A Review of Trends in Digital Game-Based Language Learning Research

Hsiu-Ting Hung & Jo-Ling Chang

***Abstract*—Former literature reviews or research syntheses on digital game-based learning have provided important results, but little is known about the use of digital games in specific learning domains, with language education being one fertile area for additional research. While the use of digital games for educational purposes varies in different contexts, understanding the emerging trends of how digital games are currently implemented in language learning can inform both language educators and researchers of game use for learning, and thus help to improve their professional practices. Accordingly, the current review aims to identify emerging trends of digital game-based language learning (DGBLL) articles published during years 2010 to 2014. Major findings of this review indicate that: 1) Only 4% of the articles are identified as related to DGBLL within the reviewed corpus, 2) most DGBLL researchers employed mixed methods, 3) higher education learners were the most frequently examined group of participants in DGBLL studies, 4) English was the target language studied by the majority of DGBLL researchers, and 5) Off-the-shelf digital games, particularly the type of Massively Multiplayer Online Role-Playing Games (MMORPG), are the most commonly implemented games in the DGBLL literature. This review provides a panoramic overview of the trends in DGBLL research and draws attention to areas where there are prominent gaps within the literature.**

Keywords*—*language learning; digital games; game-based learning; digital game-based language learning

I. INTRODUCTION

Advances in technology have given educators many new resources to enhance their educational environments, and among which digital games are one promising form. As argued by [1], digital games possess goals that players are required to achieve, and which give the players motivation to spend time using them. This claim has been supported by some research showing that digital games may increase the motivation of learners to greater extent than is possible in traditional, non-gaming classrooms, which may lead to better learning outcomes [2]; [3]; [4]. In recent years, a growing number of researchers have been investigating the effectiveness of digital games in relation to various subjects, such as science [5], engineering [6], history [7], geography [3], nutrition [8], and language education [9]. These pioneering studies on digital games in educational settings contribute to an emerging field of study, digital game-based learning (DGBL). Reference [10] stated that DGBL is "putting games and learning together" (p. 97) and described DGBL research as able to create new learning opportunities, using games as a medium.

As DGBL has grown in popularity, many scholars have been reviewing the related studies to identify research trends in the literature. Reference [11] reviewed 137 articles published in SSCI-indexed journals to analyze the trends seen in DGBL research from 2001 to 2010. It was observed that the number of articles published on DGBL from 2006 to 2010 was four times the number published from 2001 to 2005. This trend clearly indicates the fast increasing interest of researchers in this topic since 2006. They also found that students from higher education were the most frequently selected sample group. This is because most DGBL researchers considered young adults to be the major players of digital games. In terms of the trend on major learning domains related to DGBL, it was found that most studies mainly investigated affective impacts of digital games (e.g., motivations, perceptions, and attitudes) without aligning with a specific learning domain.

Likewise, [12] reviewed 24 studies on using digital games to enhance student learning that were published in SSCI-indexed journals from 2003 to 2012. Their review results generally confirm the trends identified by [11] with respect to the rising status of DGBL research, the major sample groups, and the primary learning domains. According to [12], while many studies did not specify what subject matters were involved, science and social studies appeared to be the major learning domains in recent years, with a limited amount of DGBL studies examining language learning. This trend implies the need for more language educators and researchers to probe into the promising field of DGBL.

While the use of digital games for educational purposes varies in different contexts, understanding the emerging trends of how digital games are currently implemented in language learning can inform both language educators and researchers of game use for learning, and thus help to improve their professional practices. As a

subset of DGBL, digital game-based language learning (DGBLL) refers to "the design and use of a diverse array of digital games for the purpose of learning or teaching a second or foreign language" [13]. Adopting this operational definition, the current review aims to identify the emerging trends of DGBLL articles published in four influential journals in the field of computer-assisted language learning (CALL) during years 2010 to 2014. The following research questions are addressed in this review.

1) What is the percentage of published articles related to DGBLL in the selected journals?
2) What research methods are employed in the selected DGBLL studies?
3) What target languages are studied in the selected DGBLL studies?
4) What language learners are investigated in the selected DGBLL studies?
5) What digital games are used for second or foreign language learning in the selected DGBLL studies?

II. METHOD

The corpus to be searched for relevant articles in this review includes four selected journals: *Language Learning & Technology* (LLT), *Computer Assisted Language Learning* (CALL), the *ReCALL* journal, and the *CALICO* journal. These journals were chosen because they are key journals in the field of CALL, as suggested in [14] and [15], who conducted influential literature reviews in CALL contexts.

Within this corpus, a total of 589 articles from 2010 to 2014 were screened, using search terms related to ludic activities, such as *"game-based learning," "game play," "gaming," "games," "digital games," "computer games," "online games," "video games," "serious games,"* and *"educational games"* (adapted from [16]; [17]). The articles included in the current review were limited to studies that empirically investigated the effectiveness of digital games for students' learning of second language (L2) or foreign language (FL).

After the screening process, 23 relevant articles met the inclusion criteria, and thus were subject to later analysis. In the coding process, two researchers of the research team reviewed all the identified DGBLL studies at least three times. First, each researcher read the full text of the studies independently to further screen for relevance. Next, reading logs for each of the studies were created individually and then reviewed collaboratively by the two researchers, based on a coding scheme developed for this work. Finally, all the studies were reviewed again and crossed-referenced with their associated reading logs, with an Excel file documenting the holistic coding results of the 23 DGBLL studies included in this review.

The two researchers played the role of inter-raters in the current review. In terms of the screening of study identification, the initial agreement level was 97%. As for the coding results, the initial agreement level was 85%. Throughout the screening and coding processes, any inconsistency was first resolved by re-examination of the raw data, and then finalized thorough discussions that were held in weekly meetings, in order to reach full agreement (100%) of the research team, and thus enhance the reliability of this work.

III. RESULTS

The DGBLL research trends emerging from the current review with regard to the five research questions are discussed in this section.

A. Articles Published

A low percentage of DGBLL studies (4%) was identified in the total pool, as shown in Table 1. It is found that *ReCALL* contributed the most articles, with 9 DGBLL studies, and it even produced a special issue on DGBLL in 2012. This is then followed by *LLT*, which also had a special issue on DGBLL in 2014, and published 7 related articles, and then *CALL*, which published 5 DGBLL articles, and lastly, only 2 DGBLL articles were published in *CALICO*. Former review attempts on DGBLL also identified a small amount of empirical studies on this topic (for example, see a review of 14 DGBLL studies in [18]). Taken together, although in recent years there has seen an increasing attention to DGBL research (see [11]; [12]), the results of this review still suggest that more studies on using digital games for language learning are needed to provide more empirical evidence for the emerging line of research on DGBLL.

TABLE I. RELEVANT DGBLL ARTICLES PUBLISHED IN EACH OF THE SELECTED JOURNALS DURING 2010-2014

Selected Journals	***Total number of articles published***	***Frequency of DGBLL articles***	***Percentage of DGBLL articles (%)***
LLT	162	7	4
CALL	134	5	4
ReCALL	117	9	8
CALICO	176	2	1
Total	589	23	4

B. Research Methods Employed

Among the 23 reviewed DGBLL studies, mixed methods (52%) were most frequently used, followed by qualitative methods (26%), and quantitative methods (22%), as shown in Table 2. The results for this trend indicate that even though a small percentage of DGBLL studies have been published in the selected journals during the focal time period, these researchers most often conduct in-depth and comprehensive studies using mixed methods. It is also found that most DGBLL researchers conducted short-term studies rather than longitudinal ones. Accordingly, the

current review suggests that a mixed-method design to be employed and more longitudinal studies to be conducted by future DGBLL researchers.

TABLE II. FREQUENCIES AND PERCENTAGES OF RESEARCH TYPES IDENTIFIED IN THE REVIEWED STUDIES

	Number of studies	*Percentage (%)*
Quantitative Method	5	22
Qualitative Method	6	26
Mixed Method	12	52

C. Target Languages Studied

With regard to the frequencies and percentages of target languages identified in the reviewed DGBLL studies, Table 3 shows that English (74%) was the most commonly studied target language, followed by Spanish (18%), with both Japanese and Chinese accounting for only 4%. The results of this trend suggest that more work in DGBLL research is needed on less commonly studied languages (e.g., Japanese, Chinese, German, French, and among many others).

TABLE III. FREQUENCIES AND PERCENTAGES OF TARGET LANGUAGES IDENTIFIED IN THE REVIEWED STUDIES

	Number of studies	*Percentage (%)*
English	17	74
Spanish	4	18
Japanese	1	4
Chinese	1	4

D. Language Learners Selected

As shown in Table 4, the most common educational level of learners examined in the DGBLL studies was higher education (65%), followed by elementary education (9%) and secondary education (4%). DGBLL authors who did not specify the educational levels of the learners or recruited a mixture of educational levels were categorized as "others" (22%), and this category ranked the second highest in this work. In the review of [11], similar results have been observed that university students were the most frequently selected sample group. Considering sample size, the findings of the current review revealed that the maximum number of participants in any one study was 86 learners, and the minimum was 2 learners, with a mean of 30. Clearly, most of the DGBLL studies examined in this work recruited a small size of participants. It is thus suggested that larger samples from a wider range of educational levels be used in future DGBLL studies.

TABLE IV. FREQUENCIES AND PERCENTAGES OF EDUCATIONAL LEVELS IDENTIFIED IN THE REVIEWED STUDIES

Educational Levels	*Number of studies*	*Percentage (%)*
Elementary education	2	9
Secondary education	1	4
Higher education	15	65
Others	5	22

E. Digital Games Implemented

In terms of game availability (see Table 5), most DGBLL researchers prefer to use off-the-shelf digital games (79%) over self-developed ones (17%). The popularity of off-the-shelf games is perhaps due to the effort and cost required for the researchers to develop their own games. It is also worth noting that, despite the great variety of digital games available in the market, most authors applied Massively Multiplayer Online Role-Playing Games (MMORPG) in their studies, such as *World of Warcraft*. In a former research synthesis, [19] even conducted DGBLL review with a specific focus on the use of MMORPG in language education. This trend of game availability thus indicates that language educators are in favor of applying MMORPG for their language teaching. On the other hand, it also suggests that other game genres, such as action games, puzzle games, adventure games, strategy games, and simulation games, should thus be examined in future works. Major pedagogical implications drawing from this review suggest that language learners and teachers could take advantage of off-the-shelf digital games as readily applicable learning tools. For teachers who are in search of a suitable type of digital games for the teaching of language, MMORPG can be a smart choice as such games offer an immersive environment in support of language learners' situated learning.

TABLE V. FREQUENCIES AND PERCENTAGES OF THE AVAILABILITY OF GAMES USED IN THE REVIEWED STUDIES

	Number of studies	*Percentage (%)*
Off-the-shelf	18	79
Self-developed	4	17
Others	1	4

IV. CONCLUSION

The current review was conducted to generally depict the trends in DGBLL research. The results can be summarized as follows: 1) Only 4% of the articles are identified as related to DGBLL within the reviewed corpus, 2) most DGBLL researchers employed mixed methods, 3) higher education learners were the most frequently examined group of participants in DGBLL studies, 4) English was the target language studied by the majority of DGBLL researchers, and 5) Off-the-shelf digital games, particularly the type of MMORPG, are the most commonly implemented games in the DGBLL literature.

These results, however, must be considered in light of its limitations. One notable constraint is the pool of articles adopted in this work. Because only four journals were examined with regard to DGBLL studies, some important publications may have been neglected. For example, influential journals like *Computers & Education*, *Educational Technology & Society*, and *British Journal of Educational Technology* are not included in this review, and thus some important DGBLL studies were left out. Another limitation is that many quality DGBLL studies that were

not published within the time span of current review were not included. Therefore, future literature reviews or research syntheses on DGBLL should include more sources of data, with expanded time period, to reduce the possibility of only obtaining partial knowledge about the phenomena of interest.

Despite of its limitations, this review provides a panoramic overview of the trends in DGBLL research and draws attention to areas where there are prominent gaps within the literature. While this review presents and discusses the key characteristics of DGBLL studies in language education, more research syntheses using meta-analysis or in-depth content analysis methods are still needed to contribute to this emerging line of research.

ACKNOWLEDGEMENT

This study was sponsored by the Ministry of Science and Technology of Taiwan under the grants MOST-101-2511-S-327-002 and MOST-104-2511-S-224-002-MY3.

REFERENCES

[1] M. Prensky, Digital Game-based Learning, 1st ed., vol. 1. New York: McGraw Hill, 2001, pp.106-144.

[2] M. Papastergiou, "Digital Game-based Learning in High School Computer Science Education: Impact on Educational Effectiveness and Student Motivation," Computers & Education, vol. 52, Jan. 2009, pp. 1-12, doi:10.1016/j.compedu.2008.06.004.

[3] H. Tüzün, M. Yılmaz-Soylu, T. Karakuş, Y. İnal, and G. Kızılkaya, "The Effects of Computer Digital Games on Primary School Students' Achievement and Motivation in Geography Learning," Computers & Education, vol. 52, Jan. 2009, pp. 68-77, doi:10.1016/j.compedu.2008.06.008.

[4] H. Y. Sung, and G. J. Hwang, "A Collaborative Game-based Learning Approach to Improving Students' Learning Performance in Science Courses, Computers & Education, vol. 63, Apr. 2013, pp. 43-51, doi:10.1016/j.compedu.2012.11.019.

[5] A. Meluso, M. Zheng, H. A. Spires, and J. Lester, "Enhancing 5th Graders' Science Content Knowledge and Self-efficacy through Game-based Learning.," Computers & Education, vol. 59, Sep. 2012, pp. 497-504, doi:10.1016/j.compedu.2011.12.019.

[6] B. D. Coller and D. J. Shernoff, "Video Game-based Education in Mechanical Engineering: A Look at Student Engagement," International Journal of Engineering Education, vol. 25, 2009, pp. 308-317.

[7] J. Huizenga, W. Admiraal, S. Akkerman, and G. T. Dam, "Mobile Game-based Learning in Secondary Education: Engagement, Motivation and Learning in a Mobile City Game," Journal of Computer Assisted Learning, vol. 25, Aug. 2009, pp. 332-344, doi: 10.1111/j.1365-2729.2009.00316.x.

[8] J. M. Yien, C. M. Hung, G. J. Hwang, and Y. C. Lin, "A Game-based Learning Approach to Improving Students' Learning Achievements in a Nutrition Course," Turkish Online Journal of Educational Technology, vol. 10, Apr. 2011, pp. 1-10.

[9] L. K. Sylvén and P. Sundqvist, "Gaming as Extramural English L2 Learning and L2 Proficiency among Young Learners," ReCALL, vol. 24, Sep. 2012, pp. 302-321, doi: 10.1017/S095834401200016X.

[10] M. Prensky, Computer Games and Learning: Digital Game-based Learning. In Raessens, J. & Goldstein, J. (Eds.), Handbook of computer game studies. Cambridge: The MIT Press, 2005.

[11] G. J. Hwang and P. H. Wu, "Advancements and Trends in Digital Game-based Learning Research: A Review of Publications in Selected Journals from 2001 to 2010," British Journal of Educational Technology, vol. 43, Jan. 2012, pp. E6-E10, doi: 10.1111/j.1467-8535.2011.01242.x.

[12] C. W. Tsai and Y. T. Fan, "Research Trends in Game-based Learning Research in Online Learning Environments: A Review of Studies Published in SSCI-indexed Journals from 2003 to 2012," British Journal of Educational Technology, vol. 44, Sep. 2013, pp. E115-E119, doi: 10.1111/bjet.12031.

[13] F. Cornillie, S. L. Thorne, and P. Desmet, "Digital Games for Language Learning: Challenges and Opportunities," ReCALL, vol. 24, Sep. 2012, pp. 243-256, doi: 10.1017/S0958344012000134.

[14] P. Hubbard, "A Review of Subject Characteristics in CALL Research," Computer Assisted Language Learning, vol. 18, 2005, pp. 351-368, doi: 10.1080/09588220500442632.

[15] G. Stockwell, "A Review of Technology Choice for Teaching Language Skills and Areas in the CALL Literature," ReCALL, vol. 19, May 2007, pp. 105-120, doi: 10.1017/S0958344007000225.

[16] M. Papastergiou, "Exploring the Potential of Computer and Video Games for Health and Physical Education: A Literature Review," Computers & Education, vol. 53, Nov. 2009, pp. 603-622, doi:10.1016/j.compedu.2009.04.001.

[17] P. Wouters and H. Van Oostendorp, "A Meta-analytic Review of the Role of Instructional Support in Game-based Learning," Computers & Education, vol. 60, Jan. 2013, pp. 412-425, doi:10.1016/j.compedu.2012.07.018.

[18] Y. H. Chiu, C. W. Kao, and B. L Reynolds, "The Relative Effectiveness of Digital Game-based Learning Types in English as a Foreign Language Setting: A Meta-analysis," British Journal of Educational Technology, vol. 43, Jul. 2012, pp. E104-E107, doi: 10.1111/j.1467-8535.2012.01295.x.

[19] M. Peterson, "Massively Multiplayer Online Role-playing Games as Arenas for Second Language Learning," Computer Assisted Language Learning, vol. 23, Nov. 2010, pp. 429-439, doi: 10.1080/09588221.2010.520673.

CODED STUDIES

[1] J. deHaan, W. M. Reed, and K. Kuwada, "The Effect of Interactivity with a Music Video Game on Second Language Vocabulary Recall," Language Learning & Technology, vol. 14, Jun. 2010, pp. 74-94.

[2] K. Collentine, "Learner Autonomy in a Task-based 3D World and Production," Language Learning & Technology, vol. 15, Oct. 2011, pp. 50-67.

[3] Y. J. Lan, "Does Second Life Improve Mandarin Learning by Overseas Chinese Students?" Language Learning & Technology, vol. 18, Jun. 2014, pp. 36-56.

[4] A. Chik, "Digital Gaming and Language Learning: Autonomy and Community," Language, Learning & Technology, vol. 18, Jun. 2014, pp. 85-100.

[5] H. Reinders and S. Wattana, "Can I Say Something? The Effects of Digital Game Play on Willingness to Communicate," Language Learning & Technology, vol. 18, Jun. 2014, pp. 101-123.

[6] L. K. Allen, S. A. Crossley, E. L. Snow, and D. S. McNamara, "L2 Writing Practice: Game Enjoyment as a Key to Engagement," Language Learning & Technology, vol. 18, Jun. 2014, pp. 124-150.

[7] D. Hattem, "Microblogging Activities: Language Play and Tool Transformation," Language Learning & Technology, vol. 18, Jun. 2014, pp. 151-174.

[8] H. C. Yang and D. Zapata-Rivera, "Interlanguage Pragmatics with a Pedagogical Agent: The Request Game," Computer Assisted Language Learning, vol. 23, Nov. 2010, pp. 395-412, doi: 10.1080/09588221.2010.520274.

[9] K. Jauregi, S. Canto, R. de Graaff, T. Koenraad, and M. Moonen, "Verbal Interaction in Second Life: Towards a Pedagogic Framework for Task Design," Computer Assisted Language Learning, vol. 24, Jan. 2011, pp. 77-101, doi: 10.1080/09588221.2010.538699.

[10] A. K. Wehner, A. W. Gump, and S. Downey, "The Effects of Second Life on the Motivation of Undergraduate Students Learning a Foreign Language," Computer Assisted Language Learning, vol. 24, Jun. 2011, pp. 277-289, doi: 10.1080/09588221.2010.551757.

[11] H. C. Liou, "The Roles of Second Life in a College Computer-assisted Language Learning (CALL) Course in Taiwan, ROC," Computer Assisted Language Learning, vol. 25, 2012, pp. 365-382, doi: 10.1080/09588221.2011.597766.

[12] M. Y. Liang, "Foreign Ludicity in Online Role-playing Games," Computer Assisted Language Learning, vol. 25, 2012, pp. 455-473, doi: 10.1080/09588221.2011.619988.

[13] M. Peterson, "Learner Participation Patterns and Strategy Use in Second Life: An Exploratory Case Study," ReCALL, vol. 22, Sep. 2010, pp. 273-292, doi: 10.1017/S0958344010000169.

[14] M. Peterson, "EFL Learner Collaborative Interaction in Second Life," ReCALL, vol. 24, Jan. 2012, pp. 20-39, doi: 10.1017/S0958344011000279.

[15] F. Cornillie, G. Clarebout, and P. Desmet, "Between Learning and Playing? Exploring Learners' Perceptions of Corrective Feedback in an Immersive Game for English Pragmatics," ReCALL, vol. 24, Sep. 2012, pp. 257-278, doi: 10.1017/S0958344012000146.

[16] S. L. Thorne, I. Fischer, and X. Lu, "The Semiotic Ecology and Linguistic Complexity of an Online Game World," ReCALL, vol. 24, Sep. 2012, pp. 279-301, doi: 10.1017/S0958344012000158.

[17] L. K. Sylvén and P. Sundqvist, "Gaming as Extramural English L2 Learning and L2 Proficiency among Young Learners," ReCALL, vol. 24, Sep. 2012, pp. 302-321, doi: 10.1017/S095834401200016X.

[18] P. S. Rama, R. W. Black, E. van Es, and M. Warschauer, " Affordances for Second Language Learning in World of Warcraft," ReCALL, vol. 24, Sep. 2012, pp. 322-338, doi: 10.1017/S0958344012000171.

[19] D. Zheng, K. Newgarden, and M. F. Young, "Multimodal Analysis of Language Learning in World of Warcraft Play: Languaging as Values-realizing," ReCALL, vol. 24, Sep. 2012, pp. 339-360, doi: 10.1017/S0958344012000183.

[20] M. Peterson, "Learner Interaction in a Massively Multiplayer Online Role Playing Game (MMORPG): A Sociocultural Discourse Analysis," ReCALL, vol. 24, Sep. 2012, pp. 361-380, doi: 10.1017/S0958344012000195.

[21] D. Ryu, "Play to Learn, Learn to Play: Language Learning through Gaming Culture," ReCALL, vol. 25, May 2013, pp. 286-301, doi: 10.1017/S0958344013000050.

[22] T. Cobb and M. Horst, "Does Word Coach Coach Words?" CALICO Journal, vol. 28, 2011, pp. 639-661.

[23] C. I. Hitosugi, M. Schmidt, and K. Hayashi, "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, vol. 31, 2014, pp. 19-39.