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Can Game-Based Learning Enhance Students' English Learning Motivation and Outcome in Higher Education?

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Abstract

The international community has devoted substantial resources to advancing Sustainable Development Goal 4—Quality Education—but achievement gaps persist. In English as a foreign language (EFL) setting, vocabulary acquisition is often regarded as a tedious task. Game-based learning in playful narratives and rule-based interactions has established the premise of enhancing undergraduates' learning outcomes and motivation; thus, it may also enhance learning outcomes and motivation among students. This study examines the impact of game-based learning on students' learning outcomes and motivation compared to that of a lecture-based learning context. It also aims to explore the impact of demographic factors, such as gender and prior English proficiency. There are 129 participants: 42 male and 87 female. To ensure that all students benefit from the GBL environment, we explored their demographic background, including their prior English proficiency and gender. The results showed that students had greater gains in the GBL environment, especially those with lower English proficiency. The study finds a gender preference for game types, as well as an association between students' satisfaction and confidence. The results indicated that integrating board games into English instruction can enhance undergraduates' motivation and learning outcomes. A game-based context can enhance students' motivation and learning outcomes regardless of their gender or prior English proficiency.

Keywords: game-based learning; motivation; higher education English; board games; English proficiency; sustainable development goal; gender preference

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1. Introduction

The international community has devoted substantial resources to advancing Sustainable Development Goal (SDG) 4—Quality Education (The United Nations, 2025); however, achievement gaps continue to prevail in the areas of meeting minimum proficiency as well as those related to demographic factors such as gender (D.-F. Chang & ChangTzeng, 2020). In English as a foreign language (EFL) settings, vocabulary acquisition is frequently cited as a bottleneck: students often regard it as tedious rote memorization, unaware that lexical breadth is fundamental to overall proficiency. EFL research suggests that game-based learning promotes vocabulary retention and motivation among English learners (Malakouti et al., 2024). Over the past decades, Game-based Learning (GBL) has emerged as a pedagogy by embedding specific games into disciplinary content.

GBL can be shown through playful narratives and rule-based interactions. Semi-structured games can capture learners' attention, foster collaboration, and accommodate diverse learner backgrounds. Its curriculum design is also more flexible, aligning with curricular goals and reshaping learners' perceptions. Given the importance of vocabulary acquisition in undergraduate English courses, this study explores whether integrating games into instruction enhances motivation and learning outcomes.

Prior studies mostly examined lecture-based courses. This leaves open the question of whether the motivational benefits of games extend equally to learners regardless of gender or English proficiency. This study also aims to target 4.5 on inclusive education and SDG 4—the quality of education. To address these issues, the present study integrated TOEIC high-frequency vocabulary into a customized board-game intervention in First-Year College English courses. By linking micro-level classroom design with macro-level sustainability targets, this study seeks empirical evidence to enhance instructional quality and accelerate progress toward inclusive, quality education.

2. Literature Review

The literature review initially describes integrating board games into GBL, then discusses the relationship among GBL, motivation, and learning performance. Finally, other GBL studies about students' demographic backgrounds and their effects.

2.1. Integrating Board Games in Game-Based Learning

Numerous studies have been conducted to apply GBL for all age levels, ranging from elementary school to higher education. The various applications include online games, educational platforms, smartphone Apps, and board games. The aims of GBL lie not only in strengthening learning objectives but also in incorporating learning content from school curricula. GBL uses a complete set of games as part of the curriculum and incorporates learning activities into classroom games. It helps students to advance their understanding and alleviates their learning anxiety (Fatta et al., 2019). GBL can also enhance students' perceptions of their learning materials during the teaching process and provide clear learning outcomes after class (Figueroa-Flores, 2016). GBL transformed game elements or concepts from course content into a game mechanism in which different player choices generated corresponding results (Perrotta et al., 2013). GBL can also be defined as semi-structured games with definite learning outcomes.

GBL also includes board games with rules and game materials, such as cards or dice (De Voogt et al., 2013), and this combination allows students to experience themes, game rules, interactions, and randomness (Chircop, 2017). Research also suggests that when students are fully engaged in a particular activity, they can engage in more reflective thinking and enhance their problem-solving skills (Chou et al., 2023; Hou & Keng, 2021). Learners enhance learning participation, accept subject materials, stay focused in class, and engage in interactive and collaborative discussions among peers via GBL (Li et al., 2024; Y.-C. Lin & Hou, 2024). Compared to traditional learning methods, GBL with board games can enhance students' interpersonal interactions and allow them to construct knowledge together.

The usage of GBL in education and teaching has become more popular. A literature review of 137 Taiwanese studies on GBL from 2002 to 2016 revealed that education-related uses accounted for 72.3%, which is the highest percentage (N = 99, 72.3%), and English educational games were also mostly used (C. Y. Chen & Wong, 2017). Playing board games can strengthen students' interpersonal skills and reduce their learning anxiety. Incorporating board games into English language classrooms helps students overcome difficulties, as they must interact with their classmates through the game mechanics. Another study also suggested that comprehensive use of board games, whether for teaching beginner vocab-

ulary or advanced learners' communication (O'Neill & Holmes, 2022). As a result, using GBL can increase students' opportunities to use vocabulary and practice English-speaking skills in a subliminal way.

For students with varying English proficiency levels, incorporating the GBL approach in English instruction can enhance comprehension and increase their willingness to express themselves in the target language (Wu, 2018; Yeh et al., 2017). Another study also found that integrating GBL into teaching would enhance the learning effectiveness of low-achieving EFL learners (Waluyo & Leal, 2021). The current research focuses on using board games in the context of GBL to determine whether this can increase undergraduates' English learning motivation and performance, regardless of their initial English proficiency.

2.2. Game-Based Learning, Motivation, and Learning Performance

GBL is an innovative educational approach that has demonstrated significant potential in enhancing both learning motivation and academic performance (Lampropoulos & Sidiropoulos, 2024). The core of GBL lies in integrating game mechanics into the learning process, enabling a more concrete, engaging, and interactive learning process. GBL has been shown to improve students' critical thinking skills and academic performance in science and technology education (Mohammed et al., 2024). GBL also fosters learners' motivation through game mechanics, keeping students highly engaged. By incorporating interactivity and challenge-based learning, GBL also encourages students to use immediate feedback to provide positive reinforcement, further enhancing learner confidence and motivation. Thus, GBL improves academic performance and motivation, potentially contributing to sustainable learning.

GBL has also been shown to improve academic performance and motivation in the above-mentioned studies; this study aims to explore its effect on sustainable English learning. Improving learners' motivation for language learning has been an ongoing issue among educators and researchers (S. Chen & Liu, 2023; Sun & Gao, 2020). There has been a growing trend in incorporating game-based learning concepts into language learning activities, with the aim of enhancing learners' engagement, motivation, and attitudes towards learning (Dehghanzadeh et al., 2021; Azzouz Boudadi & Gutiérrez-Colón, 2020). Learners with higher learning motivation tend to achieve better results in second-language acquisition (C. J. Lin et al., 2018). A mobile game-based learning environment had a positive impact on learners' motivation for second-language learning (Gamlo, 2019). Another study compared students who received a game-based teaching and assessment tool (Kahoot!) and those who did not and found that learners who received game-based teaching had higher second-language learning motivation (Eltahir et al., 2021). Other studies further such foundation and found how GBL enhances students' motivation, concentration, and memory, grammatical application, targeted language acquisition, and their self-efficacy in English speaking and listening (Cabrera-Solano, 2022). GBL also supports underperforming students in enhancing motivation in learning mathematics and academic performance (Ku et al., 2014). To understand the effects of GBL in different learning environments, this study intends to explore whether incorporating GBL activities into online language learning motivates students.

2.3. GBL and English Language Learners

Research has found mixed results on how learning might be impacted by learners' backgrounds, such as gender preference or English proficiency. Female learners prefer narrative-driven and immersive games, whereas male learners favor competitive and rule-based games (Spieler & Slany, 2018). Female learners perform better than male learners in game flow experience and gameplay progress performance, particularly in language

learning contexts such as Thai grammar acquisition (Wang et al., 2021). Additionally, female learners demonstrate superior learning outcomes in small-scale educational games and science education, indicating that GBL may be more effective for female students. Female students demonstrated higher consistency and linguistic stability, while male students relied more on code-switching strategies and a robot-assisted system (Wang et al., 2021).

Previous research has mixed results on whether learners' backgrounds affect their learning outcomes (A. Chang & Nkansah, 2024; Gašević et al., 2016), while many studies have focused on the impact of gender and educational level differences on online learning (Diep et al., 2016; Park et al., 2019). Research has found that female learners have stronger self-regulated learning abilities, which also contributes to their learning outcomes (Alghamdi et al., 2020). Female students tend to use learning strategies to learn English and achieve better performance (Iwaniec, 2019). For example, female students use more social and emotional strategies in language learning compared to male students (Ilmi et al., 2019; Juniarti et al., 2023). Studies have yielded mixed results on whether gender has any impact. Another study found no significant difference in the frequency of using learning strategies among college students, regardless of gender (Ranjan & Philominraj, 2020). In view of this, this study intends to explore the impacts of GBL in the First-year English courses and whether there are any gender or other differences.

This study intends to explore how GBL contributes to overall learning outcomes. Specifically, do we observe any impacts from their demographic backgrounds, such as gender or prior English proficiency? Could students perform equally well in the GBL environment regardless of their prior English proficiency or gender? The learning outcomes include motivation to learn and academic achievement. The research questions of this study are:

1. How does GBL motivate students in learning English in higher education?
2. How does GBL improve sustainable English learning in higher education?
3. How does the demographic background of learners interact with sustainable English learning in a GBL environment?

3. Research Methods

The research applied quantitative research methods to analyze the collected data. The research participants were divided into two groups: an experimental group and a control group. The research instruments included a pre-test, a post-test, a pre-questionnaire, and a post-questionnaire. Research participants in the experimental group received an intervention using board games in a GBL environment, whereas participants in the control group received the traditional TOEIC high-frequency vocabulary teaching method. Research instruments include a pre-test to measure students' English competency level and learning motivation questionnaires, which were administered before and after the intervention to assess changes in students' learning motivation.

3.1. Research Participants

The majority of students were enrolled in the First-Year English courses, with some retakers. Motivational impact was measured with Keller's Instructional Materials Motivation Survey (IMMS), which captures four dimensions—attention, relevance, confidence, and satisfaction (Keller, 2010). 129 students participated in the research and completed both the pre-questionnaire and post-questionnaire, of whom 42 were male and 87 were female. There were 65 students in the experimental group and 64 students in the control group. They are students in the following two courses scheduled for 18 weeks: English Listening and Speaking Lab and Freshman English Reading.

3.2. Research Procedures & GBL Design

The current research was conducted in three Freshman English courses at Chung Yuan Christian University, located in northern Taiwan. The GBL teaching experiments were administered after the midterm exam week and lasted for four weeks. Each week, a new board game is introduced in class, and the instructor incorporates selected TOEIC high-frequency vocabulary from a list of 640 words. A total of four different commercial board games were chosen for the class. Due to the COVID-19 pandemic, the classes were delivered online via Microsoft Teams, so the four selected board games were also redesigned by the instructors. These board games were selected as they are appropriate for students' levels and well-aligned with the course design and objectives.

During those four weeks, class instruction was divided into lectures on the textbook materials, and online board games were introduced and played during the second hour of class. The 65 students in the experimental group participated in online board games in small groups, starting with Dobble, then Toddles-Bobbles, Bananagrams, and finally Codenames. These board games were selected as they are appropriate for students' levels and well-aligned with the course design and objectives. Such a GBL design took place from week 14 to week 17, with the intent of enhancing students' motivation to acquire English vocabulary. Online board games were used to strengthen students' learning motivation and class participation by providing a more relaxed and efficient way to memorize TOEIC vocabulary. These four selected games are suitable for incorporating TOEIC vocabulary and might advance students' English competency. The instructor explained the rules to the students using PowerPoint slides, and then those students watched tutorial videos before each online board game. After students watched the videos, they then started playing the online board games with their group members. The ultimate goals behind such a procedure and design are to help students increase their interest and motivation in learning TOEIC vocabulary. The majority of students were enrolled in the First-Year English courses, with some retakers. Motivational impact was measured with Keller's Instructional Materials Motivation Survey (IMMS), which captures four dimensions—attention, relevance, confidence, and satisfaction (Keller, 2010). 129 students participated in the research and completed both the pre-questionnaire and post-questionnaire, of whom 42 were male and 87 were female. There were 65 students in the experimental group and 64 students in the control group. They are students in the following two courses scheduled for 18 weeks: English Listening and Speaking Lab and Freshman English Reading.

3.3. Game Mechanisms for Each of the Four Selected Online Games

The four selected board games were introduced, and the instructor first explained the rules to the students using PowerPoint slides. Then, the students were instructed with a tailored video showing how to play the game, especially made for these online games in this GBL environment. Dobble was the first online board game introduced to the students, serving as an initial icebreaker to draw their attention and increase their motivation to engage in game-based learning. By sharing the screen, students played the game on the Word Wall website, which the instructor had previously programmed. In a small group of four to five people, they flipped cards on the website as instructed in the given game rules. They had to learn the names of all the symbols on the cards first. Then, they had to shout the names of the symbols that were identical between their card and their teammate's card. Whoever shouts first wins one point, and points can be accumulated by clicking the points board on the Word Wall website.

The second game was a memory game called Toddles-Bobbles, in which the students had to name each of the twelve cards from a card pile, using a chosen TOEIC vocabulary list of high-frequency words provided by the instructor. The twelve cards of different patterns

appear repeatedly from the pile. The students were taught the meanings of some chosen TOEIC adjectives describing people, e.g., loyal, before playing the game. Students then take turns flipping cards from a card pile in the center of the Word Wall Website interface. When a card appears a second time from the card pile, whoever correctly shouts the name first wins one point. In other words, students had to remember the twelve chosen adjectives for each of the twelve cards. The point accumulation mechanism works the same way as the previous game. When students flipped all the cards from the central card pile, the game ended. The student who receives the highest score is the winner. This memory game serves as a vocabulary builder in the class.

The third game was Bananagrams, a spelling game that helps students practice TOEIC vocabulary. The designed online version of Bananagrams is played differently from the original game rules. The game was designed and programmed to be played from the Miro collaborative website at (www.Miro.com, accessed on 1 November 2025). Fifteen TOEIC vocabulary words were chosen by the instructor and posted, with each word spelled using alphabet tiles on the left-hand side of the web interface. The students were instructed through a video showing how to play the game by building vocabulary grids like crossword puzzles. The more crossing points created, the higher the score was. This game serves as a brainstorming activity that helps students practice spelling skills and build team spirit. Discussions are required to win the game; thus, students practiced their speaking skills.

The fourth game was Codenames, in which students had to collaborate with their teammates to find the answers and win. Codename is also a card game in which students flip two cards per round. The cards are designed around the instructor's chosen TOEIC high-frequency vocabulary; students can learn new TOEIC vocabulary while playing the game. In total, there are sixteen cards, two different colors representing the two teams: the blue team and the red team. The students were split into two teams within each small group of six, with three students per team. One student from each group volunteers to be the spy master for their team and must come up with a keyword that represents the two cards they picked. After the spy master announced the codename, the corresponding team had to do their best to determine which two cards it represented. By sharing their screen in Microsoft Teams, students played the game on the Word Wall website, which the instructor had previously programmed. The group that finds the maximum pairs of words based on the codenames within the required time wins the game. This game served as a brainstorming and memory game, helping students practice speaking skills during discussions.

3.4. Research Instrument

The learning motivation questionnaire used in this study was adapted from Keller's IMMS (Instructional Materials Motivation Survey), which includes four dimensions: Attention (2 items), Relevance (3 items), Confidence (5 items), and Satisfaction (4 items). Responses were collected using a Likert scale from 1 (strongly disagree) to 5 (strongly agree). To ensure questionnaire validity, an exploratory factor analysis was conducted. The results showed a KMO value of 0.666 and Bartlett's test of sphericity p-value of <0.05, indicating suitability for analysis. These results were supported by an overall explained variance of 64.44%, demonstrating strong explanatory power. Finally, item-to-item consistency analysis yielded a Cronbach's alpha value of 0.721, indicating good reliability.

4. Results

4.1. Students Learned Equally Well in Both the GBL and the Lecture Environment

To examine the effects of GBL on English learning, this study compares pre- and post-test results and finds that students learn better in GBL than in the lecture environment, as Table 1 shown. The data analysis also shows that students showed significant improvement

in their learning outcomes, whether they are in the GBL or the lecture environment. The results of the covariate analysis showed that the experimental group (M = 86.09, SD = 8.79) significantly outperformed the control group (M = 76.63, SD = 14.32) on English learning performance (F = 20.07, $p < 0.001$). These results also suggest that college students learn English more effectively online in a GBL environment.

Table 1. GBL, Lecture and students' learning achievement.

Method	N	Pretest		Posttest		t	Sig.
		Mean	SD	Mean	SD		
GBL	65	76.95	11.79	86.09	8.79	7.55	$p = 0.000$ ***
Lecture	64	73.06	14.85	76.63	14.32	2.46	$p = 0.016$ *

*** $p < 0.001$, * $p < 0.05$.

4.2. Students Are More Motivated to Learn in the GBL Environment

Results of the independent samples t-test showed that GBL significantly increased students' learning motivation, whereas the lecture did not, as shown in Table 2. From the results of the covariate analysis, it was found that students in the experimental group (M = 3.90, SD = 0.55) significantly outperformed students in the control group (M = 3.77, SD = 0.52) in terms of English learning performance (F = 4.17, $p < 0.04$). Further examining the differences in the different motivational orientations, the analysis showed that the experimental students significantly outperformed the control students in the two motivational orientations of attention and relevance. Based on the standard deviation, individual differences decreased in the post-test. Specifically, we observed that the value of standard deviation decreased more in a GBL environment. The result suggests that GBL is more effective than a lecture context in increasing students' learning motivation. Students are more likely to learn equally in a GBL environment.

Table 2. GBL, Lecture and four dimensions of Learning Motivation.

Dimension	Method	N	Mean	SD	F	Sig.
Attention	GBL	65	3.80	0.72	4.85	0.03 *
	Lecture	64	3.59	0.68		
Relevance	GBL	65	4.21	0.62	5.74	0.02 *
	Lecture	64	4.02	0.57		
Confidence	GBL	65	3.65	0.73	1.12	0.29
	Lecture	64	3.59	0.70		
Satisfaction	GBL	65	4.10	0.54	3.43	0.07
	Lecture	64	3.94	0.54		
Total	GBL	65	3.90	0.55	4.17	0.043 *
	Lecture	64	3.77	0.52		

* $p < 0.05$.

4.3. Demographic Backgrounds and GBL

Regarding academic achievement, we did not find any significant gender differences, as shown in Table 3. In other words, students learn equally well in a GBL environment regardless of their gender. The GBL environment motivates male undergraduates more than female undergraduates. This study found that male students are more motivated in learning English than female undergraduates in a game-based learning context. Regarding learning motivation performance, the dependent-samples t-test found that male students showed a significant improvement. In contrast, female students did not show significant changes in learning motivation. The results of the covariate analysis also confirmed that male undergraduates' learning motivation was significantly higher than that of female

undergraduates. The decreased standard deviation among male students in the post-test also suggested that such a strategy is effective. Such results suggest that gender did make a difference in learning motivation, if not in academic achievement, when it comes to learning English in a GBL environment.

Table 3. GBL, gender, and students' learning motivation.

Gender	N	Pretest		Posttest		t	Sig.
		Mean	SD	Mean	SD		
Female	45	3.71	0.51	3.80	0.53	1.26	0.215
Male	20	3.80	0.75	4.12	0.55	2.91	0.009 *

* $p < 0.05$.

Students could improve their English in the GBL environment regardless of their prior English proficiency, as shown in Table 4. Students had varying levels of English proficiency in First-Year English; however, their prior proficiency did not hinder their learning in the GBL environment. Students with higher English proficiency learn well in the GBL environment. We also found that students with lower English proficiency learn particularly well in the GBL environment; specifically, they improved by 15 points, from 67 to 82 out of 100. Students with higher English proficiency also benefit from the GBL environment, as they improve from 86.7 to 90 out of 100 points. Such results suggest that GBL could eliminate the academic achievement gap between students with higher and lower English proficiency.

Table 4. English proficiency and GBL learning outcomes.

English Proficiency	N	Pretest		Posttest		t	Sig.
		Mean	SD	Mean	SD		
Low proficiency	33	67.45	8.48	82.18	10.25	8.65	0.000 ***
High proficiency	32	86.7	4.21	90.13	4.25	3.48	0.002 **

*** $p < 0.001$, ** $p < 0.01$.

Having compared whether there are any significant differences in learning outcomes, this study compares English proficiency, motivation, and learning outcomes. This study found that students' learning motivation is not affected by their English proficiency in the GBL environment. In other words, students with various levels of English proficiency are equally motivated to learn in the GBL environment. In addition, we also found that GBL could enhance students' learning motivation regardless of their original English proficiency.

5. Conclusions and Discussion

This study examined the effects of applying GBL in the First-Year English courses in Taiwan. The findings of this study reaffirm the positive effects of GBL and its potential to achieve sustainable goals. It also discusses the potential of GBL and how it might bridge achievement gaps and enhance the quality of education.

5.1. GBL and Sustainable Education

Beyond disciplinary gains, the findings highlight how thoughtfully designed game-based instruction can advance broader sustainability goals. These align particularly with those in the United Nations 2030 Agenda. The results of this study show that GBL enhances students' motivation and learning outcomes. Students with varying levels of English proficiency all benefit from GBL. Specifically, students with lower English skills show significant improvement in both the GBL environment and in motivation. These outcomes

fit well with Sustainable Development Goal 4: Quality Education. SDG 4 emphasizes effective learning and engaging pedagogy for competencies in sustainable development.

Students are motivated to learn English in the GBL environment, regardless of prior English proficiency. Positive motivation also improves learning outcomes and academic achievement. Students with low English proficiency improve significantly in GBL settings. This provides evidence of reduced academic achievement gaps. Such improvement supports Target 4.5 of SDG 4, which aims to cut disparities in education by 2030. GBL instruction builds a more inclusive academic ecosystem. It prepares diverse populations to engage with global sustainability challenges.

5.2. GBL and Transformative Pedagogy

This study demonstrates that GBL significantly improves students' learning outcomes and motivation compared to a lecture context. Such results underscore the potential of GBL as a transformative pedagogy in today's First-Year English classrooms. The launch of ChatGPT 3 has transformed language learning into large language modeling, and students often forget that writing is a form of thinking. Without writing their own essay, they are not thinking through the ideas. Without that, students did not develop critical thinking or other cognitive abilities. GBL presents significant advantages for the development of students' cognitive abilities. Research indicates that GBL environments can facilitate higher-order cognitive abilities, such as problem-solving and critical thinking (Khoo et al., 2025). These cognitive abilities benefit largely from the carefully designed challenges and engaging learning offered by GBL.

GBL effectively integrates technology and motivates students. Its immersive setting and real-time feedback mechanisms facilitate the internalization of knowledge and address students' diverse needs (Lai & Hu, 2025). These features create an adaptive and supportive learning experience, tailored to individual student preferences and progress. It also enables students to apply their knowledge in meaningful ways with stimulating real-world scenarios. This kind of learning context develops understanding and bridges the gap between theoretical knowledge and practical application. It enhances understanding and supports the formation of long-term memory.

Applying GBL in the First-Year English curriculum also transforms instructors' pedagogy, aligning with students' preferences and guiding them to challenge their comfort zones. Previous students often found that male learners are quickly engaged in the challenges, excitement, and captivity of the GBL environment. This often captures their attention and further engages them in learning. This study found that such gender preferences might exist; however, students learn equally well regardless of their gender. This implies how educators use GBL to challenge students and help them navigate challenges and the unknown.

5.3. GBL and Inclusive Learning

In traditional college classrooms, "learning" happened when students sat in large lecture halls and received one-way instruction. GBL provided a glimpse of how instructors could tailor content to meet learners' diverse needs and integrate these elements into curriculum design. This study found that GBL enhances students' learning motivation and outcomes, regardless of their prior English proficiency. It also shows how GBL could contribute to an inclusive learning environment that accommodates the diverse needs of today's undergraduates. GBL would provide more comprehensive learning support and foster inclusive educational experiences for diverse students.

GBL provides real-time feedback through personalized design, which can internalize knowledge and subsequently master it. Its individualized tasks and personalized feedback

are more beneficial for students with lower English proficiency. In traditional teaching environments, these students often find learning stressful, and their learning journey is marked by multiple layers of frustration. That undermines their motivation to learn and affects their learning outcomes. This is the premise of GBL and how it could contribute to the inclusive learning environment.

5.4. GBL, Challenges, Possibilities, and Sustainability

Further analysis of GBL revealed that male students have higher motivation to learn than female students, indicating the challenges and possibilities of GBL. For example, do male students still have higher motivation when the intervention is prolonged? Do such gender preferences interact with learning outcomes in the long run? While the intervention benefits all students, future curricula design should still consider the timeline and how both genders can collaborate equally. In other words, the future GBL design should consider that stories or narratives could also encourage higher engagement among female students and guide male students out of their comfort zone. While male students excel and are highly motivated under the current GBL design, instructors could include narratives to ensure motivational benefits are distributed equitably. This might also neutralize gender preferences identified by this and previous studies and enable the possibility of achieving sustainable citizenship.

The United Nations identifies that sustainable citizenship should encompass skills such as communication, teamwork, strategic thinking, and problem-solving. Embedding vocabulary practice in cooperative scenarios within First-Year English courses could cultivate these skills while enhancing undergraduates' English proficiency. As undergraduates work in small groups to solve those board games, they develop continuous dialogue, mutual support, and teamwork to achieve collective victory. Such teamwork is rarely taught in Taiwan's educational system, as students must take entrance exams on their own. As such, many students know how to achieve individual victories rather than orchestrate collective victories, which are necessary for interdisciplinary collaboration.

To enhance sustainability through interdisciplinary collaboration, future studies could be embedded with other environmental themes, such as global warming, climate change, or the impact of Artificial Intelligence (AI) on our daily lives. These topics could foster students' understanding of the impact of technology and environmental changes on our daily lives. Integrating the abovementioned issues with social justice, educational equity also reflects how technology and environmental factors impact resource allocation or potentially reinforce existing inequity. Through dialogue and collaboration, students could practice their problem-solving skills. Such practices might sustain engagement among undergraduates and translate into equitable participation into adulthood. This study offers a practical, scalable pathway toward a more inclusive and sustainable educational context.

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Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

GBL	Game-based Learning
EFL	English as a foreign language
TOEIC	Test of English for International Communication
SDG	Sustainable Development Goal

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