Increasing Understanding of Foreign Language Vocabulary Through Technology-Based Educational Games

Anggun Pertiwi[1] ⓘ, Haris Danial[2] ⓘ, Sardian Maharani Asnul[3] ⓘ, Dahlan Abdullah[4] ⓘ

[1]Universitas Buana Perjuangan, Indonesia

[2]Universitas Negeri Gorontalo, Indonesia

[3]Universitas Islam Negeri Alauddin, Indonesia

[4]Universitas Malikussaleh Aceh, Indonesia

ABSTRACT

Background. In the 21st century learning era, innovation in learning methods is crucial. Educational games stand out as an interesting and effective solution to improve the quality of learning. In particular, foreign language learning requires a more interactive and fun approach to motivate students.

Purpose. The main aim of this research is to measure the extent to which technology-based educational games can improve understanding of foreign language vocabulary. In addition, this research evaluates the level of satisfaction and motivation of students in using educational games as a means of learning vocabulary.

Method. With a quantitative approach and survey design, this research involved 30 language students. The use of the method of drawing student numbers for sample selection and distributing the questionnaire link via the WhatsApp group with a random technique ensures representativeness and voluntary participation of respondents. The research instrument was a structured questionnaire.

Results. The results of the questionnaire showed that 70% of respondents expressed satisfaction with the use of educational games, with 30% of them feeling 'Very Satisfied.' In terms of motivation, 87% of respondents reported increased motivation after using educational games, where 30% said 'Very Improved' and 56.7% said 'Improved.' Even though 13.3% of respondents felt 'Neutral' regarding increasing motivation, this does not reduce the positive impact felt by the majority of participants.

Conclusion. The use of educational games is effective in increasing student satisfaction and motivation in learning foreign language vocabulary. The game's attractiveness factors, reward system, and level achievement are the main contributors to a positive experience. Variations in levels of satisfaction and motivation can be used as a basis for further development and optimization of educational game designs according to student preferences and expectations. This conclusion provides a basis for improving the quality of foreign language learning at the tertiary level.

INTRODUCTION

In the era of globalization and technological advances of the 21st century, foreign language learning plays a key role in preparing students to face the challenges

of an increasingly connected world ("7. The Industrial Age (1800–2000)," 2019). Understanding vocabulary is the main basis for understanding and communicating in a foreign language (Sari & Aminatun, 2021). However, foreign language students are often faced with the challenge of mastering vocabulary effectively and pleasantly amidst the dynamics of 21st century learning.

Traditional vocabulary learning methods, such as reading books, listening, and memorizing words, are often considered less responsive to the needs of today's students (Schmitt, 2019). This is where the role of technology, especially through the use of technology-based educational games, gives rise to revolutionary opportunities in enriching and improving the process of learning foreign language vocabulary. By using technology in learning, it is hoped that it can create a more interactive, adaptive and interesting learning environment for students (Hassan et al., 2021).

The importance of vocabulary mastery is not only limited to academic needs, but is also relevant to the needs of the world of work which increasingly demands cross-cultural communication skills (Du, 2022). Today's students not only need to master vocabulary mechanically, but also need critical thinking skills, creativity and the ability to adapt to technological developments (Permana et al., 2019). Therefore, learning foreign languages with an innovative approach, such as through educational games, can not only improve vocabulary understanding, but also form essential cognitive and social skills in facing the challenges of the 21st century.

By understanding the complexity of foreign language learning and its important role vocabulary in it, we can see that the integration of technology-based educational games can be a relevant answer to the needs of today's students (Nagy, 2021). Educational games are able to create a fun learning experience, combining competitive, collaborative and adaptive elements to provide a more interesting and effective learning atmosphere (Almeida & Simoes, 2019). Therefore, research on increasing understanding of foreign language vocabulary through technology-based educational games is not just an academic experiment, but a progressive step in initiating learning innovations that are relevant to the demands of the times.

Previous research on the use of games in education has attracted attention from educators who see games as motivational tools that can improve their teaching and learning practices. Gamification in education is a relatively new field that encourages the use of games for educational purposes. Gamification or game-based teaching is a growing trend among educational institutions, which use it to promote training, develop problem-solving skills in learners, and enhance the learning experience. This research aims to review the literature on the use of gamification in educational settings, specifically in the ESL/EFL context for English language teaching and learning. Games have been proven effective in improving speaking, listening, writing, reading and grammar skills in language learners (Abdeen & Albiladi, 2021).

This study evaluates the relationship between academic motivation and the use of educational technology in learning English as a foreign language (EFL). Related studies show a significant positive correlation. However, further research is needed to understand the impact of Mobile-Assisted Language Learning (MALL) and Computer-Assisted Language Learning (CALL) on learner motivation. The literature shows that the attractiveness, effectiveness, and usefulness of digital tools can increase motivation. Factors such as integration with the community, cultural knowledge, input opportunities, academic engagement, and interaction with native speakers also contribute to increased motivation. Pedagogical implications are presented to increase enthusiasm and reduce learner anxiety. Meanwhile, further research is recommended to explore emotional variables such as motivation (Wei, 2022).

This research evaluates the impact of using digital games in learning English as a foreign language (EFL) in Bangladesh. A total of 78 students took the Oxford Quick Placement Test, and 50 students were selected for the target group. They were divided into experimental group (EG) and control group (CG). EG was taught with digital games, while CG received traditional instruction. After teaching 90 vocabulary words, posttests showed significant differences between EG and CG, with EG superior on both immediate and delayed posttests. This research has important implications in vocabulary teaching and learning (Patra et al., 2022).

The conclusions from three previous studies show that the use of technology, especially educational games and digital games, is effective in increasing foreign language understanding, academic motivation, and vocabulary retention. These results support the aim of further research which aims to measure the extent to which technology-based educational games can improve understanding of foreign language vocabulary, as well as evaluate the level of student satisfaction and motivation in using this learning method. The implications of these studies can guide the design of learning strategies that combine the advantages of educational technology with the potential for academic motivation and vocabulary retention, making a positive contribution to the development of innovative and effective foreign language learning in the future.

The importance of understanding vocabulary in foreign language learning is a strong reason for conducting this research. Foreign language students often have difficulty absorbing and remembering vocabulary, so an innovative approach is needed that can solve this problem. With technology, educational games can be an interesting and effective solution for improving vocabulary understanding. Therefore, this research aims to explore the extent of the potential of technology-based educational games in improving understanding of foreign language vocabulary.

This research uses a quantitative method by distributing questionnaires to language students at various universities. The questionnaire was designed to measure the level of vocabulary understanding before and after using technology-based educational games. By collecting data from language students, this research is expected to provide a clearer picture of the effectiveness and acceptability of educational games as a vocabulary learning tool.

The main aim of this research is to measure the extent to which technology-based educational games can improve understanding of foreign language vocabulary. Apart from that, this research also aims to evaluate the level of satisfaction and motivation of students in using educational games as a means of learning vocabulary. Thus, it is hoped that the results of this research can make a positive contribution to the development of more innovative and effective foreign language learning methods in the higher education environment.

RESEARCH METHODOLOGY

This research adopts a quantitative approach with a survey design to explore the impact of using technology-based educational games in improving understanding of foreign language vocabulary among language study program students (Dutot et al., 2019). The research population included all language students, and a sample of 30 respondents was selected randomly using the student number lottery method. The aim is to ensure sample representativeness and diversity of research participants. The sampling procedure involves random techniques in distributing questionnaire links.

To achieve this, the questionnaire link was distributed via the WhatsApp (WA) group which is a popular media among students. The use of random techniques in link distribution aims to minimize bias and ensure that respondent participation is voluntary. The research instrument is a carefully designed questionnaire to explore information related to understanding foreign language

vocabulary and experiences using educational games. The questionnaire includes structured questions that can provide an in-depth picture of the effectiveness of educational games in the context of foreign language learning.

Data analysis was carried out by applying Miles Huberman's theory to explore patterns and relationships between the variables studied (Madjdi & Rokhayani, 2021). Through descriptive and inferential statistical analysis, this research aims to provide a deeper understanding of the extent to which technology-based educational games can make a positive contribution to the understanding of foreign language vocabulary among students. Thus, this research methodology is designed to provide a comprehensive and accurate picture of the impact of using educational games in the context of foreign language learning at the tertiary level.

RESULT AND DISCUSSION
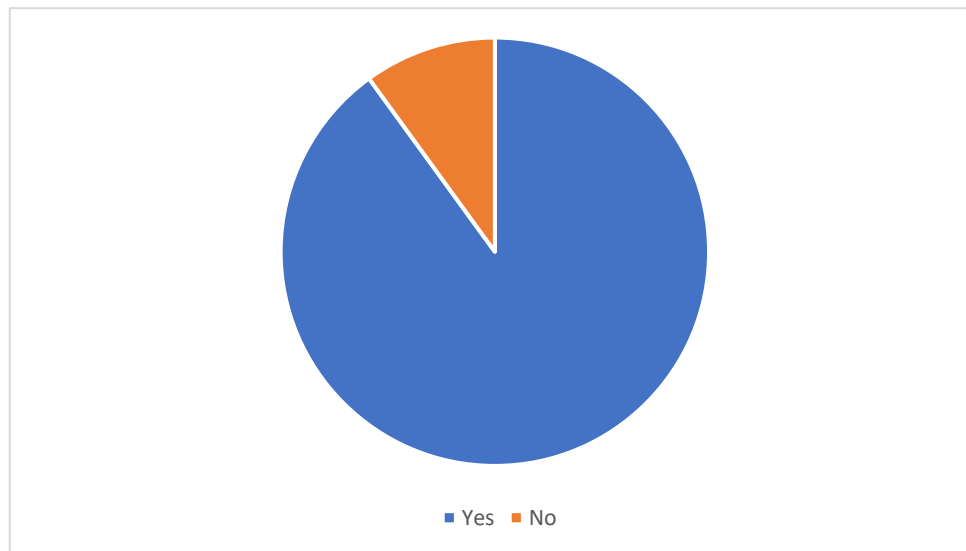### Technology Based Educational Games

Technology-Based Educational Games are an innovation in the world of education that explores the potential of technology to improve the learning process (Qurat-ul-Ain et al., 2019). By using game elements, such as challenge, strategy, and intrinsic motivation, technology-based educational games not only teach educational concepts, but also create interactive and fun learning experiences (Zhao et al., 2022). In this context, technology is not only considered as a tool, but as a medium that provides opportunities for deeper and more effective learning. One of the distinctive characteristics of technology-based educational games is their ability to personalize the learning experience (Xie et al., 2019). By providing customizable levels, this game can accommodate students' individual needs and skill levels. This allows each student to learn at their own pace, creating an environment that supports better understanding and retention of information. In addition, instant feedback and rewards in games can motivate students to continue trying and improve their achievements.

In this digital era, technology-based educational games also provide the possibility for collaborative learning (Chang & Hwang, 2019). Some games provide social features that allow students to interact, share experiences, and work together to complete educational tasks. Thus, these games not only help in developing academic knowledge, but also social, collaborative, and communicative skills that are critical in a connected global society (Bedir, 2019).

Nonetheless, it is important to conduct an in-depth evaluation of the effectiveness of technology-based educational games (Chen et al., 2019). This involves analysis of student engagement, understanding of concepts, and achievement of learning outcomes. Empirical research and quantitative data analysis, such as those conducted in this study, provide more accurate insights into the positive impact and development potential of technology-based educational games.

In the face of continued technological developments, technology-based educational games play a key role in changing the landscape education (Escueta et al., 2020). Bridging the gap between technology and learning, this game creates a dynamic and engaging learning space, having a positive impact on understanding and motivation to learn (Zeng et al., 2020). Therefore, combining technology with education through technology-based educational games is an innovative step that gives hope for creating a generation that is more skilled, creative, and ready to face future challenges.

Based on interviews with 30 students with the question: Have you ever used educational games? technology-based to learn a foreign language beforehand? With yes and no answer options. With the following answer results:

**Figure 1.** Have you ever used educational games?

The results of the questionnaire analysis highlight interesting trends regarding the use of technology-based educational games in foreign language learning among university students. Of the total of 30 respondents, 27 students, or around 90%, indicated that they had used technology-based educational games to learn foreign languages. In answering this question, students identified several popular platforms and applications that they had utilized, such as Duo Lingo and several mobile games designed specifically for learning Arabic.

It is interesting to note that the majority of students chose to use these games as an alternative and interesting approach in honing their foreign language skills. Technology-based educational games, such as Duo Lingo, have become known for providing interactive and fun learning experiences, allowing users to learn languages in a more relaxed and unconventional way. The presence of a large number of students who have adopted and applied these games confirms that this method has attracted interest and received a positive response from the majority of research participants.

However, although the majority of respondents have utilized technology-based educational games, a small number of students, namely 3 people from 30 respondents stated that they had never used these games in the context of foreign language learning. Although this proportion is relatively small, these findings indicate that there is a small portion of students who may not be familiar with or have not chosen to use technology-based educational games in their efforts to deepen their understanding of a foreign language. This phenomenon is interesting to understand further and may be used as a basis for further strategies in increasing student acceptance and participation in the use of technology-based educational games.

Overall, the results of this question provide a fairly rich picture of the use of technology-based educational games among students. students in the context of foreign language learning. Further analysis regarding how the use of these games relates to students' levels of vocabulary understanding and learning motivation could provide deeper insight into the potential and challenges in adopting this technology in foreign language learning spaces in higher education environments.

The next question, According to your own assessment, What is the level of understanding of foreign language vocabulary when using language educational games? With the following answer options: Very Low, Low, Medium, High and Very High. With the following answer results:
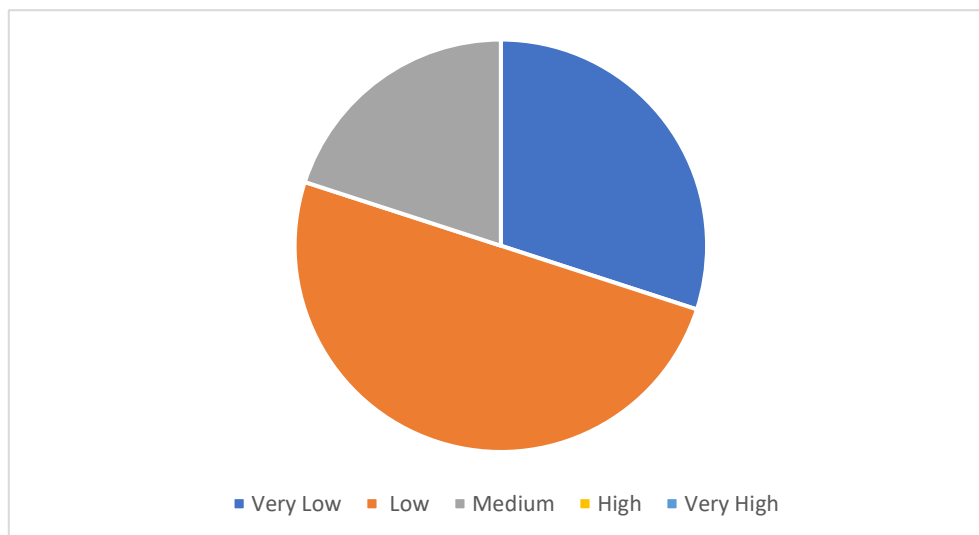
Figure 2. What is the level of understanding of foreign language vocabulary when using language educational games?

From the results of the analysis of questions related to self-assessment of the level of understanding of foreign language vocabulary before using language educational games, it appears that the majority of respondents had quite positive perceptions of their level of understanding before engaging with these educational games. A total of 15 respondents, or half of the total 30 participants, stated that their vocabulary understanding before using educational games was at a low level. Meanwhile, 9 respondents indicated that their previous understanding of vocabulary was very low, and 6 respondents considered their understanding to be moderate.

These results illustrate that there were variations in the level of understanding of foreign language vocabulary before the adoption of educational games. Most respondents recognized there was room for improvement and improvement in their vocabulary understanding. Factors such as diversity of educational backgrounds and previous experiences can influence these perceptions.

As part of the research findings, this information can be the basis for understanding in more detail the impact of educational games on improving understanding of foreign language vocabulary among college students. Furthermore, further analysis can be carried out to explore the relationship between the initial level of understanding and the development of understanding after using educational games, so as to provide a more holistic view of the effectiveness of this method in the context of foreign language learning.

Next question, Do you feel that your vocabulary understanding has improved? increased after using technology-based educational games? With the following answer options: Very Increased, Increased, No Change, Decreased and Very Decreased. With the following answer results:
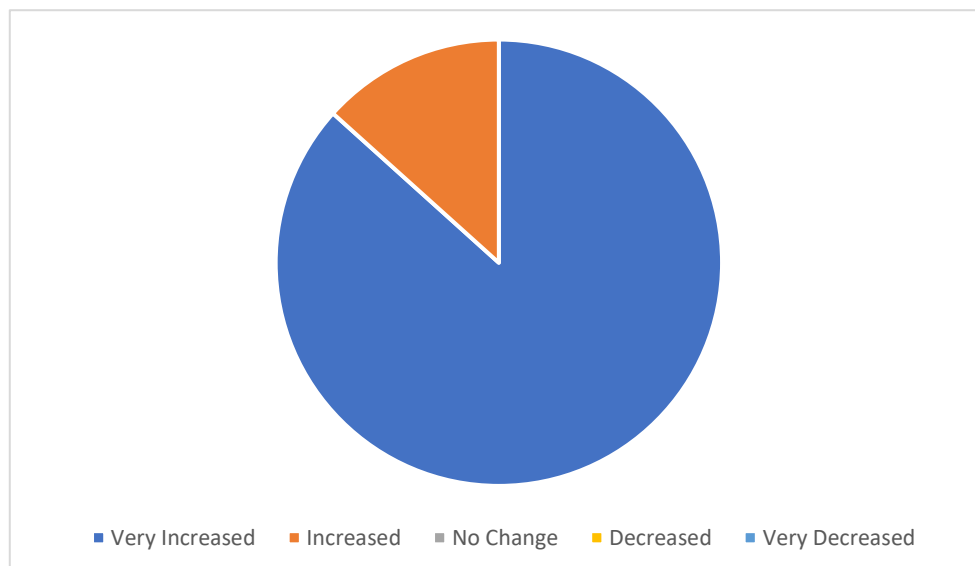
Figure 3. Do you feel that your vocabulary understanding has improved? increased after using technology-based educational games?

The results of questions regarding subjective assessments of increasing vocabulary understanding after using technology-based educational games showed positive indications from the majority of respondents. Of the 30 participants, 26 people or around 87% stated that they experienced an increase in vocabulary understanding after being involved with the educational game. Furthermore, of the 26 respondents who experienced an increase, 4 of them even stated that the increase was very significant.

This finding reflects the effectiveness of technology-based educational games in supporting increased understanding of foreign language vocabulary. This increase may be due to the use of more interactive and fun methods, which can help students to be more involved in the learning process. In addition, the instant feedback that is often included in educational games can also be a contributing factor in increasing awareness and understanding of concepts.

However, keep in mind that there is a small number of respondents who may not experience significant improvement or even experience a decrease in understanding. These factors may involve individual preferences, learning styles, or previous skill levels in understanding a foreign language. Therefore, further analysis can be conducted to understand these differences and identify factors that influence varying results among research participants.

Satisfaction and Motivation

Motivation plays a key role as the main driver in language learning activities through the use of games (Yu et al., 2021). In this context, motivation includes a series of internal factors that stimulate individuals to engage and persist in the learning process. One element that stands out in games as a language learning tool is the setting of challenges and rewards (Zhang & Zou, 2022). Smartly designed challenges inspire interest and enthusiasm for learning, while reward systems, such as points or recognition for certain achievements, provide positive incentives that can spur motivation (Tolentino & Roleda, 2019). By combining challenge and reward, games create a dynamic learning environment, where motivation serves as a catalyst for achieving language learning goals.

Increasing levels in the game also acts as a motivational driving factor (Huang et al., 2019). Increasing levels brings not only ever-increasing challenges, but also an increased feeling of accomplishment as users successfully complete tasks or reach higher levels (Luo et al., 2022). In the

context of language learning, increasing levels provides a gradual level of difficulty, leaving room for the user to experience progress in language comprehension and, at the same time, maintaining a high level of motivation (Papi & Hiver, 2020).

The competitive aspect of online games also makes a significant contribution to motivation (Esteves et al., 2021). When users compete with each other, the sense of competition can be a powerful stimulant to achieve better results. The existence of a leaderboard or recognition of the highest achievements gives a social dimension to the competition, creating an extra incentive to actively participate in language learning activities through games (Bai et al., 2021).

However, it is important to understand that motivation is not a static entity; rather, it is a dynamic cycle (Mau et al., 2020). High motivation creates a positive circle where students are more likely to participate actively, try to achieve goals, and feel satisfaction in the learning process (Cecchini et al., 2019). In designing and implementing games as language learning tools, game design and motivational strategies must be carefully considered in order to effectively support users to remain engaged and enthusiastic in the language learning journey (Zhang & Zou, 2022).

After distributing a questionnaire with the question: How satisfied are you with the use of educational games in learning foreign language vocabulary? With answer options: Very Satisfied, Satisfied, Quite Satisfied, Not Satisfied and Not Satisfied At All. With the following answer results:
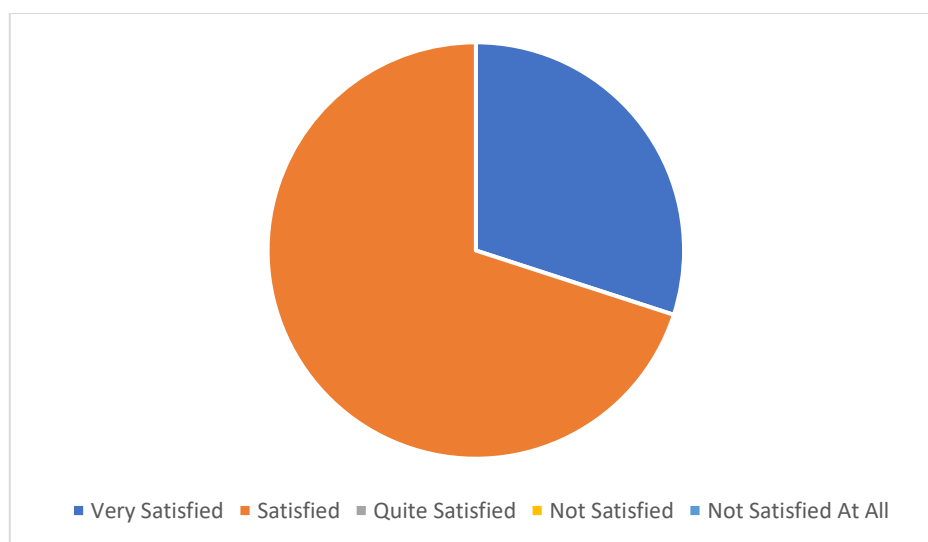
Figure 4. How satisfied are you with the use of educational games in learning foreign language vocabulary?

The results of the questionnaire showed a positive response to the use of educational games in learning foreign language vocabulary. A total of 9 respondents expressed a high level of satisfaction by giving the answer 'Very Satisfied,' while 21 other people expressed satisfaction by choosing the option 'Satisfied.'

The 'Very Satisfied' answer from the majority of respondents reflects a significant level of satisfaction with the experience of using educational games. This means that the educational game succeeded in creating a satisfying and effective learning experience for the majority of participants. This success may be due to the visual appeal, interactivity, and game elements integrated into vocabulary learning, creating an engaging and enjoyable learning environment.

Meanwhile, 'Satisfied' answers from other respondents indicate that although they are satisfied with the use of educational games, there may still be some aspects that can be improved or optimized. This could be an area for further improvement, such as diversifying game content,

adjusting difficulty levels, or integrating additional features that could enrich the learning experience.

Further analysis could involve qualitative approaches, such as interviews or group discussions, to gain deeper insight into the factors -factors that cause the level of satisfaction found in the questionnaire results. This can help educational providers or game developers to make improvements that are more specific and relevant to student needs. By understanding individual perspectives and preferences, the use of educational games in foreign language vocabulary learning can continue to be improved to provide an optimal and satisfying learning experience for all students.

The next question is, does using educational games increase your motivation in learning foreign language vocabulary? With answer options: Strongly Increase, Increase, No Change, Decrease and Very Decrease. With the following answer results:
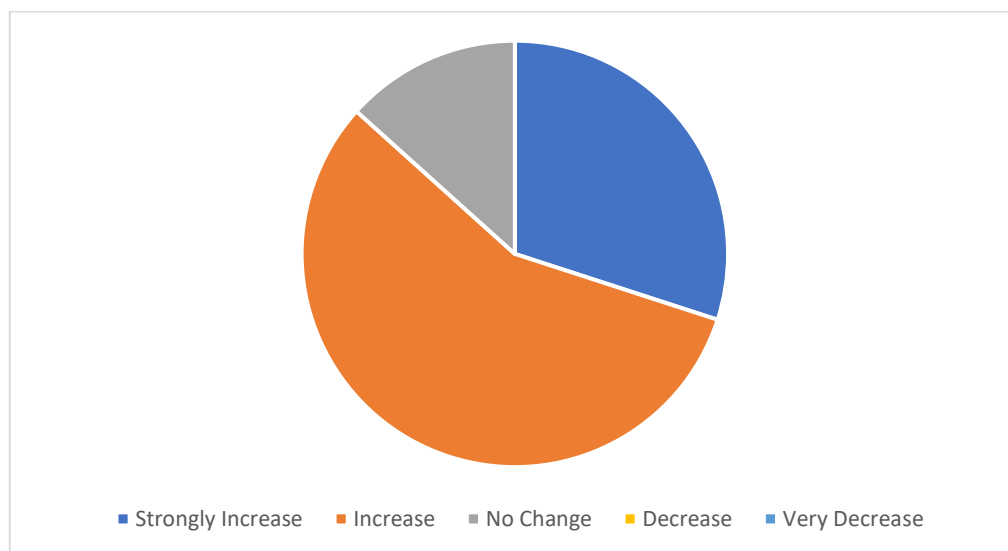
Figure 5. Does using educational games increase your motivation in learning foreign language vocabulary?

The results of answers to questions regarding the influence of the use of educational games on motivation in learning foreign language vocabulary show a significant positive trend. A total of 9 respondents stated that the use of educational games greatly increased their motivation, while 17 other people stated that their motivation increased. However, there were 4 respondents who expressed a neutral attitude towards the motivational influence of using educational games.

'Very Improved' answers from a number of respondents reflected a significant positive impact on their motivation levels. This shows that the use of educational games is not only considered an effective learning tool but also has the ability to provide a high motivational boost in the context of foreign language vocabulary learning. Factors such as game appeal, level attainment, and reward systems may contribute significantly to this increase in motivation.

Answers of 'Improved' by other respondents still indicated a positive impact, although to a slightly lesser extent than those who stated 'Improved a lot .' This confirms that the majority of participants felt increased motivation as a result of using educational games, however there was variation in the extent to which this motivational impact was felt.

Although there were 4 respondents who expressed a neutral attitude, this cannot be considered a negative impact. Neutral attitudes may be caused by various factors, including

different learning preferences or varying individual experiences in using educational games. Overall, the results of these answers indicate that the use of educational games generally has a positive impact on student motivation in learning foreign language vocabulary. Further analysis could involve in-depth discussions to understand the factors that support or hinder such motivation, and this could form the basis for further development in the use of educational games to increase learning motivation in foreign language contexts.

CONCLUSION

Based on the results of the five questionnaires conducted, it can be concluded that the use of educational games in learning foreign language vocabulary received a positive response from respondents. Most participants showed a high level of satisfaction, with 9 respondents (30%) stating 'Very Satisfied' and 21 respondents (70%) stating 'Satisfied' with the use of educational games. Furthermore, in terms of motivation, the majority of respondents also showed a positive increase in motivation. A total of 9 respondents (30%) stated that the use of educational games 'Very Increased' their motivation, while 17 respondents (56.7%) stated that their motivation 'Increased' after using educational games. Although there were 4 respondents (13.3%) who responded with a 'Neutral' attitude towards increasing motivation, this did not significantly reduce the positive impact felt by the majority of participants.

From this conclusion, it can be concluded that the use of educational games in learning foreign language vocabulary effective in increasing student satisfaction and motivation. Factors such as game appeal, reward systems, and level attainment can be major contributors to this positive experience. However, it is important to note that there was variation in levels of satisfaction and motivation among participants, and this could be investigated further to understand individual preferences and potential areas of improvement. This conclusion provides an important basis for education providers and educational game developers to continue to improve and optimize game design to better suit students' needs and expectations in the context of foreign language vocabulary learning.

AUTHORS' CONTRIBUTION

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.
Author 2: Conceptualization; Data curation; In-vestigation.
Author 3: Data curation; Investigation.
Author 4: Formal analysis; Methodology; Writing - original draft.

REFERENCES

7. The Industrial Age (1800–2000). (2019). In J. D. Sachs, *The Ages of Globalization* (pp. 129–168). Columbia University Press. https://doi.org/10.7312/sach19374-008

Abdeen, F. H., & Albiladi, W. (2021). Gamification and Technology-Based Learning: Uncovering the Potential of Using Games in Language Teaching and Learning. *Journal of Studies in Education*, *11*(2), 62. https://doi.org/10.5296/jse.v11i2.18339

Almeida, F., & Simoes, J. (2019). The Role of Serious Games, Gamification and Industry 4.0 Tools in the Education 4.0 Paradigm. *Contemporary Educational Technology*, *10*(2), 120–136. https://doi.org/10.30935/cet.554469

Bai, S., Hew, K. F., Sailer, M., & Jia, C. (2021). From top to bottom: How positions on different types of leaderboard may affect fully online student learning performance, intrinsic motivation, and course engagement. *Computers & Education*, *173*, 104297. https://doi.org/10.1016/j.compedu.2021.104297

Bedir, H. (2019). Pre-service ELT Teachers' Beliefs and Perceptions on 21st Century Learning and Innovation Skills (4Cs). *Dil ve Dilbilimi Çalışmaları Dergisi*, *15*(1), 231–246. https://doi.org/10.17263/jlls.547718

Cecchini, J. A., Carriedo, A., & Méndez-Giménez, A. (2019). Testing a circular, feedback model in physical education from self-determination theory. *The Journal of Educational Research*, *112*(4), 473–482. https://doi.org/10.1080/00220671.2018.1555788

Chang, C. Y., & Hwang, G. J. (2019). Trends in digital game-based learning in the mobile era: A systematic review of journal publications from 2007 to 2016. *International Journal of Mobile Learning and Organisation*, *13*(1), 68. https://doi.org/10.1504/IJMLO.2019.096468

Chen, Y., Mayall, H. J., York, C. S., & Smith, T. J. (2019). Parental perception and English Learners' mobile-assisted language learning: An ethnographic case study from a technology-based Funds of Knowledge approach. *Learning, Culture and Social Interaction*, *22*, 100325. https://doi.org/10.1016/j.lcsi.2019.100325

Du, N. (2022). Analysis of Teaching Strategies of College English Speculative Reading Based on Big Data Analysis of Student Behavior in Cross-Cultural Education Environment. *Journal of Environmental and Public Health*, *2022*, 1–11. https://doi.org/10.1155/2022/1385074

Dutot, V., Bhatiasevi, V., & Bellallahom, N. (2019). Applying the technology acceptance model in a three-countries study of smartwatch adoption. *The Journal of High Technology Management Research*, *30*(1), 1–14. https://doi.org/10.1016/j.hitech.2019.02.001

Escueta, M., Nickow, A. J., Oreopoulos, P., & Quan, V. (2020). Upgrading Education with Technology: Insights from Experimental Research. *Journal of Economic Literature*, *58*(4), 897–996. https://doi.org/10.1257/jel.20191507

Esteves, J., Valogianni, K., & Greenhill, A. (2021). Online social games: The effect of social comparison elements on continuance behaviour. *Information & Management*, *58*(4), 103452. https://doi.org/10.1016/j.im.2021.103452

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. https://doi.org/10.1080/10494820.2019.1588745

Huang, Y., Jasin, S., & Manchanda, P. (2019). "Level Up": Leveraging Skill and Engagement to Maximize Player Game-Play in Online Video Games. *Information Systems Research*, *30*(3), 927–947. https://doi.org/10.1287/isre.2019.0839

Luo, G., Yuan, Q., Li, J., Wang, S., & Yang, F. (2022). Artificial Intelligence Powered Mobile Networks: From Cognition to Decision. *IEEE Network*, *36*(3), 136–144. https://doi.org/10.1109/MNET.013.2100087

Madjdi, A. H., & Rokhayani, A. (2021). Lesson study in increasing student learning participation in class. *Linguistics and Culture Review*, *5*(S3), 811–817. https://doi.org/10.21744/lingcure.v5nS3.1687

Mau, W., Hasselmo, M. E., & Cai, D. J. (2020). The brain in motion: How ensemble fluidity drives memory-updating and flexibility. *eLife*, *9*, e63550. https://doi.org/10.7554/eLife.63550

Nagy, T. (2021). Using Technology for Foreign Language Learning: The Teacher's Role. *Central European Journal of Educational Research*, *3*(2), 23–28. https://doi.org/10.37441/cejer/2021/3/2/9347

Papi, M., & Hiver, P. (2020). Language Learning Motivation as a Complex Dynamic System: A Global Perspective of Truth, Control, and Value. *The Modern Language Journal*, *104*(1), 209–232. https://doi.org/10.1111/modl.12624

Patra, I., Shanmugam, N., Ismail, S. M., & Mandal, G. (2022). An Investigation of EFL Learners' Vocabulary Retention and Recall in a Technology-Based Instructional Environment: Focusing on Digital Games. *Education Research International*, *2022*, 1–10. https://doi.org/10.1155/2022/7435477

Permana, A. Y., Aprilia, D. I., & Teniola, N. Q. I. (2019). Teacher Skills Through the Development of Design and Develop Learning Program Taedes 401 (gov.au) for Building Core Skill and Employability Skills for Vocational High School. *Proceedings of the 1st Vocational*

Education International Conference (VEIC 2019). Proceedings of the 1st Vocational Education International Conference (VEIC 2019), Semarang, Indonesia. https://doi.org/10.2991/assehr.k.191217.062

Qurat-ul-Ain, Q.-A., Shahid, F., Aleem, M., Islam, M. A., Iqbal, M. A., & Yousaf, M. M. (2019). A Review of Technological Tools in Teaching and Learning Computer Science. *EURASIA Journal of Mathematics, Science and Technology Education*, *15*(11). https://doi.org/10.29333/ejmste/109611

Sari, S. N., & Aminatun, D. (2021). STUDENTS' PERCEPTION ON THE USE OF ENGLISH MOVIES TO IMPROVE VOCABULARY MASTERY. *Journal of English Language Teaching and Learning*, *2*(1), 16–22. https://doi.org/10.33365/jeltl.v2i1.757

Schmitt, N. (2019). Understanding vocabulary acquisition, instruction, and assessment: A research agenda. *Language Teaching*, *52*(02), 261–274. https://doi.org/10.1017/S0261444819000053

Tolentino, A. N., & Roleda, L. S. (2019). Gamified physics instruction in a reformatory classroom context. *Proceedings of the 10th International Conference on E-Education, E-Business, E-Management and E-Learning*, 135–140. https://doi.org/10.1145/3306500.3306527

Wei, Y. (2022). Toward Technology-Based Education and English as a Foreign Language Motivation: A Review of Literature. *Frontiers in Psychology*, *13*, 870540. https://doi.org/10.3389/fpsyg.2022.870540

Xie, H., Chu, H.-C., Hwang, G.-J., & Wang, C.-C. (2019). Trends and development in technology-enhanced adaptive/personalized learning: A systematic review of journal publications from 2007 to 2017. *Computers & Education*, *140*, 103599. https://doi.org/10.1016/j.compedu.2019.103599

Yu, Z., Gao, M., & Wang, L. (2021). The Effect of Educational Games on Learning Outcomes, Student Motivation, Engagement and Satisfaction. *Journal of Educational Computing Research*, *59*(3), 522–546. https://doi.org/10.1177/0735633120969214

Zeng, J., Parks, S., & Shang, J. (2020). To learn scientifically, effectively, and enjoyably: A review of educational games. *Human Behavior and Emerging Technologies*, *2*(2), 186–195. https://doi.org/10.1002/hbe2.188

Zhang, R., & Zou, D. (2022). Types, purposes, and effectiveness of state-of-the-art technologies for second and foreign language learning. *Computer Assisted Language Learning*, *35*(4), 696–742. https://doi.org/10.1080/09588221.2020.1744666

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