



Digital Game-Based Second Language Learning of JLPT N5 & N4 Grammatical Concepts for Japanese

Emir Medina and Marbert John Marasigan^(✉) 

Department of Physical Sciences and Mathematics, College of Arts and Sciences, University of
the Philippines Manila, Manila, Philippines
{elmedina, mcmarasigan2}@up.edu.ph

Abstract. Learning grammatical concepts and syntax of a targeted language have been a considerable research gap in Digital Game-based Language Learning (DGBLL). In particular, the development of a digital game that leverages DGBLL affordances has yet to be done in the context of the Japanese language. This paper aims to develop a digital game that facilitates second language learning of Japanese grammatical concepts based on the N5 and N4 levels of the Japanese Language Proficiency Test (JLPT). The resulting digital game, named *Bunshiki*, is a role-playing game with shoot ‘em up elements. It features gameplay mechanics that are consistent with the goal of facilitating Japanese grammar acquisition while leveraging affordances of DGBLL apps and approaches based on the two major philosophies of grammar pedagogy, namely, focus on forms (FonFs) and focus on form (FonF). A quasi-experimental test in the form of pretests and posttests was done to test the effectiveness of the game. Additionally, a usability test: the Game User Experience Satisfaction Scale (GUESS-18) was also completed by the participants. The first test has shown an improvement in their level of knowledge on JLPT N5 and N4 grammatical concepts based on the participants’ pretest scores and posttest scores. The usability test, meanwhile, boasted above average ratings across most of the categories tested.

Keywords: Digital Game-based Language Learning · Game Development · Gamification

1 Introduction

Japanese, one of the world’s major languages, has several certification examinations that operate on different contexts: the business-oriented Business Japanese Test [1], the native speaker catered Nihongo Kentei [2], and the general use J-test [3]. However, the most well-known of these certification exams is the Japanese Language Proficiency Test (JLPT). First offered by the Association of International Education in 1984, JLPT has since become the largest-scale Japanese-language test in the world [4]. It has five stages of certification, from N5 being the lowest level to N1 being the highest. N5 and N4 are

referred to as the beginner and high-beginner levels, with JLPT N4 being the minimum for skilled workers in Japan [5].

Learning another language can be very daunting. The basics of language learning hinges on input, output, and feedback [6]. As such, serious learners would seek these and find them in foreign language classrooms. Self-learning a language has always been possible through reading and flashcards, but it was only in the context of new technologies that it became more viable [7]. These include technologies such as video games which are prevalent and make up a substantial portion of screen-time, interest in the integration of language acquisition in these digital games has increasingly found interest in Computer-assisted Language Learning (CALL) research with its subfield of Digital Game-based Language Learning (DGBLL) [8, 9].

Many previous studies on DGBLL have been found to have a distinct effectiveness in vocabulary expansion but the same cannot be said for grammar [10]. This study will tackle this question along with the scarcity of development-focused studies in the field by developing a game for the learning of such grammatical concepts.

2 Theoretical Framework

2.1 Japanese

The Japanese language (日本語, Nihongo) is an East Asian language native to Japan. It is a language isolate, with very little other languages related to it. It forms its own Japonic family of languages [11]. Japanese is written in Chinese characters (漢字 Kanji), the two Kana syllabaries (カタカナ・ひらがな Katakana and Hiragana), and the Roman alphabet. Japanese has a segmental phonology that separates in morae and has some tonal characteristics [11]. The isolated status of Japanese is the result of little documentation as it was only when the Chinese writing system was introduced that the language has been recorded through literature [12].

The Japanese-Language Proficiency Test (日本語能力試験, Nihongo Nouryoku Shiken) is a standardized test that is offered since 1984 as “a reliable means of evaluating and certifying the Japanese proficiency of non-native speakers” [4]. Separated into five levels: N5 to N1, the JLPT seeks to measure communicative competence required to perform tasks. This is derived from the three elements that comprise the test: Language Knowledge, Reading, and Listening. Those who receive JLPT certifications enjoy advantages such as preferential treatment at immigration for skilled occupations, admission in Japanese medical exams, and the ability to go under the Economic Partnership Agreement (EPA) specific for nurses and caregiver candidates [13].

A significant portion of the JLPT is dedicated to grammar [14]. Japanese grammar has an SOV (Subject-Object-Verb) basic word order unlike the SVO in English. Besides the standard categorization of parts of speech (noun, verb and adjectives), case marking particles make up a sentence. Japanese grammar is typified as an agglutinative language where both verbs and adjectives inflect to change the ideas they express [12].

2.2 Second-Language Acquisition

Second-language Acquisition (SLA) is the process of learning a language (called the target language or L2) other than the learner’s native language (referred to as L1). A

central theme of SLA research is the relationship between L1 and L2, with the primary research question being the difference in acquisition of L2 from L1. Further key questions branched out from this such as whether formal grammar instruction for L2 is necessary [15].

Grammar Pedagogy in the context of SLA concerns the formal instruction of the target language. In spite of the trend of placing less importance on the grammatical aspect and more on the communicative aspect of language learning, it is agreed upon that grammar is still an essential component of language learning not only among researchers and instructors [16], but also among students [17].

There also exists an ongoing discussion on how this instruction is carried out. One argues that grammar learning must align with formal, traditional instruction which is called Focus on Forms (FonFs). While the other, Focus on Form (FonF) is a newer point of view that argues for a mode of instruction that favors the meaning of grammatical points more than the formal morphology thereof [18]. Both philosophies are distilled into grammar which is taught according to three aspects. Namely, these foci refer to the grammatical concept's form, meaning, and use. Form refers to how the concept is spoken and written. Meaning covers the reason for the concept's existence, what it communicates. Use is when and how the concept is utilized in communication [19].

2.3 Computer-Assisted Language Learning and Gamification

Computer-assisted Language Learning (CALL) is a field that connects language learning and computer science. It aims to make insights from these multidisciplinary fields to make decisions in language acquisition. CALL provides a way for learners to better control their own learning processes, making it quite valuable for self-learning [20]. As newer technological advancements became available, CALL has become increasingly relevant in the fields of game development, mobile applications, and virtual reality [21].

Gamification is the integration of game elements in non-game contexts like education and occupation training. In the context of instruction, it is game-based learning (GBL). A well-known example of gamification in education are the games published by JumpStart Games. Then known as Knowledge Adventure, JumpStart Games published the JumpStart franchise which encompassed educational computer games for children [22]. For occupation training, often gamification may be found integrated with simulated environments such as those for medical training [23]. The advantages of gamified situations in the latter use-case is perhaps cost and safety over real-life simulations.

The convergence of CALL and GBL is effectively the use of digital games or video games for language learning and this culminates in the field of Digital Game-based Language Learning (DGBLL). These digital games may utilize the increased immersiveness of a game environment and the engagement of the gameplay mechanics. Among these affordances, a learner may experience increased motivation which is ultimately congruent to a better learning experience [9].

3 Related Work

Digital games are interactive games operated by computer circuitry on platforms such as consoles or personal computers [24]. Use of game elements in instruction and education

is called game-based learning (GBL) [9, 25]. GBL is a novel approach noted for its uses in mathematics, engineering, science, and more especially, language learning [26]. Positive results of GBL has been found in studies such as Bjørner [27] who had found the increase of engagement among learners who utilized gaming in their assignments. The use of GBL in language learning is Digital Game-based Language Learning (DGBLL). It provides affordances such as learner motivation, engagement, and immediate feedback [28]. DGBLL also has theoretical ties with Task-based Language Learning [29].

A considerable number of DGBLL studies focused on commercial multiplayer games. As such, they focused on the potential of language transfer in cooperative communication games such as “Keep Talking and Nobody Explodes” [30] and “Among Us” [31]. Meanwhile and more notably, a substantial number of papers have utilized game development and have created games for the purpose of their research. These games tend to focus on a single aspect of the target language. For instance, Kanakatana [32] uses RPG gameplay to teach spelling in Japanese, while studies by Mohd [33] and Wang [34] focused on speaking the target language. The games also have unique ways of content delivery. Faena [35] leverages story and narrative, Hololingo! [36] integrates virtual reality for tandem learning, and Words in Motion [37] uses a full-body kinetic virtual reality system. No matter the approach, these games all resulted in positive gains in language acquisition.

However, despite there being a wealth of DGBLL papers focusing on the vocabulary aspect [10], coverage for other aspects like grammar and sentence construction is lacking [23, 38]. This may be due to the difficulty of balancing the contrasting grammar pedagogy philosophies of FonFs and FonF [18]. It should also be noted that learners of Japanese as a second language have often found difficulty in grammar concepts like sentence endings [17]. A few DGBLL adjacent papers have covered grammar acquisition. Throw Back Time [39] is a game developed for English as a Second Language Learners (ESL) and was designed to encourage players to use grammar. A study by Eryiugit [40] notes the positive gains of gamification for grammatically deep and morphologically complicated languages; this study focused on Turkish, an agglutinative language much like Japanese [12].

In conclusion, the potential and effectiveness of DGBLL has been proven since its expansion in recent years. The results are similar in the way that they emphasize the retention of material long-term. To facilitate this, researchers have found that leveraging some aspects afforded by DGBLL can galvanize such an effect. Affordances such as interactivity, immediate feedback, entertainment, and engagement were tackled and shown to be effective accompaniments. However, there is a paucity in studies that are custom-built for grammar acquisition despite there being many for vocabulary acquisition [41]. Following this, development of the game was decided to be subject with implementation of both the adaptive learning and immediate feedback affordances.

4 Gamification Approach and Implementation

To answer the research question, game design techniques based on principles such as goals, interactivity and feedback are used [42]. The gameplay mechanics are made to be congruent to Japanese grammar acquisition – Enemies of the game represent grammar

concepts and are defeated with grammar mini-games. The setting and narrative of the game was themed around Japanese culture. Finally, the concepts themselves are based on online lists of frequency in JLPT N5-N4 tests [43, 44].

A Unity-based game, called *Bunshiki*, was developed for the purpose of this study. It was developed with two modes – Story and Endless (Fig. 1). The game has six levels, each having a story and a combat section.



Fig. 1. The Main Menu.

Bunshiki is a Role-Playing Game with Shoot ‘em up elements. Players take the role of a human trapped in the underworld with only living paper dolls called *Bunpou Shikigami* as help. Figure 2 depicts a combat section of a level; it shows the player the “Sight” that contains the player character and the enemy on opposite sides. On the corners of the sight, important information like the player’s health can be seen. Gamification of grammar acquisition mainly occurs with enemy attacks and spells.

The main mechanic of the main game that allows players to experience learning Japanese grammar and to train their knowledge is situated in the app’s gameplay. Enemies of the game represent grammatical structures and concepts and attacks are resolved through three NPCs that act as summons. The success of these NPCs’ attacks is decided upon microgames that involve honing the player’s skill on that particular concept. The aforementioned summons and enemies belong to one of these elements that are based on an aspect of grammar: form, use, and meaning.

Enemies spawn attacks with Japanese sentences that move towards the player. The attacks typically follow a pattern. First, the enemy will spawn an attack that introduces a particular grammatical concept. Then, they will spawn sets of sentences with English translations (shown in Fig. 3). Finally, the enemy will spawn an attack that makes the player answer a question about the concept. This gamification approach teaches the player in an inductive manner by utilizing their L1 knowledge into L2 knowledge. This style of teaching is reminiscent of grammar tasks based on the FonF philosophy [16].



Fig. 2. The Sight. Encircled in circles are the information (starting from the bottom-left, counter-clockwise) of the player’s health, player’s mana, enemy’s health, and the number of enemies left.

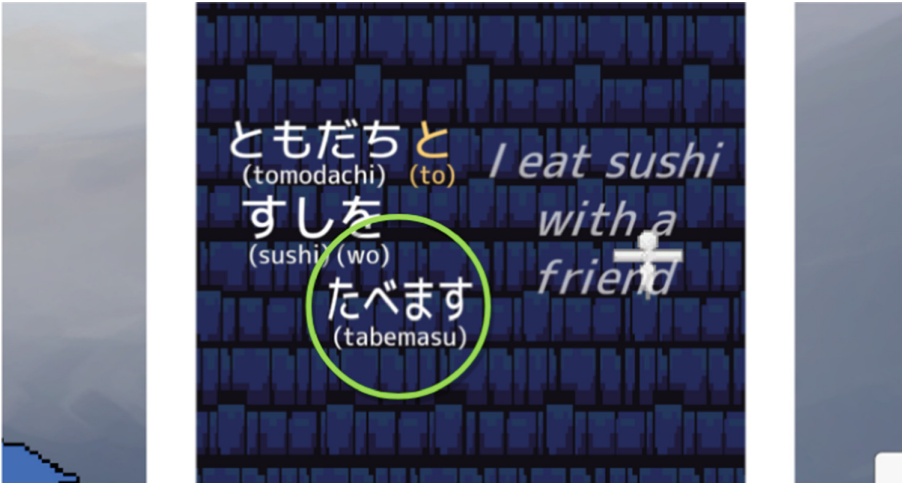


Fig. 3. A word within an enemy attack. Encircled is a damaging white word, while gray words are safe to pass. Black words, pictured in Fig. 2, grant mana points.

Spells are mini-game, whose score determines the damage dealt to the enemy. The three spells are *Yakuyaki*, *Sakanobori*, and *Fuushakari* (shown in Fig. 4). Testing the player in the foci of meaning, *Yakuyaki* has the player pick the English equivalent that is not present in the Japanese sentence on top. Meanwhile, for the element of form, *Sakanobori* has the player choose the correct conjugation of a word in a sentence. Finally, *Fuushakari* trains the player's grammar use by focusing on the correct order of words in a sentence. While these spells offer a mix of approaches to grammar pedagogy, they are designed to be more in line to traditional methods of drilling to practice correct grammar forms and therefore congruent with the FonFs philosophy.



Fig. 4. The Three Spells. (From left to right) *Yakuyaki*, *Sakanobori*, and *Fuushakari*.

In summary, *Bunshiki* was implemented with two game elements that are made to represent one of the two major philosophies in grammar pedagogy. The enemies of the game launch attacks that require the player to make inductive links very much like the FonF philosophy recommends. In contrast, the spells have mini-games that have the player perform tasks in line with the more traditional FonFs philosophy. By representing these two philosophies, a balance is struck to make the grammar acquisition more well-rounded.

5 Method

5.1 Pre and Post Testing

During the development phase, when playable prototypes were made for the game, initial usability testing in the form of playtesting was carried out. As mentioned previously, this playtesting involved five (5) participants who gave their thoughts and feedback through survey questions about the usability, design and usefulness of the game.

To evaluate the effect of the game on Japanese grammar acquisition of N5 and N4 grammatical concepts, a quasi-experimental test was performed. This test was carried out during the final phase of the study. Twenty-five (25) undergraduate participants [45] from the University of the Philippines Manila were chosen through a purposive sampling method. The participants had varying familiarity of the Japanese language but none had native-level fluency. Firstly, the participants went through pre-testing that will test their initial N5 and N4 grammar skills, they were then given seven (7) days to play the game while limiting their playtime to two (2) hours per day. After this period, they were given the post-test to see if there were improvements in their knowledge of N5-N4 Japanese Grammar. The results from the pre-test and post-test were then analyzed through a matched pairs t-test as a design known as a one-group pretest-posttest design [46].

5.2 Usability Testing

Usability testing was done through the methods of playtesting the game, followed by a questionnaire. Playtesting involves five participants who were asked standard questions in playtesting [47–49]. The said questionnaire is the Game User Experience Satisfaction Scale (GUESS-18) [50], a 7-point Likert scale with 18 questions that tackle 9 constructs of game usability. These constructs are categories that measure the game’s usability in various respects, from simple game features such as its graphics and sound to more subjective qualities such as how engrossing and inspiring the game is [51]. Another questionnaire that was considered was the User Engagement Scale (UES) [52]. The UES is a 5-point Likert scale with 31 questions on six factors or dimensions of user engagement; a shorter variant also exists with only 12 questions called the UES-SF [52]. GUESS-18 was chosen over the UES because of the GUESS-18 questionnaire’s specificity toward games and broader usability constructs. The final usability test was also conducted along with the posttest to get their feedback on the usability of the system.

6 Results

6.1 Pretest/Posttest Results

While 32 responses were gathered for the pre-test, only 25 respondents were able to answer the post-test after receiving the game. Table 1 presents the data of respondents who have finished both pretest and posttest. Figure 5 shows the difference of scores from pretest to posttest.

Table 1. Summary of Pre-test and Post-test Results.

	N	mean	Min	Max	Sd	Var
Pretest	25	11	4	24	6.28	39.5
Posttest	25	14	7	23	4.58	21.02

Table 2 shows the results of the t-test for the one-group paired design. It yielded a t-score of 4.55 with df of 24, with the p-value of 6.45×10^{-5} that leads to the conclusion of the alternative hypothesis stating that there exists a significant difference between the means of pretest and posttest scores and that it is not by chance. Furthermore, examination of the means of pretest and posttest scores reveals that an improvement is present as the mean posttest score (14) is higher than the mean pretest score (11).

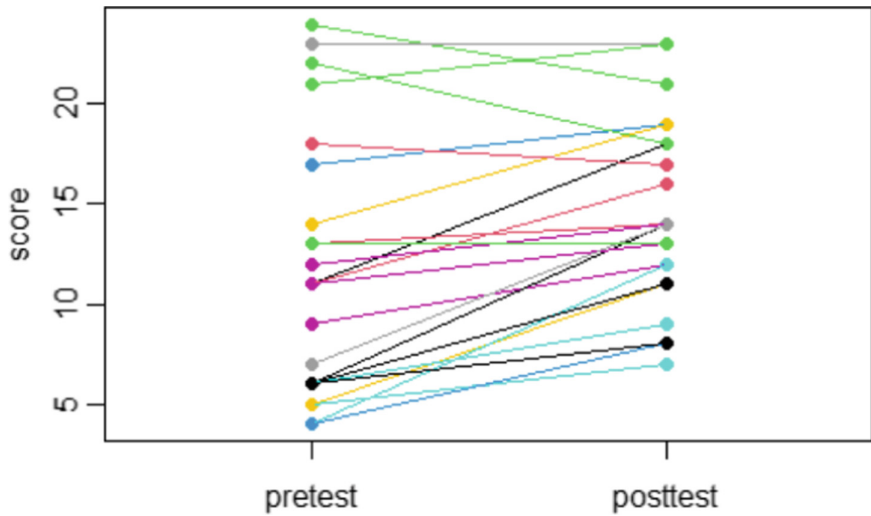


Fig. 5. Ladder Plot illustrating the change of scores from pretest to posttest.

Table 2. One-Group Paired t-test Result.

	t	df	p-value	Mean difference	95% confidence interval	
score	4.55	24	6.45×10^{-5}	2.84	1.77	Inf

6.2 Usability Test Results

Table 3 shows the results from the GUESS-18 questionnaire. Out of a possible total score of 54, the game has scored 45.3. Among the categories and constructs, the relatively high scores of Playability, Narrative, Enjoyment, Audio, Personal Gratification and Graphics stand out. While the game received relatively lower scores in Engrossment.

Table 3. GUESS-18 Results.

#	Category	Sample Question	Mean Score
1	Playability	I find the controls of the game to be straightforward	5.5
2	Narrative	I am captivated by the game's story from the beginning	5.36

(continued)

Table 3. (continued)

#	Category	Sample Question	Mean Score
3	Engrossment	I feel detached from the outside world while playing the game	3.47
4	Enjoyment	I think the game is fun	5.28
5	Imagination	I feel the game allows me to be imaginative	4.66
6	Audio	I enjoy the sound effects in the game	5.34
7	Personal Gratification	I want to do as well as possible during the game	5.59
8	Multiplayer	I like to play this game with others	4.45
9	Graphics	I enjoy the game's graphics	5.66
	Total Score		45.3

7 Discussions

Bunshiki is a game designed to facilitate the grammar acquisition of learners of the Japanese language as a second language. The levels of *Bunshiki* teach grammatical points commonly found in N5 and N4 JLPT tests by taking advantage of affordances of DGBLL and strategies proposed by two grammar philosophies.

The main application used in the development of this project is Unity. Unity is a game development engine that supports the creation of games 2D or 3D. 2D graphics in the style of pixel-art were used in the game because they are deemed easier to create. Some assets used in the game, such as sprite sheets, are made in the raster graphics editor, Adobe Photoshop, while other elements, such as background images, were collected online from Open Game Art [53], an open-source art repository. Finally, scripting was done in Visual Studio Code, an integrated development environment (IDE) with extensions that can facilitate Unity development.

As mentioned earlier, the game features or mechanics are the main way of addressing the ultimate goal, which is the facilitation of grammar acquisition. In order to ensure that this process is effective, a pretest-posttest was done to find out whether the game actually improves the player's grammar acquisition. Based on the results of the t-test over the pretest and posttest scores of the participants, it can be concluded that there is significant evidence that the game is effective in helping the player's learning of JLPT N5-N4 grammatical concepts. Furthermore, in the usability tests through the GUESS-18 questionnaire, the game received relatively high scores in the Playability, Narrative, Enjoyment, Audio, Personal Gratification, and Graphics categories, but relatively low scores in the Engrossment category. The mean score of the Engrossment category may also be interpreted as positive, as the researchers hypothesize that being too engrossing might be detrimental to the learning aspect of the game. It should be noted that while many players have viewed the controls to be straightforward, some players still had problems navigating the interface.

During development, quite a number of challenges were encountered. One of them came with the implementation of the save and load functionality which ended up being

done automatically through Unity's built-in PlayerPrefs. A brief bout of feature-creep or featuritis was also present during development. Feature-creep, a relatively common occurrence among new game developers, is the tendency to add more features as development goes on. Originally, it was designed that there will be six (6) spells, but this ended up being minimized to a more manageable number: three (3). Finally, the challenge of finding bugs in code was made more manageable with the help of the IDE and playtesting of the final prototype before the game was released to the pretest-posttest participants. There was a particularly important finding in the playtests in that while a help function was implemented, it was hardly used by the participants. This was a concern as this caused the participants to not know how to control the player character. This was remedied by implementing a tutorial enemy, a special kind of enemy that has attacks that contain gameplay hints like controls.

8 Analysis and Conclusion

This paper has proposed and developed a game with the goal of facilitating Japanese grammar acquisition. And from the results of the t-test over the pretest and posttest scores of the participants, it can be concluded that there is significant evidence that the game is effective in helping the player's learning of JLPT N5-N4 grammatical concepts. Furthermore, the results from the GUESS-18 questionnaire yielded similarly positive outcomes for the usability of the game. It scored the highest in most of the categories, but the lowest in the Engrossment category. As mentioned, the average scores of the Engrossment category may also be interpreted as positive, as being too engrossing might be a detriment to the learning aspect of the game. Further work is, therefore, suggested to show the effects of engrossment to the level of learning.

As it provides the learner a way to augment their learning process, gamification and DGBLL continues to be on the forefront of CALL research. It has been proven before that DGBLL has a distinct effectiveness regarding vocabulary expansion, so researchers have attempted to see if it holds true for other aspects of language as well. This paper has sufficiently done this with grammar acquisition. It demonstrates that, through a game that integrates a balance of two contrasting philosophies to grammar pedagogy, learners may also see enhancements in grammatical knowledge that leads to better grammatical practice, in this case, of concepts commonly found in JLPT N5 and N4 exams.

Further work is recommended to focus on the improvement of the game being developed. Other genres like adventure games based on the study by Last [35] or implementation of virtual reality similar to the study by Vazquez [37] may be explored. With regards to the use of one-group pre-post testing, limitations inherent in the testing design make a less robust experimental outcome. For example, a higher number of participants and a longer exposure period is recommended. It would also be more optimal if the usability testing sessions are supervised if circumstances allow it. It is also recommended that a study comparing this and classroom-based learning, self-study, or other CALL methods be conducted. Finally, more development-focused DGBLL studies that focus on more diverse languages with different aspects are suggested and encouraged.

References

1. Japan kanji aptitude testing foundation. <https://www.kanken.or.jp/bjt/english/about/>. Accessed 12 Jan 2022
2. Nihongo kentei about page. <https://www.nihongokentei.jp/about/>. Accessed 12 Jan 2022
3. J. Test information. <https://j-test.jp/newjtest>. Accessed 12 Jan 2022
4. Japan educational exchanges and services: objectives and history. <https://www.jlpt.jp/e/about/purpose.html>. Accessed 12 Jan 2022
5. Japan foundation: Japanese-language proficiency test (JLPT). <https://jfmo.org.ph/jlpt/>. Accessed 12 Jan 2022
6. Learning languages. <https://learningcenter.unc.edu/tips-and-tools/learning-a-second-language/>. Accessed 12 Jan 2022
7. How technology has revolutionized language learning. <https://interestingengineering.com/how-technology-has-revolutionized-language-learning>. Accessed 12 Jan 2022
8. Benini, S., Thomas, M.: A critical review of research on gamification and second language acquisition. *Digit. Games Lang. Learn.* 9–46 (2021)
9. Zhang, R., et al.: Target languages, types of activities, engagement, and effectiveness of extramural language learning. *PLoS ONE* **16**(6), 253–431 (2021)
10. Klimova, B., Kacetl, J.: Computer game-based foreign language learning: its benefits and limitations. In: Cheung, S.K.S., Lam, J., Li, K.C., Oliver, A., Ma, W.W.K., Ho, W.S. (eds.) *ICTE 2018. CCIS*, vol. 843, pp. 26–34. Springer, Singapore (2018). https://doi.org/10.1007/978-981-13-0008-0_3
11. Shibatani, M.: *Japanese*. Elsevier, Amsterdam (2009)
12. The Japanese language. <http://web.mit.edu/jpnet/articles/JapaneseLanguage.html>. Accessed 12 Jan 2022
13. Advantages of JLPT. <https://www.jlpt.jp/e/about/merit.html>. Accessed 13 Jan 2022
14. Scoring sections, pass or fail, score report. <http://www.jlpt.jp/e/guideline/results.html>. Accessed 13 Jan 2022
15. VanPatten, B., Smith, M., Benati, A.: *Key Questions in Second Language Acquisition: An Introduction*. Cambridge University Press, Cambridge (2019)
16. Takashima, H., Sugiura, R.: Integration of theory and practice in grammar teaching-grammaring, grammarization and task activities. *Readings Second Lang. Pedagogy Second Lang. Acquisition Jpn. Context* **4**, 59–74 (2006)
17. Tsutsui, C.: 外国人生徒が国語の読解でつまづく要因: 文法的側面から. フェリス女学院大学部記要 (2017)
18. Fujino, H.: L2 learners' perceptions of grammar: the case of JFL learners in the UK. *Lang. Learn. J.* **49**, 343–357 (2021)
19. TEFL grammar. <https://www.youtube.com/watch?v=MIVBGQouvoA>. Accessed 13 Jan 2022
20. Soleimani, H.: *Computer Assisted Language Learning: Theory and Practice*. Payame Noor University, Tehran (2021)
21. Chen, X., Zou, D., Su, F.: Twenty-five years of computer-assisted language learning: a topic modeling analysis. *Lang. Learn. Technol.* **25**(3), 151–185 (2021)
22. Matthews, N., Orr, B., Harris, B., McIntosh, R., Openden, D., Smith, C.: Parent and child outcomes of JumpStart, an education and training program for parents of children with autism spectrum order. *Res. Autism Spectr. Disord.* **56**, 21–35 (2018)
23. Nicola, S., Virag, I., Stoicu-Tivadar, L.: VR medical gamification for training and education. *eHealth* **1**(1), 97–103 (2017)
24. Electronic game. <https://www.britannica.com/topic/electronic-game>. Accessed 12 Jan 2022
25. Yukselturk, E., Altioek, S., Baser, Z.: Using game-based learning with kinect technology in foreign language education course. *J. Educ. Technol. Soc.* **21**(3), 159–173 (2018)

26. Su, F., Zou, D., Xie, H., Wang, F.: A comparative review of mobile and non-mobile games for language learning. *SAGE Open* **11**(4), 151–185 (2021)
27. Bjørner, T., Sum, A., Ludvigsen, R., Bouquin, N., Larsen, F., Kampel, U.: Making homework fun: the effect of game-based learning on reading engagement. In: *Proceedings of the 2022 ACM Conference on Information Technology for Social Good (GOODIT2022)*, pp. 353–359. Association for Computing Machinery, New York (2022)
28. Poole, F., Jody, C.: A systematic review of digital games in second language learning studies. *Int. J. Game-Based Learn. (IJGBL)* **10**(3), 1–15 (2021)
29. Reinders, H.: Digital games and second language learning. In: *Language, Education and Technology*, pp. 329–343, Taylor & Francis (2017)
30. Hofmeyr, M.: Lighting the fuse for interaction and negotiation: the potential of information-gap digital puzzle games for language learning. *Technol. Lang. Teach. Learn.* **3**, 1–20 (2021)
31. Calvo-Ferrer, J., Belda-Medina, J.: The effect of multiplayer video games on incidental and intentional L2 vocabulary learning: the case of among Us. *Multimodal Technol. Interact.* **5**(12), 80–83 (2021)
32. Olson, C., Kauffman, D., Fowler, A., Khosmood, F.: Teaching Japanese through game mechanics: an exploratory study. In: *Proceedings of the 6th FDG workshop on Procedural Content Generation, Monterey, California. PCG Workshop, Monterey, California* (2015)
33. Rozi, N., Ahmadon, F., Aris, R., Hizal, M., Maarod, H.: Mobile application for learning and memorizing japanese characters using game-based learning. *Universiti Teknologi Mara* (2020)
34. Wang, C., Lan, Y., Tesng, W., Lin, Y., Gupta, K.: On the effects of 3D virtual worlds in language learning - a meta-analysis. *Comput. Assist. Lang. Learn.* **33**, 891–915 (2020)
35. Last, I.: *Faena: a narrative-based language learning video game*. Master's thesis. University of New Mexico, Albuquerque (2021)
36. Ahlers, T., Bumann, C., Kollé, R., Lazovic, M.: Hololingo! - a game-based social virtual reality application for foreign language tandem learning. In: *Proceedings of the 19th Fachtagung Bildungstechnologien (DELFI2021)*, pp. 37–48. Gesellschaft für Informatik, Bonn (2021)
37. Vázquez, C., Xia, L., Aikawa, T., Maes, P.: Words in motion: kinesthetic language learning in virtual reality. In: *Proceedings of the 18th International Conference on Advanced Learning Technologies (ICALT2018)*, pp. 272–276. IEEE, Bombay (2018)
38. Dhimolea, K., Kaplan-Rakowski, R., Lin, L.: A systematic review of research on high-immersion virtual reality. *SSRN* (2021)
39. Paris, T., Manap, N., Abas, M., Ling, L.: Mobile-assisted language learning (MALL) in language learning. *J. Asian Behav. Stud.* **6**(19), 61–73 (2021)
40. Eryigit, G., Bektas, F., Ali, U., Dereli, B.: Gamification of complex morphology learning: the case of Turkish. Taylor & Francis (2021)
41. Castillo-Cuesta, L.: Using digital games for enhancing EFL grammar and vocabulary in higher education. *Int. J. Emerg. Technol. Learn. (iJET)* **15**(20), 116–129 (2020)
42. Laird, J.: *Principles of Game Design*. University of Michigan, Ann Arbor (2005)
43. JLPT guide N4 grammar. https://en.wikibooks.org/w/index.php?title=JLPT_Guide/JLPT_N4_Grammar. Accessed 13 Jan 2022
44. JLPT guide N5 grammar. https://en.wikibooks.org/w/index.php?title=JLPT_Guide/JLPT_N5_Grammar. Accessed 13 Jan 2022
45. How can I compare pretest to posttest scores in a small sample?. <https://www.insightassessment.com/article/how-can-i-compare-pretest-to-posttest-scores-in-a-small-sample>. Accessed 13 Jan 2022
46. Allen, M.: *The SAGE Encyclopedia of Communication Research Methods*. SAGE, Thousand Oaks (2017)

47. Rajanen, M., Tapani, J.: A survey of game usability practices in North American game companies. In: Proceedings of the 27th. International Conference on Information Systems Development (ISD2018). Lund University, Sweden (2018)
48. What Does Playtesting Mean? techopedia.com/definition/27197/playtesting. Accessed 13 Jan 2022
49. The definitive guide to playtest questions. <https://www.schellgames.com/blog/the-definitive-guide-to-playtest-questions>. Accessed 13 Jan 2022
50. Keebler, J., Shelstad, W., Smith, D., Chaparro, B., Phan, M.: Validation of the GUESS-18: a short version of the game user experience satisfaction scale (GUESS). *J. Usability Stud.* **16**(1), 49 (2020)
51. Ishaq, K., Azan, N., Rosdi, F., Abid, A., Ali, Q.: Usability of mobile assisted language learning App. *Int. J. Adv. Comput. Sci. Appl.* **11**, (2020)
52. O'Brien, H., Cairns, P., Hall, M.: A practical approach to measuring user engagement with the refined user engagement scale (UES) and new UES short form. *Int. J. Human-Comput. Stud.* **112**, 28–39 (2018)
53. Open game art. <https://opengameart.org/>. Accessed 13 Jan 2022