen kinds and forms of game-based learning must correspond to both the preferences of the students and the possibilities of the universities, mainly in terms of curricula and technology. In other words, traditional lectures and seminars can be enhanced by game-based case studies, role-playing, and simulations. The result depends only on the interest of teachers and students, not on the field or the educational level.

The results can be applied in the design of game-based learning activities by educators in different educational institutions. Further research following the results could be aimed at assessing of efficiency of various digital and non-digital learning games in delivering topically interesting and visually attractive content that motivates learning.

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References

Belova, N., & Zowada, C. (2020). Innovating higher education via game-based learning on misconceptions. *Education Sciences*, *10*(9). https://doi.org/10.3390/educsci10090221

Crocco, F., Offenholley, K., & Hernandez, C. (2016). A proof-of-concept study of game-based learning in higher education. *Simulation & Gaming*, *47*(4), 403-422. https://doi.org/10.1177/1046878116632484

Daniel, A. D., Negre, Y., Casaca, J., Patrício, R. & Tsvetcoff, R. (2024). The effect of game-based learning on the development of entrepreneurial competence among higher education students. *Education and Training*. https://doi.org/10.1108/ET-10-2023-0448

Gonzalez Perez, A., & Alvarez Serrano, A. (2022). Game-based learning for second language acquisition in higher education. *International Journal of Technology and Educational Innovation*, *8*(2), 114-128. https://doi.org/10.24310/innoeduca.2022.v8i2.13858

Green, F., & Henseke, G. (2021). Europe's evolving graduate labour markets: supply, demand, underemployment and pay. *Journal for Labour Market Research*, *55*(2). https://doi.org/10.1186/s12651-021-00288-y

Hojda, P., Roszkowska, S., & Trojak, M. (2022). What drives labour market success? Empirical analysis of university graduates in Poland. *Education and Training*, *64*(5), 619-641. https://doi.org/10.1108/ET-09-2021-0354

Iriondo, I. (2022). Graduate labour market outcomes and satisfaction with university education in Spain. *PLoS ONE*, *17*(7). https://doi.org/10.1371/journal.pone.0270643

Jaaska, E., & Aaltonen, K. (2022). Teachers' experiences of using game-based learning methods in project management higher education. *Project Leadership and Society*, *3*. https://doi.org/10.1016/j.plas.2022.100041

Leitner, M., Greenwald, E., Wang, N., Montgomery, R., & Merchant, C. (2023). Designing game-based learning for high school artificial intelligence education. *International Journal of Artificial Intelligence in Education*, *33*(2), 384-398. https://doi.org/10.1007/s40593-022-00327-w

Moylan, G., Burgess, A. W., Figley, C., & Bernstein, M. (2015). Motivating game-based learning efforts in higher education. *International Journal of Distance Education Technologies*, *13*(2), 54-72. http://doi.org/10.4018/IJDET.2015040104

Nadolny, L., Alaswad, Z., Culver, D., & Wang, W. (2017). Designing with game-based learning: Game mechanics from middle school to higher education. *Simulation & Gaming*, *48*(6), 814-831. https://doi.org/10.1177/1046878117736893

Skrinjaric, B. (2023). Competence proximity to employers' requirements and labour market success of economics and business graduates. *South East European Journal of Economics and Business*, *18*(2), 140-161. https://doi.org/10.2478/jeb-2023-0024

Vodenicharova, M., (2022). Gamed-based learning in higher education. *TEM Journal*, *11*(2), 779-790. https://doi.org/10.18421/TEM112-35

Zhao, D., Muntean, C. H., Chis, A. E., Rozinaj, G., & Muntean, G. M. (2022). Game-based learning: Enhancing student experience, knowledge gain, and usability in higher education programming courses. *IEEE Transactions on Education*, *65*(4), 502-513. https://doi.org/10.1109/TE.2021.3136914

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