

**A Review of Digital Game-based Language Learning
(DGBLL) Studies: Utilization of Commercial Off-the-shelf
Games and Implications for Future Research**

SHI Haoting

Abstract

In this review, the evolution of technology in language learning was first explored. It then delves into the utilization of educational games, addressing challenges associated with the development and implementation. Next, the focus turns to the incorporation of Commercial Off-The-Shelf (henceforth COTS) games in Digital Game-Based Language Learning (henceforth DGBLL) studies. An in-depth analysis of eleven previous DGBLL studies that investigated second language or foreign language learning by using COTS games clarifies the various methodologies and points out similarities and distinctions across studies. Suggestions for future studies in DGBLL are derived from the insights presented in the selected research.

Evolution of technology in Language Learning

The roots of technology in language learning can trace back to the 1960s when the PLATO (Programmed Logic for Automated Teaching Operations) system was introduced at the University of Illinois. This marked the beginning of mainframe-based computer systems in education, offering a range of language-learning activities influenced by audiolingualism (Peterson, 2016, p.2).

In the 1990s, significant advancements in language learning technology occurred with the introduction of CD-ROMs and the advent of videoconferencing. Studies from this period suggested that CD-ROMs led to enhancements in listening comprehension (Brett, 1997) and grammar knowledge (Felix, 2000). Similarly, videoconferencing created opportunities for understanding and engaging in the negotiation of meaning (Gass & Varonis, 1994).

Encouraged by these positive results, educators, teachers, and researchers began focusing more on integrating technology into language learning. The history of technology in language learning unfolds with these pivotal developments in the 1960s and 1990s, which

played crucial roles in shaping the landscape and pedagogy of language education. This laid the groundwork for the eventual emergence of computer-assisted language learning (henceforth CALL) in the 1980s (Peterson, 2016).

Games and language learning

With the emergence of CALL, the central focus of earlier CALL studies was on educational games designed specifically for learning languages. However, there are some barriers for teachers when using educational games to teach language. First and foremost, the development of educational games is resource-intensive, requiring a significant investment of time and money. Successful educational game creation necessitates collaboration among teachers, educators, and game designers. Furthermore, the effective implementation of educational games in a classroom setting presents challenges, especially for teachers unfamiliar with new technologies or lacking computer skills. Timuçin (2006, p. 264) emphasizes that teachers needed convincing and assurance that their involvement was important, and that they would receive support, especially regarding their lack of computer skills. To sum up, from the initial stages of educational game development to practical implementation in real language teaching contexts, various challenges need to be overcome.

Researchers also focus on a type of game designed with a contrasting purpose compared to educational games, referred to as COTS games. Prior to the incorporation of COTS games into the realm of Second Language Acquisition (SLA), researchers had highlighted the unique benefits that games can provide. For instance, the virtual world provided by games can be seen as rich contexts for language acquisition. Furthermore, “Games create new social and cultural worlds: worlds that help people learn by integrating thinking, social interaction, and technology, all in service of doing things they care about.” (Shaffer et al., 2005, p.3). To unravel the potential benefits of games in the realm of language learning and to provide compelling evidence that demonstrates effective

methodologies for their integration, researchers in Digital Game-based Language Learning (henceforth DGBLL) have undertaken extensive research efforts. Their collective work has shown that various aspects of language acquisition can be significantly improved through engaging with digital gaming experiences. For instance, according to DeHann (2005), playing a baseball video game improved both listening and reading comprehension. Franciosi et al. (2016) noted that playing a simple simulation game could improve long-term vocabulary retention. Mills and Thanyawatpokin (2021) observed that students often see games as valuable learning tools. According to Benini and Thomas (2021), games can provide enjoyment and intrinsic motivation. Moreover, Li et al. (2022) found that digital gaming can enhance learners' autonomy and confidence.

The evolution of technology in language learning began in the 1960s with the introduction of the PLATO system, evolving through stages, including CD-ROMs and videoconferencing. While the initial focus was on educational games, challenges, such as time constraints, costs, and teacher unfamiliarity, were encountered. The subsequent emergence of personal computers and game consoles prompted exploration into the use of COTS games for language education. Despite the accessibility of COTS games, challenges in implementation persist. Nevertheless, research has highlighted the positive and enjoyable aspects of various COTS games in language learning. The following section examines closely eleven previous studies that applied COTS games for second or foreign language learning.

Previous DGBLL Studies utilizing COTS games

The collection of studies investigates the impact of digital games on language learning (As shown in Table 1), with a specific focus on various aspects such as additional learning materials, participant attitudes towards the game, focused language abilities, experiment context, and findings. The standard of selecting is that these studies used COTS games for

second or foreign language learning since the results of a meta-analysis of DGBLL studies conducted by Dixon et al. (2022) indicated that games specifically created for entertainment purposes demonstrate greater efficacy compared to those designed for second language (L2) education. Further, all the selected studies provided empirical evidence supporting the results. Exploring the effects of supplementary materials in structured gameplay, Miller and Hegelheimer (2006) and Ranalli (2008) highlight the significance of additional resources in gameplay of *The SIMs* occurring in a laboratory setting, demonstrating their positive correlation with learning outcomes. The intriguing interplay between player enjoyment and vocabulary recall, as elucidated in the study conducted by DeHaan et al. (2010), introduces a unique perspective, revealing both players and watchers recalled vocabulary, but the watchers recalled significantly more than the players after playing a music game, *Parappa the Rapper 2*. Chen and Yang's (2011) studies focused on the efficacy of gameplay in a controlled computer laboratory environment, yielding significant gains in vocabulary acquisition. In contrast, Li, Peterson, and Wang's (2021, 2022) research emphasizes the impact of out-of-class gameplay of a cooperative game, *Phasmophobia*, on the development of participants' autonomy and confidence, with positive effects on vocabulary, listening, and oral fluency. Similarities and differences among the selected DGBLL studies are outlined below, offering insights into the landscape of DGBLL and providing potential directions for future research:

Similarities

Focused Language Skills: The majority of the studies centered on vocabulary learning. Li et al. (2022) and the second study by Chen and Yang (2011) uniquely explored autonomy, confidence, and learners' perceptions toward the game.

Learning Outcomes: Positive results were consistently observed across all studies, regardless of the specific language abilities measured.

Meaning of Vocabulary: Studies primarily focused on the meaning aspect when evaluating the learning gains of vocabulary.

Participant Attitudes Toward the Game: In both classroom and extramural settings, participants derive enjoyment, with acknowledgment given to the captivating game design (Chen & Yang, 2011) and the overall interest evoked by the games (Lee, 2023).

Additional Materials and Tasks: Vocabulary tests and gameplay journals were commonly added as additional tasks in the studies that incorporated extra supplementary materials alongside gameplay.

Differences:

Game Types: Various studies employed different types of games, including simulation games (e.g., *The SIMs*), adventure games (e.g., *Bone, Life is Strange*), and online multiplayer games (e.g., *Among Us*), showcasing the adaptability of digital games for language learning across genres.

Supplementary Materials: Miller and Hegelheimer's study (2006) and Ranalli's study (2008) highlight the role of supplementary materials in a classroom setting, emphasizing their positive impact on vocabulary gains. In contrast, some studies, like Chen and Yang (2011), concentrate exclusively on gameplay without any additional materials.

Learning Context: Studies differed in learning contexts, with some conducted in computer laboratories (Chen & Yang, 2011; Hitosugi et al., 2014) or classrooms (Miller & Hegelheimer, 2006; Calvo-Ferrer & Belda-Medina, 2021). While others were conducted in out-of-school settings (DeHaan, 2005; Lee, 2023).

Vocabulary Acquisition: While positive outcomes in vocabulary acquisition were consistent, the duration of retention varied across studies. Some demonstrated long-

term retention (e.g. Franciosi et al., 2016), while others focused on immediate and ongoing vocabulary development (e.g. Li et al, 2021).

These similarities and differences highlight the nuanced aspects of the selected DGBLL studies. The next section will discuss implications for future DGBLL studies utilizing COTS games based on the provided information.

Table 1

Previous DGBLL Studies utilizing COTS games

Author & Date	Additional learning materials	Attitudes of participants towards the game	Language abilities	Experiment context and Game	Findings
DeHaan, J. W. (2005)	Game log	Not mentioned	Japanese Kanji (vocabulary meaning test) and listening	Out-of-school setting/ <i>Jikkyo Pawafuru Puro Yakyu 6</i> (Sports game)	Listening comprehension (self-report) and kanji character recognition was facilitated.

(continued)

Miller, M., & Hegelheimer, V. (2006).	Vocabulary lists and exercises; grammar; descriptions and exercises; culture notes; a link to an online dictionary	Not mentioned	Vocabulary (meaning) and grammar	Classroom setting/ <i>The SIMs</i> (simulation game)	Significant learning gains in vocabulary. Feedback from students suggests that materials were beneficial for successful task completion.
Ranalli, J. (2008).	Vocabulary information and quizzes; culture notes; instructions for each day's play; link to an online dictionary	Not mentioned	Vocabulary	Not mentioned but it is likely to be in a lab setting/ <i>The SIMs</i> (simulation game)	Significant learning gains in vocabulary learning. Positive feedback received from the participants.
DeHaan, J., Reed, W. M., & Kuwanda, K. (2010).	No additional tasks	Players enjoy it more than	Vocabulary (written recall test; fill in the blanks with the words from the rap you just heard)	In a laboratory setting/, <i>Parappa the Rapper 2</i> (Music game)	Both players and watchers recalled vocabulary, but the watchers recalled significantly more than the players.

(continued)

Chen, H. J. H., & Yang, T. Y. C. (2011) Study 1	Only gameplay guide	Not mentioned	Vocabulary (meaning test)	A computer laboratory setting/ <i>Bone</i> (adventure game)	Significant learning gains of vocabulary.
Chen, H. J. H., & Yang, T. Y. C. (2011) Study 2	Short report after gameplay	Participants enjoyed the gameplay because of the intriguing game design	Learners' perception towards the game	Out-of-class context/ <i>Bone</i> (adventure game)	Positive attitudes towards using the game for language learning; Improved listening, reading, and vocabulary knowledge.
Hitosugi, C. I., Schmidt, M., & Hayashi, K. (2014).	Study 1 using the game as supplementary to a textbook unit. Study 2 uses vocabulary lists as supplementary at the beginning.	Included in the Affect survey (I like playing <i>Food Force</i> very much; 7-point Likert affect scale)	Vocabulary (meaning test)	In a computer lab (Integrate the game into classroom) / <i>Food Force</i> (An UN-sponsored off-the-shelf video game)	The results indicated that Study 2 resulted in better learning of words than Study 1. No gender difference in vocabulary test.
Franciosi, S. J., Yagi, J., Tomoshige, Y., & Ye, S. (2016).	Quizlet	Not mentioned	Vocabulary (meaning test)	In a classroom context/ <i>3rd World Farmer</i> (simulation game)	Long-term retention of vocabulary but no significant learning gains in the immediate posttest.

(continued)

Calvo-Ferrer, J. R., & Belda-Medina, J. (2021)	Vocabulary list for intentional group; Nothing for incidental group	Not mentioned	Vocabulary (meaning and production level)	In a classroom context/ <i>Among Us (Online multiplayer social deduction game)</i>	Intentional learning approach led to better vocabulary learning gains than incidental learning.
Li, K., Peterson, M., & Wang, Q. (2021).	Quizlet and supplement introductory materials	Involved in the semi-structured interview	Vocabulary (meaning test)	Out-of-class context/ <i>Life is Strange (adventure game)</i>	Results showed that statistically significant vocabulary development was found, and participants believed that they made progress in listening and reading.
Li, K., Peterson, M., & Wang, Q. (2022).	Weekly gameplay journal	Reflected via gameplay journal	Autonomy and confidence	Out-of-class context/ <i>Phasmophobia(a cooperation game)</i>	Enhancement of autonomy and confidence; Development in vocabulary, listening skills, and oral fluency.
Lee, S. M. (2023).	No additional tasks	Interest was found to have positive relationship with vocabulary	Vocabulary (meaning recognition test)	Classroom context/ <i>Her Story (A vernacular murder mystery game)</i>	L2 vocabulary acquisition and retention were facilitated.

Implications for Future DGBLL Studies

This section aims to clarify the gaps and nuances that can be found in previous studies within the realm of DGBLL. Additionally, it offers recommendations for crucial considerations that should be taken into account in future DGBLL studies. The following aspects are discussed in this section: needs analysis, the effects of additional tasks/instructions, the rationale of implementing additional tasks/instructions, theory-based research, utilization of Artificial Intelligence (AI), a balanced combination of qualitative and quantitative research methods, and the measurement of learning outcomes.

Needs-Analysis

To enhance the efficacy of learning through digital games, it is crucial that the chosen game aligns with the specific interests of the learners (e.g., Chen & Yang, 2011). For instance, male learners might express a preference for playing first-person shooter (FPS) games, whereas female learners may generally exhibit a lack of interest in FPS games, which may potentially result in negative learning gains (Anderson et al., 2008). Therefore, conducting a needs analysis to select the game before the experiment is crucial to reduce the risk of participants becoming demotivated in engaging with the selected game.

The effects of additional tasks/instructions

"Even the harshest critics agree that we can learn something from playing video games. The question is: how can we use the power of video games as a constructive force in schools, homes, and at work?" (Shaffer et al., 2005, p. 3). While prior research extensively discussed the unique advantages of digital games and their impact on language learning, it is noteworthy that relatively few studies have explored the effects of games exclusively for language learning. In contrast, structured gameplay (e.g., Miller & Hegelheimer, 2006;

Ranalli, 2008), involving intentional language learning by incorporating additional tasks to the gameplay, has dominated the DGBLL studies landscape.

To gain a better understanding of the contributions that games make to language learning, future studies should examine the impact of digital games on learning English, with a specific focus on comparing various learning approaches (structured gameplay, incidental learning, intentional learning) to English language learning through playing digital games. Including control groups is an appropriate method to differentiate the learning outcomes derived from gameplay and completing additional tasks. Without comparing the results, it is difficult to ascertain whether the learning gains arise from playing the game or completing additional out-of-game tasks. Additionally, without examining the effects of additional tasks or instructions, there is a risk of overstating the benefits associated with digital games, or the learning gains may be attributed to completing additional tasks rather than gameplay.

In future DGBLL studies, it is valuable and essential for researchers to include a control group (e.g., gameplay only; additional tasks only) to clarify the extent of the difference in comparison to the experimental group (e.g., gameplay plus additional tasks). Within the group exposed to gameplay only, the learning gains can be credited to the benefits derived from playing games. Consequently, teachers and educators can gain a clearer understanding of the advantages of games for language learning and may foster a greater willingness to incorporate games into language teaching.

The rationale of implementing additional tasks/instructions

Gameplay journals, vocabulary lists, Quizlet tests, etc. – DGBLL studies employed various types of additional tasks in the learning process (shown in Table 1). Researchers are aware that using COTS games for language learning does not mean asking students to play the game and expecting them to acquire the target language solely through gameplay. Miller

and Hegelheimer (2006) pointed out that *the SIMs*, being a COTS game, is not appropriate to be used as a CALL task when compared with the criteria for CALL task appropriateness developed by Chapelle (2001). For instance, they mentioned that the game itself “does not provide much language learning potential, the linguistically fit audience is vague, and the positive impact largely unknown for this particular game and audience.” (Miller & Hegelheimer, 2006, p.315) Thus, to adapt the game for language learning, supplemental materials were created for participants to use alongside the SIMs. Moreover, similar to Miller and Hegelheimer's (2006) study, multiple types of materials were employed in previous DGBLL studies. Therefore, there is value in exploring the nuanced effects of each type of task, which is essential for teachers and educators to better understand efficacious tasks within the context of DGBLL utilizing COTS games.

Theory-based research

"Any attempt to successfully implement technological innovations in Computer-Assisted Language Learning (CALL) in the future should be primarily theory-led, rather than technology-led, and grounded in a thorough understanding of how CALL development has been conceptualized in the past" (Peterson 2016, p.10). As shown in Table 1, researchers have rarely applied frameworks or theories in their studies, with exceptions found in Li et al. (2021, 2022), where designs were based on the Community of Inquiry (CoI) model and Activity Theory. Considering the rapid development of technology in recent years, researchers may struggle to keep pace with these advancements. Therefore, researchers, teachers, and educators must prioritize exploring theories that can effectively leverage technology instead of solely focusing on investigating the impact of different types of technology.

Utilization of Artificial Intelligence (AI)

The rise of generative AI, such as ChatGPT, offers a significant opportunity to integrate it into extramural digital gameplay, thereby providing significant potential for language learning. In the context of DGBLL beyond traditional educational settings, such as schools, AI provides a solution to the lack of instructors offering real-time feedback and suggestions during the learning process. Further, the ability of ChatGPT to offer personalized instruction (Baskara, 2023) can be used in future extramural DGBLL projects to create adaptive and personalized language learning experiences based on the digital gameplay. This approach will ensure that learners receive customized feedback and learning suggestions according to their individual proficiency levels and learning preferences within an out-of-school context.

A balanced combination of qualitative and quantitative methods

This section is related to the effectiveness of additional tasks or instructions. In the context of DGBLL, the predominant approach utilizes quantitative methods to investigate vocabulary learning gains through comparing pre-test, immediate test, and post-test results. However, as mentioned earlier, when additional tasks or instructions are introduced, their influence requires careful analysis. For example, if the statistical results reveal significant learning gains, learning gains cannot be solely attributed to gameplay; the effects of additional tasks or instructions must also be taken into account. Thus, relying only on quantitative methods is inadequate to reveal the true benefits derived from playing the game. It is imperative to utilize qualitative methods, such as semi-structured interviews, to provide context to the results and gain a deeper understanding of the learning outcomes.

Measurement of learning outcomes

Most previous studies in DGBLL focused mainly on assessing the acquisition of vocabulary through digital games, as shown in Table 1. While acquiring vocabulary is a crucial aspect of language learning, it is essential not to overlook additional potential benefits that digital games may offer. To explore these benefits, such as the development of autonomy and confidence demonstrated by Li et al. (2022), it is advisable to include tools that specifically target aspects beyond acquiring vocabulary. The study conducted by Li et al. (2022) specifically used the Measuring Instrument for Language Learner Autonomy (MILLA), developed by Murase (2015), to measure the development of autonomy. It is essential to expand the scope of investigation beyond vocabulary learning in digital game-based language learning. Considering the unique advantages associated with digital gaming, exploring aspects such as motivation and autonomy development warrants meticulous investigation. The unique affordances of digital games go beyond mere vocabulary acquisition, and recognizing and examining these broader benefits contribute to a more comprehensive understanding of their potential in language education.

Summary

The sections presented explore key aspects in the field of DGBLL, starting by emphasizing the importance of a needs analysis for improved learning efficacy. Furthermore, the effects of additional tasks and instructions in gameplay were discussed, recommending that future studies compare various learning approaches and include control groups to differentiate the impact of gameplay from additional tasks/instructions. The reasoning behind implementing additional tasks needs to be considered and more investigation into the benefits these tasks bring to language learning. The importance of theory-based research in the DGBLL field is also discussed. Future DGBLL studies are recommended to be guided by frameworks or theories. Proposing the integration of artificial intelligence (AI), especially generative AI

like ChatGPT, is suggested to the DGBLL project in an out-of-school context. Additionally, the importance of a balanced mix of qualitative and quantitative methods in DGBLL research is emphasized, particularly when evaluating the effectiveness of additional tasks or instructions. Moreover, the measurement of learning outcomes should go beyond vocabulary acquisition, additional aspects such as motivation and autonomy development should be focused.

Conclusion

The historical evolution from PLATO to CD-ROMs and videoconferencing laid the foundation for integrating technology into language education. Challenges in developing and implementing educational games necessitate collaborative efforts. The utilization of COTS games in DGBLL studies opens new possibilities, revealing positive outcomes in vocabulary acquisition, autonomy, and confidence development. For future DGBLL studies, drawing on information from previous research, this review discusses the importance of needs analysis, the impact of additional tasks/instructions, and the reasoning behind implementing additional tasks/instructions. The study also suggests that future extramural DGBLL studies can integrate AI to play the role of instructor. To have a deeper understanding of the results, using a well-rounded mix of qualitative and quantitative methods is suggested. Further, assessing more aspects of learning outcomes can be helpful for educators and teachers to decide the ways of using games in their language teaching courses. As the journey of digital game-based language learning progresses, researchers should prioritize providing evidence for the unique benefits of using digital games for language learning. A shift from exploring the benefits of technology to exploring the methodology and theory of incorporating technology into language teaching and learning is crucial.

References

- Anderson, T. A., Reynolds, B. L., Yeh, X. P., & Huang, G. Z. (2008, November). Video games in the English as a foreign language classroom. In *2008 Second IEEE international conference on digital game and intelligent toy enhanced learning* (pp. 188-192). IEEE.
- Baskara, R. (2023). Exploring the implications of ChatGPT for language learning in higher education. *Indonesian Journal of English Language Teaching and Applied Linguistics*, *7*(2), 343-358.
- Benini, S., & Thomas, M. (2021). A critical review of research on gamification and second language acquisition. *Digital games and language learning*, 9-46.
- Brett, P. (1997). A comparative study of the effects of the use of multimedia on listening comprehension. *System*, *25*(1), 39-53.
- Calvo-Ferrer, J. R., & Belda-Medina, J. (2021). The effect of multiplayer video games on incidental and intentional L2 vocabulary learning: The case of Among Us. *Multimodal Technologies and Interaction*, *5*(12), 80.
- Chappelle, C. A. (2001). *Computer applications in second language acquisition*. Cambridge University Press.
- Chen, H. H. J., & Yang, C. (2011). Investigating the effects of an adventure video game on foreign language learning. In *Edutainment Technologies. Educational Games and Virtual Reality/Augmented Reality Applications: 6th International Conference on E-learning and Games, Edutainment 2011, Taipei, Taiwan, September 2011. Proceedings 6* (pp. 168-175). Springer Berlin Heidelberg.
- DeHaan, J. W. (2005). Acquisition of Japanese as a foreign language through a baseball video game. *Foreign Language Annals*, *38*(2), 278-282.
- DeHaan, J., Reed, W. M., & Kuwanda, K. (2010). The effect of interactivity with a music video game on second language vocabulary recall. *Language learning & technology*, *14*(2), 74-94
- Dixon, D. H., Dixon, T., & Jordan, E. (2022). Second language (L2) gains through digital game-based language learning (DGBLL): A meta-analysis. *Language Learning & Technology*, *26*(1), 1-25.
- Felix, U. (2000). The potential of CD-ROM technology for integrating language and literature: student perceptions. *German as a Foreign Language*, 1-18.
- Franciosi, S. J., Yagi, J., Tomoshige, Y., & Ye, S. (2016). The effect of a simple simulation game on long-term vocabulary retention. *Calico Journal*, *33*(3), 355-379.
- Gass, S. M., & Varonis, E. M. (1994). Input, interaction, and second language production. *Studies in second language acquisition*, *16*(3), 283-302.
- Hitosugi, C. I., Schmidt, M., & Hayashi, K. (2014). Digital game-based learning (DGBL) in the L2 classroom: The impact of the UN's off-the-shelf videogame, Food Force, on learner affect and vocabulary retention. *Calico Journal*, *31*(1), 19-39.
- Lee, S. M. (2023). Factors affecting incidental L2 vocabulary acquisition and retention in a game-enhanced learning environment. *ReCALL*, *35*(3), 274-289.

- Li, K., Peterson, M., & Wang, Q. (2021). Using community of inquiry to scaffold language learning in out-of-school gaming: A case study. *International Journal of Game-Based Learning (IJGBL)*, 11(1), 31-52.
- Li, K., Peterson, M., & Wang, Q. (2022). Out-of-school language learning through digital gaming: A case study from an activity theory perspective. *Computer Assisted Language Learning*, 1-29.
- Miller, M., & Hegelheimer, V. (2006). The SIMs meet ESL Incorporating authentic computer simulation games into the language classroom. *Interactive technology and smart education*, 3(4), 311-328.
- Mills, D. J., & Thanyawatpokin, B. (2021). The relationship between extramural digital gameplay and twenty-first-century skills in the language classroom. *Digital Games and Language Learning: Theory, Development and Implementation*, 193.
- Murase, F. (2015). Measuring language learner autonomy: Problems and possibilities. In C.J. Everhard & L. Murphy (Eds), *Assessment and autonomy in language learning*. Palgrave Macmillan.
- Peterson, M. (2016). *Computer games and language learning*. Springer.
- Ranalli, J. (2008). Learning English with The Sims: exploiting authentic computer simulation games for L2 learning. *Computer Assisted Language Learning*, 21(5), 441-455.
- Shaffer, D. W., Squire, K. R., Halverson, R., & Gee, J. P. (2005). Video games and the future of learning. *Phi delta kappan*, 87(2), 105-111.
- Timuçin, M. (2006). Implementing CALL in an EFL context. *ELT journal*, 60(3), 262-271.