Gamification and m-learning: An innovative approach to sustainable language learning

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Abstract. This study delves into the role of AI-assisted gamification in enhancing user engagement within mobile language learning applications. The investigation begins with a critical examination of popular gamified applications, such as Duolingo, to identify key elements that drive user engagement. The research employs a mixed-method approach, integrating the analysis of user feedback gathered from surveys and interviews to understand the impact of these gamification elements on learner motivation and satisfaction. A significant focus of the study lies in exploring how artificial intelligence (AI) contributes to personalizing the learning experience. This is achieved by tailoring challenges and rewards to align with individual user progress and preferences, ultimately fostering a more engaging and enjoyable learning journey. The preliminary findings reveal the crucial role of gamification in creating an effective and motivating learning environment. Users reported a heightened appeal and engagement with this approach. These findings provide valuable insights for practitioners and developers, offering an empirical framework to design more engaging, effective, and sustainable language learning tools. The study not only emphasizes gamification's role in enhancing the learning experience but also highlights its potential to contribute to sustainable learning practices, aligning with contemporary educational needs and learner preferences.

1 Introduction

The advent of digital technologies has radically transformed the pedagogical approach to language learning, introducing more flexible, personalized and fun learning methods. This shift from a traditional approach to a learning mode based on mobility, individualization and immediacy represents a veritable revolution in the transmission of knowledge. Several research studies have highlighted the growing importance of mobile learning (m-learning), which relies on the use of mobile devices, such as smartphones or tablets, to promote access to educational resources anywhere and at any time, offering a flexible, personalized and moreover interactive learning experience [1,2]. Several mobile applications dedicated to language learning have emerged. Platforms such as Duolingo, Babbel and Mondly, to name but a few, have revolutionized the way learners approach language learning. Not least thanks to their ease of access and adaptability [3].

However, despite the advantages of mobile learning platforms, challenges remain, particularly in terms of learner engagement and motivation, especially in self-learning
contexts where traditional supervision is absent [4]. To address these challenges, AI-assisted gamification appears to be a promising solution for enhancing language learning via mobile applications. Deterding et al. defines it as "the application of playful mechanisms in non-playful contexts", he stresses that gamification aims to increase engagement, motivation, and make the language learning experience more stimulating [5]. Caponetto et al observed that elements such as points, badges, and leaderboards can transform an educational task into a motivating challenge [6]. What's more, apps like Duolingo have successfully integrated these elements to offer a learning experience that feels more like a game than a traditional course. In this sense a recent study by Hamari et al. suggests that gamification, when well designed, can significantly increase learner engagement and improve learning outcomes [7].

Indeed, the integration of artificial intelligence (AI) into education has proved to be a promising field. AI, with its ability to process large amounts of data and learn from it, can perform tasks autonomously and offer increased personalization of the learning path [8]. Studies such as those by Luckin (2017) have shown that AI can identify gaps in learners' knowledge and suggest suitable resources [9]. In addition, more recent research by Zhao et al. (2022) has shown that AI can not only personalize learning but also predict learners' future needs, making education more adaptive, responsive and learner-centric [10].

Our study focuses on examining the potential of AI-assisted gamification to increase user engagement, using the Duolingo mobile app as a case study. We aim to go beyond the simple identification of gamification elements to explore in depth the perception and experience of users of this learning platform. Through a critical analysis of the gamification mechanisms integrated into Duolingo and enriched by user feedback, this research aims to identify the most motivating gamification elements and explore how AI can personalize and enhance the self-learning experience.

Given this context, the central problem of our research is as follows: How does AI-assisted gamification promote engagement among users of the mobile application (Duolingo) and enrich the language self-learning experience? To answer this question, our study is based on several questions. We ask which specific elements of gamification are most effective in enhancing user engagement. In addition, we explore how the convergence of gamification and AI can modulate and influence learners' intrinsic motivation. Finally, we seek to determine how users, confronted with this new approach, perceive and evaluate their learning experience.

We therefore postulate that reward systems such as badges, points and rankings, by offering the learner a palpable sense of progress, would be powerful levers of engagement. The possibility of collaboration and competition, exploiting our intrinsically social nature, could also amplify this commitment. The transformation of learning into a game is also likely to make the process more attractive. Moreover, AI, by adapting learning to the specific needs of each user, could offer a tailor-made learning path, further reinforcing this motivation.

Based on an in-depth analysis of the Duolingo application and feedback from its users, our study aims to unpack the most effective gamification elements and explore how the interaction between gamification and AI can optimize the self-learning experience. Indeed, the preliminary results of this research are promising. They highlight not only the potential effectiveness of gamification, but also the crucial role that AI can play in enhancing and adapting the learning experience. This research makes a significant contribution to understanding the effectiveness of AI-assisted gamification in education, offering new perspectives for future developments in the field of language learning.
2 Methodology

To rigorously address the research problem posed, we adopted a mixed methodological approach, combining both qualitative and quantitative methods. This choice offers the advantage of combining the depth of analysis of a qualitative approach with the generality of the results of a quantitative study. To manage and analyze the collected data, we utilized Microsoft Excel LTSC 2021, ensuring organized and efficient data storage. For processing this data, IBM SPSS Statistics v27.0 was employed, facilitating robust statistical analysis. The findings of our research are articulated through a combination of tables and graphical representations, ensuring a thorough and clear presentation of the results. This dual-format approach enhances the accessibility and comprehension of our findings, catering to a diverse academic audience.

2.1 Qualitative Study

The first phase of our research is qualitative; we seek to deeply understand the nuances and specificities of the subject.

2.1.1 Theoretical Framework

Our starting point will be a comprehensive review of the existing literature. The objective is to map and understand previous research addressing the issue of self-learning through gamified applications. This exploration will allow us to situate our work in the broader context of already conducted studies and to identify gaps or new avenues for exploration.

2.1.2 Field Exploration:

The choice of Duolingo as a field for exploration is not trivial. Considered as one of the leaders in language self-learning through gamification, it offers a unique opportunity for analysis.

![Fig.1. Top 10 language learning app usage 2021 (%), Source: www.businessofapps.com](image)

2.2 Quantitative Study

After this exploratory phase, we conducted a quantitative study. The objective here is to collect numerical data to confirm or refute our initial hypotheses.

To do this, an online questionnaire (created using Google Forms) was designed and distributed to a large sample of Duolingo users (268) via Duolingo community Facebook groups and forums and clubs of this application. The questionnaire focuses on several areas: user engagement, perception of gamification, and the impact of AI on their motivation. The
use of descriptive statistics allowed us to analyze the data and draw reliable and representative conclusions.

2.3 Characteristics of the Research Sample

The study relies on a diverse sample of 268 respondents, covering a wide range of age groups and genders, thereby providing a rich insight into the demographics of Duolingo users. The majority of the participants fall within the 18-29 age bracket, accounting for 50.37% of the sample, followed by those aged 30-45 at 25%. Participants under 18 years old and those aged 46 and above make up 14.93% and 9.7% of the sample respectively. In terms of gender, a slight predominance of women is observed at 55.22%, while men represent 44.78%.

The frequency of Duolingo usage by the respondents offers interesting insights into their commitment to the application. 35.82% of the participants use Duolingo daily, indicating strong adherence to the platform. Users logging in several times a week account for 29.85%, closely followed by those who use it once a week at 19.78%. Less frequent users, logging in a few times a month or rarely, make up 9.7% and 4.85% of the sample respectively.

As for the duration of app usage, the sample is distributed fairly evenly. New users, with less than a month of usage, and those using the app for more than a year, represent 9.7% and 19.78% respectively. The intermediate brackets, namely 1 to 3 months, 3 to 6 months, and 6 to 12 months, display percentages of 19.78%, 25.75%, and 25% respectively. These figures demonstrate a balanced distribution of users in terms of tenure on the platform.

3 Results and Discussion

The analysis of the results obtained from our survey on the Duolingo application reveals several key trends concerning the effectiveness of gamification in language learning.

3.1 General Evaluation of Duolingo by Users

The data collected indicates a strong positive inclination of users towards Duolingo, as shown by the majority of users (60%) rating the application at 4 or 5 on a scale of 1 to 5. Such a distribution of scores shows that Duolingo has succeeded in meeting the expectations of the majority of its users. The reasons for this high level of satisfaction can be varied, but are likely related to several elements of the application, including gamification. As gamification is at the core of Duolingo's design, it is possible that the gamified elements of the application are the main contributors to this high rate of satisfaction. That said, it is equally essential to note that lower evaluations (scales 1 and 2) are in the minority, suggesting that only a few users have encountered challenges or dissatisfactions with the application. Understanding the reasons for these less favorable evaluations could also provide valuable insights into areas for improvement.

3.2 Language Skills Acquired Through Duolingo

The survey on acquired language skills reveals interesting trends regarding the use of Duolingo. It is clear that the application is primarily perceived as an effective tool for comprehension, both oral and written. These skills are fundamental to language learning and are often the first step for many learners. The fact that 32% of users believe they have acquired a skill in oral comprehension and 35% feel competent in written comprehension shows Duolingo's strength in these areas. These figures suggest that the structure and content of the application are particularly suited to training the ear and eye for recognizing words, phrases, and linguistic structures.
However, the low proportion of users (12%) who believe they have improved their written expression through Duolingo raises questions. Written expression is a complex skill that requires not only mastery of grammar, vocabulary, and syntax but also the ability to organize one's ideas in a coherent and logical manner. This is a skill that is often better developed through individualized feedback and extended writing opportunities, elements that can be challenging to incorporate into a gamified mobile application [11].

The integration of AI could potentially help to fill this gap. With advanced evaluation systems, AI could provide more accurate and targeted feedback on users' writing, thus offering a more enriched learning experience in this area [12].

3.3 Perception of Gamification Elements in Duolingo

Gamification is the use of game elements in non-game contexts, and Duolingo incorporates it brilliantly into its user experience to make language learning both appealing and motivating. The collected data show that certain gamification elements are particularly appreciated by users, highlighting their potential effectiveness in engagement and motivation. "Points" and "Badges" stand out clearly as motivating elements (Figure 2). The fact that 57% of users consider "Points" important and 68% see "Badges" as very important shows that these elements provide a tangible sense of progress and achievement. They serve as immediate rewards for the efforts made, thereby reinforcing users' intrinsic motivation to continue their learning. "Rewards" and "Feedback" are also essential. The opportunity to earn concrete gratifications, combined with relevant feedback, can boost learners' perseverance. Feedback, in particular, offers an opportunity for self-correction and self-reflection, crucial elements for effective self-learning. However, "Challenges" and "Leaderboard" show that not all gamification elements are universally appreciated. While some users find competition stimulating, others may find it stressful or discouraging. This underscores the importance of offering a flexible learning experience. A solution could be to give users the option to customize their experience, by activating or deactivating certain gamification elements according to their preferences [13].

![Figure 2: The importance of gamification elements in Duolingo](https://example.com/figure2.png)

Indeed, gamification elements play a significant role in Duolingo's effectiveness as a self-learning tool. However, to maximize user engagement and satisfaction, it would be beneficial to offer more personalization, allowing each user to tailor the application to their unique learning style.
3.4 Perception of the Impact of Gamification on Learning with Duolingo

3.4.1 Attractiveness of Gamification

A notable majority of 57% of users believe that gamification makes Duolingo more attractive than other learning methods. This is a strong testament to the effectiveness of gamification in terms of user engagement. This could be due to the unique combination of rewards, challenges, and feedbacks that create a stimulating and motivating learning environment. However, it is important to note that 22% of users disagree with this statement, suggesting that there is a variety of learning preferences among the studied population.

3.4.2 Ease and Flow through Gamification

58% of users believe that gamification makes using Duolingo easier compared to other resources. This perception could be attributed to how game elements simplify the complex challenges of language learning, breaking them down into smaller and more manageable tasks. These elements can also provide structure and direction, allowing users to track their progress more visibly. However, a significant proportion of 23% of users do not feel this ease, perhaps reflecting a preference for more direct and less gamified learning approaches.

3.4.3 Improvement of Language Learning through Gamification

The most striking statement is that 68% of users believe that gamification in Duolingo effectively enhances the learning of language skills. This result goes beyond attractiveness or ease of use; it directly addresses the pedagogical effectiveness of the application. This suggests that gamification, when well-executed, can not only make learning more engaging but also strengthen the acquisition of language skills. Nonetheless, attention should be paid to the minority of 22% who do not perceive this benefit, in order to understand their concerns and see how the application could possibly be improved to meet their needs. In summary, gamification in Duolingo is widely perceived as a positive element, contributing to the attractiveness of the application, facilitating its use, and even enhancing language learning. However, the divergent opinions of some users highlight the need for ongoing customization and adaptation to meet the varied needs of learners.

In summary, gamification in Duolingo is largely perceived as a positive element, contributing to the attractiveness of the application, facilitating its use, and even enhancing language learning. However, the divergent opinions of some users highlight the need for ongoing customization and adaptation to meet the varied needs of learners.

3.5 Impact of Gamification on the Motivation to Learn a New Language with Duolingo

Gamification, by integrating playful elements into learning, largely aims to strengthen the motivation of learners. Our data confirm this trend as 65.3% of users believe that gamification increases their motivation to learn a new language. These figures attest to the ability of gamification to stimulate engagement, create a positive learning dynamic, and maintain learners’ interest. The element of competition, rewards, badges, and continuous feedback are likely key factors in this increased motivation.

However, the perception is not universal. A quarter of users do not feel this motivational benefit of gamification. This could be due to a variety of reasons: some may prefer more traditional learning methods, others may find that gamification distracts from the main learning objective, or some may simply not be responsive to the integrated playful elements.
The 9.7% of uncertain users suggest that there is a population of learners who are not yet convinced or who have not sufficiently reflected on the actual impact of gamification on their motivation. Understanding this uncertainty could provide insights to further refine the gamification approach and address unmet concerns or needs.

### 3.6 Influence of gamification elements on motivation to use Duolingo

Gamification, relies on the integration of game elements to make the user experience more engaging. However, our analysis reveals that not all elements are perceived in the same way, nor do they motivate all users equally (figure 3).

- **Badges:** These seem to be the most powerful motivator for Duolingo users, with 73% claiming to be hugely motivated by them. Badges offer a form of recognition for users' achievements and reinforce a sense of accomplishment.

- **Points and Feedbacks:** These elements reinforce user engagement, providing immediate gratification for their efforts (points) and guidance on their progress (feedbacks). These elements correspond to the need for learners to obtain a tangible reward for their efforts, as well as feedback on their performance.

- **Personalization and Avatars:** While personalization is often cited as an essential feature of modern applications for improving user engagement, in the context of Duolingo it seems less relevant for motivation. With 31% of users not at all motivated by this aspect, this could indicate that the main priority for Duolingo users is language learning itself, and less so the aesthetic or personalized experience of the app.

![Figure 3: Influence of gamification elements on motivation to use Duolingo](image)

Indeed, gamification, when properly implemented, can play a crucial role in user engagement and motivation. However, it's essential to understand which gamification elements resonate most with the target user base. For Duolingo, it's clear that elements that offer direct recognition of the user's efforts, such as badges, points and feedback, are the most valued. Learning application designers must constantly evaluate and adapt their gamification approaches to best meet the needs and preferences of their users.

### 3.7 Level of engagement with Duolingo compared to traditional methods

User engagement is a crucial factor to determine the success of any learning platform. An engaged user is more likely to continue with their learning and accomplish their objectives.
Duolingo, a language learning platform, has utilized the advantages of technology, gamification and effective instructional design to captivate and engage its users. According to a survey, 74% of users feel more engaged with Duolingo in comparison to traditional methods. This is particularly significant in language learning, where sustained commitment and consistency are essential to achieve concrete results. Although 14% of users feel less engaged, this percentage is relatively low, indicating that the majority of users find added value in Duolingo's approach. However, it should be noted that every learner is unique, and what works for one may not work for another. Traditional methods may have their own benefits and may be more suitable for certain types of learners.

Duolingo has successfully combined technology, gamification and innovative teaching techniques to create a modern approach that resonates well with its users, encouraging them to become more engaged in their language learning. However, it's important to acknowledge that every learner has their own unique needs and preferences, and therefore, no one approach will be universally effective. The key is to offer a variety of tools and methods to cater to the diverse needs of learners.

4 Conclusion

The digital revolution has brought about significant advancements in language learning, especially through gamification and artificial intelligence. Our research has centered around the Duolingo app, a leader in this field, and has provided us with valuable insights into how these innovations are transforming the self-learning experience. It's evident that gamification is an effective way to engage users. Elements like badges, points, and feedback make learning more appealing and, for most users, increase motivation. This finding confirms the hypothesis that integrating playful elements into the learning process can enhance the overall experience. However, the efficiency of gamification differs for each user based on the specific elements used and their preferences. While some elements are widely popular, others such as personalization and avatars may not be sufficient to address all the challenges related to motivation and engagement. Additionally, while Duolingo is known for its proficiency in listening and reading comprehension, there is room for improvement in areas such as written expression. This presents an opportunity for further research into how AI technologies can be implemented to address these shortcomings. Lastly, while a significant majority of users prefer Duolingo's approach to traditional learning methods, it's important to keep in mind that each learner is unique. While a universally effective method may be ideal, individual needs and preferences require a diverse range of approaches. In conclusion, the combination of gamification and AI has the potential to revolutionize language self-learning. However, to make the most of these technologies, ongoing research, user feedback, and a flexible and personalized learning approach are essential.

References