**Promoting Students’ Morphological Competence in English for Medical Purposes (EMP) Courses through AI-Driven Gamification**

Huu Ngoc Nguyen

Abstract

This present quasi-experimental study aimed to investigate the effects of AI-driven gamification on the morphological competence of second-year medical students enrolled in English for Medical Purposes (EMP) courses at Nguyen Tat Thanh University. A purposive sample of 83 students was separated into the experimental group (AI-driven gamification instruction, N = 42) and the control group (lecture-based instruction, N = 41). In quantitative terms, pre-tests and post-tests were conducted to assess morphological competence in both groups before and after the course. Furthermore, qualitative data were collected through intensive semi-structured interviews to gain insights into students’ perceptions of the AI-driven gamification practice during their learning experience. The findings revealed that the experimental group significantly outperformed the control group in terms of morphological competence (p < 0.05). In addition, findings from qualitative analysis indicated that the students in the experimental group found the gamified learning experience engaging, interactive, and motivating, which helped them retain morphological knowledge more effectively. From these findings, it is suggested that incorporating AI-driven gamification into EMP teaching can make learning English medical terminology more effective, increase students’ motivation, and create a more personalized learning experience.

***Keywords*:** AI-driven gamification, English for Medical Purposes (EMP), Nguyen Tat Thanh University, quasi-experimental study.

1. Introduction

As a subset of English for Specific Purposes (ESP), English for Medical Purposes (EMP) has grown in popularity in recent years, reflecting the growing needs for medical professionals to communicate effectively in English in clinical settings (Hutchinson & Waters, 1993; Georgy, 2023). EMP courses are particularly crucial for non-native speakers to gain sufficient language proficiency to comprehend medical texts written in English and attend international medical conferences (Cojocaru, 2024).

In EMP courses, the mastery of medical terminology is utterly essential. However, English medical terms are usually complex and highly specialized because most of them are rooted in Latin and Greek, which poses significant challenges in decoding and interpretation for medical learners (Hastürkoğlu, 2020). Therefore, a full grasp of medical morphological knowledge of prefixes, roots, and suffixes is of absolute necessity to enhance learners’ ability to analyze, comprehend, and retain medical vocabulary more effectively (Nguyen Le & Miller, 2020; Oseki & Marantz, 2020; Hastürkoğlu, 2020).

While morphological competence plays an important role, it has often been neglected or ineffectively taught in the traditional classrooms that focus merely on rote learning (Hastürkoğlu, 2020). This situation, therefore, paves the way for the adoption of more effective instructional approaches that may promote students’ engagement and retention of medical vocabulary. One such innovation for education is then provided by artificial intelligence. AI-powered platforms can provide personalized learning, adapt to learners’ learning needs in real time, and provide immediate feedback, which greatly facilitate the learning of medical terms among students (Alenezi, 2023; Abbes et al., 2024).

In the mean time, gamification with the use of game-based features like points, badges and leaderboards, has shown promising capabilities to bolster students’ motivation, engagement, and participation in their learning process (Deterding et al., 2011; Salehi et al., 2023; Chugh & Turnbull, 2023). While AI and gamification have both separately demonstrated educational benefits, their combined use for EMP teaching, especially to enhance morphological knowledge, still remains underexplored.

To fill this gap, this study was conducted to investigate the effects of the use of AI-driven games on promoting students’ morphological competence in learning medical terminology in EMP courses.

To achieve the aim above, the study sought to asnwer the following two research questions:

1. *How does AI-driven gamification enhance medical students’ morphological competence in EMP courses?*
2. *What are medical students' perceptions towards the use of AI-driven gamification in their EMP courses?*

2. Literature Review

**2.1. AI-driven gamification**

*2.2.1 Definition of AI-driven gamification*

There is a wide range of definitions of gamification from various scholars, each offering distinct perspectives on its purpose and design. First, Kapp (2012) emphasizes the purposeful application of game elements in education, stating that gamification is used as “game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems” (p. 10). Similarly, Zichermann and Cunningham (2011), describe gamification as “the process of game-thinking and game mechanics to engage users and solve problems” (p.47). Werbach and Hunter (2012), on the other hand, focus on the the structural components of games. In their sudy, they propose a theoretical framework of dynamics, mechanics, and components, guiding strategic design of gamification.

When enhanced by AI, gamification has evolved with dynamic, adaptive features to cater to individual personalized learning and preferences (Macewski, 2023). Centrical (2023) describes AI-driven gamification as the integration of gamification strategies with AI features that provide tailored challenges, feedback, and rewards in real time. Chou (2023) further emphasizes that AI-based games continuously refine learner’s learning experiences by adjusting difficulty levels, and engagement methods based on performance data.

*2.2.2. Features of AI-driven gamification*

AI-driven gamification integrates artificial intelligence technologies with game design elements to enhance engagement, motivation, and personalized learning experiences. One key feature of AI-driven gamification is personalization, whereby machine learning algorithms customize content, difficulty levels, and feedback to suit the learner's learing progress and performance (Costa et al., 2024; Abbes et al., 2024). Moroever, AI-driven gamification provides real-time feedback that analyzes user behavior and provide immediate responses, helping them to monitor progress and adjust strategies (Ng et al., 2024; Spinify, 2024). What is more, AI-embedded features in certain learning platforms like Quizlet, Kahoot!, Quizizz, etc. also facilitates content generation in quizzes and assessments, improving the gamified experience (Abbes et al., 2024). Furthermore, AI enhances students’ motivation by integrating game mechanics—such as points, badges, and leaderboards (Jaramillo-Mediavilla et al., 2024; Costa et al., 2024). Lastly, AI-driven gamification supports scaffolding, offering intelligent guidance through adaptive pathways, hints, and prompts that promote self-regulated learning and autonomy (Jiang et al., 2025; Ng et al., 2024). In general, these features collectively contribute to more engaging, effective, and personalized learning environments.

**2.2. Morphological competence in English for Medical Purposes (EMP)**

Morphology in Medical English refers to the study of the formation of medical terms from meaningful units called prefixes, roots, and suffixes which primarily come from Greek and Latin (Nguyen Le & Miller, 2020; Zheng & Nation, 2013).According to Chabner (2017), an English medical term basically has three key components, namely affixes, roots and combining forms. First, prefixes are added to the beginning of a term to modify meaning such as time, a location, a direction or a number. Suffixes, on the other hand, are the essential endings of a word, indicating a procedure, a condition, a disorder or a disease. Roots are the most important part of a medical term, usually indicating the involved body parts. These components have semantic meanings and can be combined systematically to create various medical terms in Medical English (Oseki & Marantz, 2020). For instance, the term ***hypoglycemia*** is a combination of (1) the root “*glyc*" (suggar) + (2) the prefix "*hypo-*" (below, deficient) + the suffix “*-emia*” (condition of the blood), meaning “*the condition of low sugar level in the blood”*. López-Medina and García-Sánchez (2022) revealed that morphological competence helps medical learners to draw inferences and interpret the meanings of unfamiliar vocabulary, which helps to increase their comprehension of medical texts written in English. Furthermore, in their study, Nguyen and Tran (2023) found that medical students who received instruction about word structure analysis esaw a considerable improvement in their medical vocabulary acquisition. Similarly, Alshammari and Alqarni (2023) also believed that students who learned to deconstruct and analyze medical affixes developed higher confidence and precision in their use of complex terminology for both academic and clinical settings.

**2.3. Previous studies**

Certain recent research has been conducted on how AI-driven games enhance students’ morphological competence in English for Medical Purposes (EMP). Hsu et al. (2023) created Termbot, a chatbot-based crossword game offered on the LINE platform in which the AI features enable interactions and gamified mechanics give a fun engagement with medical word formation. The findings demonstrate that learners improved vocabulary acquisition and retention due to the adaptative feedback and engaing elements of games. Similarly, Qiao et al. (2023) studied gamified morphological instruction in a blended learning environment, finding that those integrating such tools into their learning performed better in reading comprehension, cognitive engagement, and morphological awareness than those did not. Alhough the research was about general English, not medical English, the implication points out that interactive gamification facilitates deeper processing of word structure. In parity with these findings, Ouanes’s study (2024) indicated how AI-powered gamified learning platforms strengthen personalized learning and conceptual retention of medical words.

3. Methodology

**3.1. Research site and participants**

The study was conducted at the Department of Medicine at Nguyen Tat Thanh University, Ho Chi Minh City, Vietnam during the first semester of the 2024–2025 academic year, from September 2024 to March 2025.

There were 83 second-year medical students participating in the study. Aged between 18 and 21 years, approximately 62% of them were males, while around 38% were females. Before enrolling in the Medical English Course 1, all of the students had completed three general English courses to have a sufficient foundation of English to be able to enrol in the English for Medical Purposes courses.

The participants were divided into two separate groups. The experimental group (n = 42) received instruction with AI-driven gamification provided by the teacher. The intervention was implemented over a course of 12 days of instruction. The control group (n = 41), on the other hand, was taught by the same teacher using traditional methods without any implementation of AI-based games. Both groups studied the same textbook.

**3.2. Research design and instruments**

The study employed a **quasi-experimental design** with a combination of quantitative and qualitative data collection.

In terms of quantitative data, pre-tests, post-tests, and a questionnaire were used. First, pre-tests were administered to students in both groups at the beginning of the course to measure their baseline level of morphological competence. The independent-sample t-test was conducted on the pre-test scores of both the control group and the experimental group, revealing that there was no significant difference in students’ performance on the test before the intervention with AI-driven gamification was introduced to the experimental group. After a three-month intervention period, a post-test, with the same format and number of questions as the pre-test, was administered to both groups to assess the students’ improvement in morphological competence.

For the qualitative data set, semi-structured interviews were conducted with 11 volunteer students from the experimental group to further explore their perceptions and their perceptions and experiences with the AI-driven gamification. The interviews were conducted by another faculty member from the Department of Medicine, who was also teaching Medical English. This approach was taken to ensure objectivity and to avoid potential bias as the interviewer was not directly involved in the intervention.

For data analysis, while quantitative data from the pre-tests, post-tests were analyzed using statistical software SPSS, qualitative data from the interviews was grouped by themes and coded accordingly.

 4. Results

***4.1. Results from the Pre-tests and Post-tests***

**Table** **1**

*Descriptive statistics for the pre-test and post-test scores of both groups*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **N** | **Min** | **Max** | **Mean** | **S.D** |
| **Control group** | *Pre-test* | 41 | 3.75 | 6.25 | 5.24 | .561 |
| *Post-test* | 41 | 5.25 | 8.00 | 6.31 | .537 |
| **Experimental group** | *Pre-test* | 42 | 3.25 | 5.75 | 5.33 | .442 |
| *Post-test* | 42 | 7.00 | 9.5 | 8.47 | .522 |

Table 1 shows the descriptive statistics for the pre-test and post-test scores of both groups. Before the intervention, the control group (N = 41) had a mean of 5.25 (SD = 0.461), with scores ranging from 3.75 to 6.25. There was a slight improvement in the post-test scores after the course ended, with a new mean of 6.50 (SD = 0.522).

On the other hand, the experimental group (N = 42) had a comparable mean of pretest score of 5.00 (SD = 0.442), varying from 4.00 to 5.75. However, there was a noticeable improvement in the post-test with the new mean standing at 8.25 (SD = 0.616) and ranging between 7.00 to 9.75. These results indicate a sigificant enhancement in the performance of the experimental group, which may be indicative of the positive impact of AI-powered gamification in students' morphological competence in EMP courses.

**Table 2**

*Overall results from the paired sample t-test*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Paired Differences | t | df | Sig. (2-tailed) |
| Mean | S.D | Std. Error Mean | 95% Confidence Interval of the Difference |  |  |  |
| Lower | Upper |  |  |  |
| **Control group** | *Pre-test– Post-test* | 1.07 | .558 | 087 | .890 | 1.25 | 12.30 | 40 | **.000** |
| **Experimental group** | *Pre-test– Post-test* | 3.14 | .495 | 076 | .076 | 3.29 | 41.32 | 41 | **.000** |

It can be seen from Table 2 that there was stastically significant improvements in the post-test scores for both the control and experimental groups. The control group’s mean score increased from 5.24 in the pre-test to 6.31 in the post-test, with a mean difference of 1.07, t(40) = 12.30, p <.001. This suggests a moderate improvement after a three-month period. The experimental group, on the other hand, showed a greater increase, with mean scores increasing from 5.33 (pre-test) to 8.47 (post-test), resulting in a mean difference of 3.14, t(41) = 41.32, p <.001. These results indicate that while both groups benefited from their respective instructional approaches, the experimental group greatly outperformed the control group in terms of performance.

***4.2. Results from the interviews***

The students in the experimental group responded positively to the integration of AI-driven gamification in their classes, claiming that it boosted their engagement and motivation during their learning process. Many emphasized that it was generally the fun and engaging nature of these games that kept their attention and interest during the classes (S1, S2, S4, S7, S8, S10, S11). The experience was described as “*learning while playing*” (S2) which they found enjoyable and engaging. Some of the participants emphasized that playing games to review the content was the most interesting part of the lesson and was what they expected the most in every lesson (S3, S4, S5, S8, S9).

*“Reviewing with games was always the best part. That’s what I always waited for in every lesson”*. (S4)

*“When we finished the content, I always hoped the teacher would say, “Now let’s play a quick game” ot “please take our your devices”. That was the most interesting part, I would say”.* (S9)

Moreover, the students especially mentioned the visual effects, soundtracks, and movement in such platforms as Kahoot, Blooket, and Quizizz, etc. made the classroom experience dynamic and stimulating (S1, S2, S4, S8, S9, S10). These games were multi-sensory, with bright colors, animation and background music to keep the students’ attention throughout the session. Some of the participants’ ideas were illustrated as below.

*“The colors and music from the game really made it exciting and kept me focused. I didn’t even notice the time passing”* (S4)

*“In Quizizz, when I answered correctly, the screen flashed and my score shot up with a sound. That was stimulating and made me want to keep playing”.* (S8)

In addition, the students also valued the high level of interactivity from the games they played (S2, S3, S5, S7, S10, S11). From their sharing, gamification enabled them to work with and against each other, thus adding a social aspect to their learning. This is illustrated in some of the students’ responses in the interview.

“*I could interact with others while playing the game. Sometimes the teacher chose team modes and we had to compete together to win”*. (S3)

*“Even in individual game mode, we could still interact with each others. Like in Blooket, I could steal points or hack others’ passwords to get their crypto”.* (S7)

An additional example was given by one student who highlighted the real-time verbal collaboration in a Kahoot! Game mode (S10). In her opinion, the Submarine Squad game mode required one student to shout the symbols to others so that everyone could choose the correct ones in time to help the submarine dive successfully. This promoted a sense of teamwork and collaboration among students during the game (S10).

Another emerging theme from the interviews was the improved retention of medical terminology and morphological aspects. This was due to the the repeated exposure to medical morphology including roots, prefixes and suffixes, embedded in different game-based tasks (S1, S2, S3, S4, S5, S7, S8, S10, S11). The students all agreed that being repeatedly exposed to prefixes, roots and suffixes through games helped to strengthen their memory of the word parts. In particular, these morphological aspects were purposefully revisited and reinforced in the game environment through AI-enhanced features like challenges, swaps, and level upgrades. As one student shared, “*The affixes came up again and again in various games: matching games, timed quizzes, leaderboards, to name a few. I had to match, guess, or race to answerthe questions. It was both fun and useful”.*

Furthermore, the students’ learning of morphology during the games was also believed to be greatly facilitated by the instant feedback from the AI-driven platforms (S1, S2, S4, S5, S6, S9, S10). In their view, when errors were pointed out immediately, they became aware of the mistakes right away, giving them a chance to correct their understanding. This kind of timely feedback effectively reinforced their grasps of the morphological parts and minimized potential for repeated misconceptions. This was demonstrated in a response by one student: “*When I chose the wrong option, the app would immediately show the correct answer with an explanation. That helped me realize my mistake and fix it right away. It’s better than just writing notes and forgetting them”* (S7). It is striking that one student participant expressed his preference for this kind of feedback because it reduced the anxiety he often felt when being corrected directly by a teacher:

*“I’m afraid when teachers tell me I’m wrong in front of the class. But the app just shows it quietly and I could learn without feeling embarrassed.”* (S10)

**Another notable finding from the interview is the personalization provided by the AI-driven gamification. From the students’ perspectives, the homework assigned through games by the teacher could be done at their convenience (S1, S5, S11).** This helped to reduce pressure and time constraints they might face in class.

***“In the class, everybody is supposed to go at one speed, but for the homework, I felt really much like I had my own journey to learning. I didn’t feel stressed trying to complete the game or rush to keep pace with others”*. (S1)**

***“The homework assigned on Quizizz can be done at any time and muitiple times, so I didn’t need to rush. I can replay to better retain the content”.* (S5)**

**In general, the students in the experimental group** had consistently positive responses toward the use of AI-driven gamification in learning morphology in EMP courses. They appreciated its engaging nature, interactivity, supportive feedback, personalization, and ability to promote retention in acquiring medical morphology.

5. Discussion

In line with previous studies, this current research confirms the positive effects of integrating AI-driven gamification on students’ acquisition, engagement, and retention of medical vocabulary. However, this study also reveals several new key findings by focusing on medical morphology and has further identifies that personalization, real-time feedback, and interactive collaboration provided by AI-driven gamification sinificantly enhanced the students’ learning experiences.

First, the quantitative data from this study provides compelling evidence that AI-driven gamification significantly enhances students’ morphological competence in English for Medical Purposes (EMP). It was revealed that while both control and experimental groups demonstrated statistically significant improvements in the test performance, the experimental group’s result was far more substantial (M = 3.14, t(41) = 41.32, p < .001), compared to the control group’s more modest improvement (M = 1.07, t(40) = 12.30, p < .001). This highlights the positive effects of AI-driven gamification on promoting students’ competence of English medical morphology. This finding closely aligns with previous studies such as Hsu et al. (2023), Nguyen and Tran (2023), Qiao et al. (2023) and Ouanes’s study (2024) who reported that AI-driven games and platforms supported students’ medical vocabulary acquisition and morphological competence.

The qualitative result indicate that AI-driven gamification increased students’ engagement and motivation, which is in line with the findings in earlier studies (Kapp, 2012; Chou, 2023; Qiao et al., 2023). The participant students found their learning with AI-driven games “fun,” “exciting,” and “motivating” primarily based on colors, sound effects, and animations of the platforms such as Kahoot!, Quizizz and Blooket. These multi-sensory features kept them focused and eager during their learning process. This particularly supports Hsu et al. (2023)’s finding that gamified mechanics contribute to a more stimulating learning environment, enhancing the students’ learning experiences.

A new finding emerging from the study is the interactivity and social dimension offered by the use of AI-driven games in their learning. It was found that the participants’ sense of teamwork and social connection was boosted as a result of playing certain game modes like “Submarine Squad” in Kahoot! or “Crypto hack” in Blooket.

Another new emerging theme is the personalized and flexible learning from the homework assigned in games to review morphological parts.The students claimed that they were able to flexibly review at their own pace and convenience and that they could do the homework repeatedly to reinforce their understanding and retention of the medical morphology.

The instant feedback given by AI-driven games also gives rise to a new finding in the study. This creates psychological comfort for the students as they could avoid the feeling of anxiety when receiving feedback from the teacher. The silent feedback provided by the games not only enhanced their correction of understanding but also reduced their embarrassement associated with being corrected in front of the class.

6. Conclusion

This study explores the effects of AI-driven gamification on students’ morphological competence in English for Medical Purposes (EMP) and their perceptions towards its use. The findings reveal that the students in the experimental group significantly outperformed those in the control group in terms of morphological competence, indicating the positive impact of AI-driven gamification on learning medical morphology.

The qualitative data shows that students found the experience enjoyable, motivating, and engaging. They appreciated the interactive features, instant feedback, and gamified mechanics like Kahoot!, Quizizz, and Blooket. Additionally, the study also provided some new insights like the social collaboration fostered through game modes, the reduced anxiety due to private feedback, and the flexibility of self-paced, personalized homework.

The findings from this study offer some pedagogical implications for the teaching of English for Medical Purposes (EMP), particularly English medical morphology. First,educators and curriculum developers should consider incorporating AI-driven games into EMP courses to facilitate the students’ learning of medical morphology and terminology. Second,instructors should make use of AI-driven game features like feedback provision to boost their students’confidence and motivation in their learning process.Third, self-paced gamified homework should be encouraged to create a comfortable learning environment for the students as well as reinforce their understanding through the repetition of homework completion.

It is recommended that future studies may be conducted to explore teachers’ perspectives of the use of AI-driven gamification on the students’ competence of medical morphology as well as the challenges they may face during the implementation. Moreover, future research could be conducted over a longer intervention period to ensure more comprehensive results, particularly regarding long-term retention and application of morphological knowledge in EMP.

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**Bionote**

Nguyen Huu Ngoc has been a lecturer of English language for over 9 years, specializing in Medical English at the Department of Medicine at Nguyen Tat Thanh University in Vietnam. He holds a Master’s degree in TESOL from the University of Social Sciences and Humanities - HCMC National University. He has expressed his interests in researching various fields, including Medical English, AI for Language Learning, Computer-Assisted Language Learning, and blended learning.