Journal of Applied Studies in Language, Volume 8 Issue 2 (Dec 2024), p. 171-183
p-issn 2598-4101 e-issn 2615-4706
http://ojs2.pnb.ac.id/index.php/JASL

Digital supplementation in language education: Evaluating mobile application's impact in large classroom settings

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Abstract - Integrating digital tools into language education has transformed traditional teaching methods, offering greater flexibility, increased engagement, and personalized learning opportunities. This study explored how effective Duolingo can be as a supplementary tool in a large speaking class of 60 first-year undergraduate Informatics Engineering students at a university. With the challenges of managing a large group and varying levels of language proficiency, this study applied a descriptive qualitative approach over half of the semester to assess Duolingo's impact on student engagement, motivation, and English proficiency. Data were gathered through Duolingo's tracking system, weekly self-reflection reports, in-class observations, and informal interviews. The analysis revealed that Duolingo significantly boosts student motivation and provides valuable practice opportunities outside the classroom, especially in vocabulary and grammar. The quantitative data showed consistent student engagement, with many students regularly earning experience points (XP) and meeting their weekly learning targets. However, the study also highlighted some challenges, such as Duolingo's limited focus on developing conversational skills and the difficulty of addressing the varied proficiency levels within such a large class. While students enjoyed the gamified aspects of Duolingo, they expressed a need for more interactive speaking exercises to help build fluency. Overall, the findings suggest that Duolingo is a useful supplement to traditional language instruction, enhancing engagement and offering personalized practice.

Keywords: digital tools; large classes; blended learning; Duolingo; English learning

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1. Introduction

Technological advancements have significantly influenced the evolution of educational practices over the past few decades. Digital tools have increasingly become integral to the academic landscape, offering innovative solutions to the challenges posed by traditional teaching methods. In the context of language learning, digital platforms provide great opportunities for learners to engage with new languages in flexible, interactive, and personalized ways. Among these platforms, Duolingo can be considered as one of the most popular and accessible applications, offering a gamified approach to language learning that appeals to a broad audience, ranging from beginner to advanced level learners.

Hossain (2018) found that traditional language learning, particularly in classroom settings, has long been challenged by issues such as varying student proficiency levels, limited contact hours, and the difficulty of providing individualized feedback. These challenges are particularly significant in speaking classes, where the goal is to develop fluency, pronunciation, and the ability to engage in spontaneous conversation. Speaking classes require an interactive and communicative environment, where students can practice their speaking skills in real time and receive immediate feedback. However, in many educational settings, particularly those with large class sizes, these ideal conditions are difficult to achieve.

The problem of large class sizes is a significant one, especially in courses that emphasize speaking and communication. When class sizes exceed a manageable number, typically around 15-20 students, the quality of interaction and personalized instruction decreases. In large speaking classes, individual students have fewer opportunities to participate, which can lead to decreased motivation and engagement. Additionally, the ability of the instructor to provide meaningful feedback and monitor each student's progress is severely limited. This situation is further complicated by the diversity of student proficiency levels within the same class, making it challenging to address the specific needs of each learner.

Given these challenges, there has been a growing interest in integrating digital tools into language learning curricula to supplement traditional classroom instruction. One example was a study conducted by Moorhouse et al (2023) on digital tools used by language schoolteachers in Hongkong. Digital tools, particularly those designed with adaptive learning technologies, can offer personalized learning experiences that are designed to meet the needs of individual students. These tools provide learners with additional practice opportunities outside of class, enabling them to reinforce what they have learned and develop their skills at their own pace. Furthermore, digital tools can serve as a bridge between classroom teaching and practical language application by providing engaging and context-based learning experiences.

Duolingo is a free language learning platform that was launched in 2011. Since its inception, it has become one of the most widely used language-learning apps worldwide, with millions of active users. Duolingo offers courses in over 30 languages, providing learners with a structured and engaging way to study new languages. The platform is built on a gamified learning model, which incorporates elements of game design such as points, levels, and rewards to motivate users and sustain their interest in the learning process.

Duolingo's uniqueness is on its adaptive learning algorithm, which adjusts exercise difficulty to match the user's performance. This dynamic approach ensures learners are appropriately challenged while avoiding excessive difficulty, enabling steady progress at a personalized pace. The platform's lessons are brief and concise, often requiring just a few minutes to complete. This design allows users to seamlessly incorporate language practice into their daily schedules, even when time is limited.

One of the key features of Duolingo is its focus on instant feedback. As the users complete exercises, they receive immediate corrections and explanations for any mistakes they make. This feedback loop is crucial for language learning, as it helps learners to identify and correct errors before they become ingrained habits. Additionally, Duolingo incorporates spaced repetition, a technique that ensures learners review and practice material at optimal intervals to reinforce their memory and understanding of the language.

Duolingo also leverages gamification to enhance the learning experience. Users earn points, unlock levels, and receive virtual rewards as they complete lessons and achieve milestones. This gamified approach is designed to make language learning more enjoyable and engaging, encouraging users to return to the app regularly and maintain consistent study habits. The social features of Duolingo, such as leaderboards and challenges, further contribute to user motivation by fostering a sense of competition and community.

This study aims to assess the effectiveness of a digital tool, Duolingo, as a supplementary language learning tool in a large speaking class setting. Specifically, the study seeks to investigate how Duolingo influences students' engagement, motivation, and proficiency in English language skills, and to identify the perceived advantages and disadvantages associated with its use. The study employs a descriptive qualitative research design, which is well-suited to exploring the experiences and perceptions of the students as they interact with Duolingo over three weeks.

This study contributes to the literature on digital language learning tools by providing insights into the applicability and impact of Duolingo in a classroom context that is characterized by large student numbers and diverse proficiency levels. This study seeks to provide actionable insights for educators and curriculum developers by analyzing students' experiences and learning outcomes, with a focus on integrating digital tools effectively into language education.

Understanding the effectiveness of a digital tool, Duolingo, in a large speaking class has significant implications for language educators. The findings of this study can inform decisions about how to best integrate digital tools into language curricula, particularly in contexts where traditional methods may be insufficient due to class size or other constraints. Additionally, the study highlights the potential of gamified learning platforms to boost student motivation and engagement, which are essential components of effective language learning.

The rapid advancement of digital technologies has brought about significant changes in educational practices, particularly in the domain of language learning. Digital tools have not only provided learners with new opportunities to engage with languages in innovative ways but have also challenged traditional pedagogical approaches. Among these digital platforms, Duolingo has emerged as a prominent tool, widely recognized for its accessibility, user-friendly interface, and gamified learning approach. This section reviews key literature on digital language learning tools, which focuses on Duolingo, and examines the effectiveness and limitations of these tools in supporting language acquisition.

Digital tools have become a focal point in educational research, with numerous studies emphasizing their ability to improve learning outcomes. Graham (2006) notes that incorporating digital tools into the classroom supports the shift toward blended learning, which combines traditional in-person teaching with online resources to provide a more adaptable and personalized experience. Specifically, in language education, digital platforms bring distinct benefits, such as real-time feedback, engaging activities, and opportunities for students to practice language skills beyond the classroom setting.

Research by Tjahyanto (2022) emphasizes the importance of instructional design in the development of digital learning tools. In his study on the ADDIE model course design for the creative industry department, Tjahyanto highlights how well-structured digital platforms can cater to diverse learner needs by providing adaptive learning paths that respond to individual progress and proficiency levels. This approach is quite relevant in language learning, where students often have varying levels of proficiency and require personalized support to achieve their learning goals.

Duolingo, launched in 2011, can be considered as one of the most popular language learning apps in the world, which has millions of users engaging with its content daily. Duolingo's success can be attributed to its gamified approach, which integrates elements of game design, such as points, levels, and rewards, into the learning process. This gamification strategy is designed to improve user motivation and engagement, which makes learning a language enjoyable and interactive. Munday (2016) argues that Duolingo stands out for its capacity to make language learning approachable and inclusive for users of all backgrounds, regardless of their previous experience or skill level.

At the heart of Duolingo's approach is its adaptive learning algorithm, which tailors the difficulty of exercises according to each learner's performance. This method ensures that users face appropriate challenges without becoming frustrated, enabling them to advance at a pace that suits their individual needs. Loewen et al. (2019) found that Duolingo is particularly effective in helping users build foundational language skills, such as vocabulary and basic grammar. Their study revealed that users who consistently engage with the app demonstrate measurable improvements in these areas, making Duolingo a valuable supplementary tool for language learners.

However, Duolingo's focus on translation exercises and rote learning has also been a point of critique. While the app is effective in teaching vocabulary and sentence structure, it may not fully prepare learners for real-world language use, particularly in conversational contexts. Garcia and Pena (2018) argue that Duolingo's emphasis on accuracy over fluidity can lead to a mechanical approach to language learning, where users prioritize completing tasks rather than truly internalizing the language. This

limitation is especially relevant in speaking classes, where the development of fluency and the ability to engage in spontaneous conversation are critical.

Gamification, which involves incorporating game-like features into non-game settings, has become a popular strategy in education to boost motivation and student engagement. In language learning, gamification can make the acquisition of new skills more enjoyable and less intimidating, particularly for beginners. Johnson et al. (2019) conducted a study on the role of gamification in education and found that it can significantly increase learner motivation, leading to higher retention rates and greater persistence in completing courses. Their findings support the idea that gamified platforms like Duolingo can play a crucial role in sustaining learner engagement over time.

However, the effectiveness of gamification is not uniform across all learners. Smith and Miller (2020) note that while gamification can be highly effective for some users, particularly those who are motivated by competition and rewards, it may be less impactful for others who prefer more traditional learning methods. In their study, they found that learners with higher levels of intrinsic motivation were less influenced by gamified elements and were more focused on the content itself. This suggests that while Duolingo's gamified approach is successful in engaging a broad audience, it may need to be complemented by other strategies so that learners' needs can be met.

One of the primary challenges of using digital tools like Duolingo in educational settings is their application in large and diverse classrooms. In large classes, where students have varying levels of proficiency and engagement, it can be difficult to ensure that digital tools meet the needs of every learner. Chen and Goh (2011) highlight the difficulties of managing large speaking classes, where the goal is to develop fluency and confidence in oral communication. They argue that while digital tools can provide valuable supplementary practice, they cannot fully replace the interactive, communicative activities that are essential for developing speaking skills.

Mobile learning has garnered significant attention in educational research due to its potential to enhance learning experiences and accessibility. Silma (2024) examined the Hellotalk application's impact on students' writing skills, particularly in mastering material on "Past Events," and emphasized its role in improving writing proficiency. Similarly, Grames et al. (2019) developed an automated approach using keyword co-occurrence networks for identifying search terms in systematic reviews, thus advancing methodological efficiency. Gupta et al. (2021) conducted a systematic review of factors influencing mobile learning in higher education, revealing its transformative potential in pedagogy.

Gurevych et al. (2021) explored the integration of augmented reality in higher education, showing how this technology fosters engagement and interactivity. Hao et al. (2017) investigated mobile learning acceptance among Chinese users and identified critical influencing factors. Herrador-Alcaide et al. (2020) analysed attitudes toward online learning tools in accounting education and underscored their utility during the m-learning era.

Iqbal et al. (2020) highlighted the use of Telegram to supplement online medical education during the COVID-19 crisis, showcasing its effectiveness in emergency remote teaching. Kayaalp and Dinc (2022) introduced a drag-and-drop mobile app for teaching algorithms in engineering education, thereby enhancing learning outcomes. Kumar et al. (2022) studied the post-pandemic behavioural shift in mobile learning acceptance among engineering undergraduates, linking it to increased adaptability.

Lan (2022) conducted a comparative study on computer and mobile-assisted pronunciation training in Taiwan, demonstrating the advantages of mobile technologies. Laurens-Arredondo (2022) adapted augmented reality to the ARCS motivation model during the pandemic, proving its impact on student motivation. Liaw et al. (2010) employed activity theory to investigate mobile learning acceptance and its role in personal knowledge management.

Lin et al. (2021) revisited the relationship between smartphone use and academic performance in a large-scale study, addressing its complex effects. Loh et al. (2021) examined the dark side of mobile learning via social media and identified its potential drawbacks. Mătă et al. (2021) assessed attitudes toward the sustainable use of mobile technologies in higher education, advocating for responsible practices.

Márquez-Díaz (2020) introduced virtual worlds as complements to hybrid and mobile learning, which enriched educational experiences. Matzavela and Alepis (2021) compared physical and digital classes during the COVID-19 era, emphasizing the significance of m-learning. Minichiello et al. (2021) developed a particle image velocimetry tool for fluid mechanics education, enhancing technical learning via mobile applications.

Mir and Llueca (2020) used mobile phones and the MIT App Inventor to teach programming, demonstrating the accessibility of mobile platforms. Motiwalla (2007) proposed a framework for

evaluating mobile learning, contributing foundational insights into the field. Mubayrik et al. (2021) applied transactional distance theory to explore mobile learning during the pandemic, illustrating its relevance in higher education.

Muthuprasad et al. (2021) studied Indian students' perceptions of online education during the pandemic and highlighted mobile learning preferences. Navandar et al. (2021) explored Instagram's use in sports biomechanics classrooms, showcasing its applicability in niche fields. Neffati et al. (2021) developed augmented reality tools for technical higher education, blending mobile technologies with e-learning.

O'Connor and Andrews (2018) surveyed nursing students about mobile apps in clinical education, demonstrating their utility in professional training. Lastly, Pham and Chen (2018) introduced PACARD, a mobile app interface designed to boost engagement, contributing to the enhancement of educational app usability.

Mobile learning (m-learning) has become an essential component of education, particularly during the COVID-19 pandemic, when online and distance learning took precedence. Adanır and Muhametjanova (2021) compared university students' acceptance of mobile learning in Turkey and Kyrgyzstan, revealing cultural and contextual influences on its adoption. Akour et al. (2021) utilized machine learning algorithms to predict individuals' intention to use m-learning platforms, emphasizing the impact of the pandemic. Similarly, Almaiah et al. (2021) employed machine learning to predict acceptance of m-learning applications, highlighting significant factors affecting its usage. Almaiah et al. (2022) proposed a smart m-learning success model tailored for higher education during the pandemic, focusing on critical success factors. Althunibat et al. (2021) examined the influences on mobile learning application usage, revealing key determinants such as ease of use and perceived usefulness.

Alturki and Aldraiweesh (2022) studied students' perceptions of m-learning usage during the pandemic, underlining its significance in higher education. Antee (2021) explored the adoption of mobile technology among lower-income students, shedding light on challenges and opportunities. Aria and Cuccurullo (2017) introduced bibliometric tools to map scientific developments in m-learning. Bahia and Delaporte (2020) analysed global mobile internet connectivity trends, relevant to the growth of m-learning. Becke et al. (2021) contributed to mapping technologies essential for digital learning frameworks.

Bernacki et al. (2020) merged mobile and psychological learning theories to provide a comprehensive understanding of m-learning. Borroto et al. (2021) highlighted the shift in online teaching strategies for subjects like biology and foreign languages. Cavus (2020) evaluated participants' attitudes toward a mobile learning system, emphasizing usability. Chen et al. (2021) explored flipped teaching with mobile devices in graphic design courses, focusing on cognitive load. Chessa and Solari (2021) examined usability and the sense of presence in online classes through web-conferencing and VR platforms.

Chu (2022) introduced a mobile augmented reality system for electrical engineering labs, addressing practical challenges during the pandemic. Cohen et al. (2018) provided foundational methodologies for education research, including m-learning studies. Coskun-Setirek and Tanrikulu (2021) examined sustainability factors in m-universities. Couso (2016) proposed participatory curriculum design approaches, offering insights into m-learning strategies. Crebert et al. (2004) discussed generic skills development, emphasizing its relevance for mobile platforms.

Crompton and Burke (2017) systematically reviewed m-learning in higher education, identifying trends and gaps. Diaz-Nunez et al. (2021) evaluated mobile application impacts on university education in Lima during the pandemic. Ding et al. (2020) explored IoT and VR applications in college physical education, expanding the scope of m-learning. Egilsdottir et al. (2021) detailed the configuration of m-learning tools for nursing education, showcasing participatory design approaches. Eldokhny and Drwish (2021) assessed augmented reality's effectiveness in online learning, presenting innovative pedagogical methods. Lastly, Fan et al. (2022) applied motivation models to understand factors influencing m-learning, offering a comparative analysis using advanced statistical methods.

The variation in student proficiency levels presents another significant challenge. In a large classroom, some students may find the content of digital tools too basic, while others may struggle to keep up with the pace. This can lead to a situation where the digital tool is either too easy for some students or too difficult for others, limiting its effectiveness. Graham (2006) suggests that to overcome this challenge, educators should consider using digital tools alongside other resources that can be tailored to individual learner profiles. This strategy, referred to as differentiation, enables teachers to offer

tailored support to students who require it, while also challenging those who are prepared for more advanced material.

The concept of blended learning has gained traction as a way to combine the best of both digital and traditional learning methods. In a blended learning environment, students benefit from the structure and interaction of face-to-face instruction while also taking advantage of the flexibility and personalized learning opportunities offered by digital tools. Richards and Rodgers (2014) emphasize the importance of integrating digital tools into the curriculum in a way that complements traditional teaching methods, rather than replacing them. They argue that digital tools should be seen as part of a broader educational strategy, where they can be used to reinforce and extend classroom learning.

In language learning, blended environments offer students more chances to practice their language skills across different contexts. Larsen-Freeman and Anderson (2011) highlight the potential of digital tools to offer contextualized language practice that reflects real-world scenarios. By integrating digital tools like Duolingo into a blended learning model, educators can create a more comprehensive and effective language learning experience, where students are supported in developing both their foundational skills and their ability to use the language in practical, everyday situations.

2. Method

The methodology employed in this study is designed to explore the effectiveness of Duolingo as a supplementary language learning tool in a large speaking class setting. Given the unique challenges posed by a large class size and varying levels of student proficiency, a descriptive qualitative approach was deemed most appropriate. This approach allows for an in-depth exploration of students' experiences and perceptions, providing rich qualitative data that can shed light on the efficacy of Duolingo in this context.

The study was conducted within the Informatics Engineering department of a university, where English is taught as a compulsory subject. The specific course under investigation was a speaking class comprising approximately 60 students. This class size is notably large for a course focused on oral communication skills, where smaller groups are typically preferred to facilitate interaction and provide personalized feedback. The diversity of the background, in terms of both language proficiency and engagement levels, presented significant challenges for the lecturer.

Given these challenges, the integration of Duolingo into the course was conceptualized as a means to supplement traditional classroom activities. The goal was to provide students with additional opportunities to practice their English language skills outside of the classroom, thereby compensating for the limited in-class speaking practice. Duolingo was selected for its accessibility, ease of use, and its potential to engage students through its gamified learning model. The app was introduced as a required component of the course, with students being asked to achieve a minimum number of XP (experience points) each week and to submit weekly reports detailing their progress and experiences.

Participants

The study involved 60 first-year undergraduate students from the Informatics Engineering program, aged between 18 and 22, with varying levels of English proficiency, ranging from beginner to intermediate. Participation was voluntary, and all participants were informed that their data would be used for research purposes. Informed consent was obtained from each participant, ensuring they understood the study's goals and their rights. To preserve anonymity, participants' identities were kept confidential, and pseudonyms were used in all reports and publications.

Data were collected over a period of three weeks, during which students were required to use Duolingo as a supplementary tool for their language learning. The data collection process aimed to capture both quantitative and qualitative information, offering a well-rounded view of the students' engagement with Duolingo and its influence on their language development.

The quantitative data were collected through Duolingo's built-in tracking system, which recorded each student's weekly XP accumulation and percentage completion rates. XP points served as a measure of student engagement, with a higher number of points indicating greater interaction with the app. The percentage completion rates reflected the extent to which students met their weekly learning goals, providing insights into their consistency and commitment to using the app.

The qualitative data were collected through weekly self-reflection reports, in-class observations, and informal interviews. Each student was required to submit a weekly report detailing their experiences with Duolingo, including the challenges they encountered, the aspects of the app they found beneficial, and their overall perceptions of its effectiveness as a learning tool. These reports were supplemented by

in-class observations, where the instructor noted changes in student participation and engagement during speaking activities. Informal interviews were also conducted to gain deeper insights into the students' attitudes towards Duolingo and to explore any emerging themes or concerns that were not captured in the written reports.

The data gathered from weekly reports, observations, and interviews were analyzed through a combination of thematic analysis and descriptive statistics. Thematic analysis was used to uncover recurring themes and patterns in the students' self-reflections and interview feedback. This qualitative analysis helped to capture the students' perceptions of Duolingo, the challenges they encountered, and the strategies they employed to overcome these challenges.

Thematic analysis involves coding qualitative data to identify recurring themes and patterns. In this study, the thematic analysis focused on identifying key themes related to student engagement, motivation, challenges, and perceived benefits of using Duolingo. The data was first coded for broad themes, such as "motivation" and "challenges," and then further refined into sub-themes, such as "gamification as a motivator" and "issues with translation exercises." This process allowed for a nuanced understanding of the students' experiences and provided insights into the factors that influenced their engagement with Duolingo.

The quantitative data, consisting of XP scores and percentage completion rates, was analyzed using descriptive statistics to provide a clearer picture of the students' engagement and progress over the three weeks. The analysis aimed to identify trends in student engagement, such as whether engagement levels increased, decreased, or remained consistent over time. This quantitative analysis was then correlated with the qualitative data to explore how the students' experiences and perceptions aligned with their actual usage of the app.

Ethical Considerations

Ethical considerations played a central role in this study. Participants were fully informed about the study's purpose and their rights, including the option to withdraw at any point without consequence. Informed consent was obtained from each participant before data collection began. To maintain confidentiality, all personal information was anonymized, and pseudonyms were used in all reports and publications. Furthermore, the study adhered to the university's ethical standards for research involving human participants.

While this study provides valuable insights into the use of Duolingo as a supplementary language learning tool, it is also necessary to address its limitations. One of the primary limitations is the short duration of the study, which was conducted over a period of three weeks. While this timeframe allowed for an initial exploration of student engagement and perceptions, it may not have been sufficient to capture the long-term impact of using Duolingo on language proficiency. Future research could extend the study duration to examine how sustained use of Duolingo influences language learning outcomes over a longer period.

Another limitation is the reliance on self-reported data. While the weekly reports provided valuable qualitative insights, there is always the possibility of bias in self-reported data, as students may overstate their engagement or underreport challenges. To mitigate this limitation, the self-reports were supplemented with in-class observations and informal interviews, which provided additional context and helped to triangulate the data.

Finally, the study's focus on a single class of Informatics Engineering students may limit the generalizability of the findings. Although this study offers useful insights into the use of Duolingo in a large, diverse classroom, additional research is required to examine how these results might apply to other educational settings, such as smaller classes, varying age groups, or alternative language learning environments.

3. Results and Discussion

The integration of Duolingo into the large speaking class provided a unique opportunity to observe how a digital language learning tool could complement traditional classroom instruction. The results from this study are organized around key themes that emerged from the data, including student engagement, language proficiency, motivation, and the challenges associated with using Duolingo in a large class setting. These themes are discussed in the context of existing literature, providing a comprehensive understanding of the tool's effectiveness and limitations.

Student Engagement with Duolingo

One of the primary indicators of the success of any educational tool is the level of engagement it fosters among students. In this study, engagement was measured through the students' weekly XP accumulation and percentage completion rates on Duolingo. The analysis of these metrics over the three-week period revealed several important trends.

Week 1 saw high levels of engagement across the class, with the majority of students achieving or exceeding the 45 XP target. This initial enthusiasm can be attributed to the novelty of using a gamified platform like Duolingo. The immediate feedback and rewards system, such as earning points and leveling up, appeared to motivate students to actively participate. This finding is consistent with studies by Johnson et al. (2019), which highlight how gamification can enhance learner motivation and sustain engagement, particularly in the early stages of using a new educational tool.

However, by Week 2, a slight decline in engagement was observed among some students, reflected in lower XP scores and percentage completion rates. This decline may be indicative of the initial excitement wearing off, coupled with external factors such as academic workload and time constraints. Interestingly, while some students' engagement dropped, others maintained or even increased their participation.

By Week 3, the data showed a further divergence in student engagement. Approximately half of the students managed to maintain a consistent level of participation, while the other half struggled to keep up with the weekly targets. The students who sustained their engagement typically cited the app's ease of use and the sense of accomplishment they felt from completing lessons as motivating factors. On the other hand, those who disengaged often mentioned issues such as repetitive content, lack of variety, and the perceived disconnect between the app's exercises and real-world language use. These findings align with the critiques of Duolingo presented by Garcia and Pena (2018), who argue that while the app is effective in teaching vocabulary and basic grammar, it may not fully prepare users for practical language use in conversational contexts.

The majority of students reported improvements in their vocabulary and grammar as a result of using Duolingo. This was particularly evident in the increased confidence some students displayed during in-class speaking activities. For example, several students who were initially hesitant to participate in class discussions became more willing to engage, often using vocabulary and phrases they had learned on Duolingo. This finding supports the claims of Loewen et al. (2019), who found that Duolingo is effective in building foundational language skills, which can then be applied in more interactive settings.

It is important to note, however, that although Duolingo contributed to improvements in students' foundational language skills, its effect on more advanced areas of language proficiency, such as fluency and pronunciation, was limited. Several students expressed frustration with the app's focus on translation exercises, which they felt did not adequately prepare them for real-life conversations. One student noted, "Duolingo is great for learning words and simple sentences, but it doesn't really teach you how to speak naturally in English." This sentiment reflects the limitations of Duolingo's methodology, which tends to prioritize accuracy over fluidity, potentially hindering the development of conversational skills.

Additionally, the app's rigid structure, which often requires users to translate sentences word for word, was identified as a barrier to achieving more nuanced language understanding. As noted by Brown et al. (2020), such an approach can lead to a mechanical learning experience, where students focus more on completing tasks than on truly internalizing the language. This critique was echoed by several students in the study, who mentioned that while they enjoyed using Duolingo, they felt it was not sufficient on its own to achieve full language proficiency.

3.1 Student Motivation and Perception

Student motivation played a crucial role in determining the effectiveness of Duolingo as a supplementary learning tool. The study found that motivation was closely linked to the students' perception of the app's relevance to their language learning goals and its ability to provide immediate rewards and feedback.

Many students reported feeling motivated by the gamified elements of Duolingo, such as earning points, unlocking levels, and receiving virtual rewards. This aligns with the findings of Smith and Miller (2020), who argue that gamification can significantly boost motivation, particularly in the context of self-directed learning. One student commented, "I love how Duolingo makes learning feel like a game. It's fun to see my progress and get rewards for completing lessons."

However, the study also found that motivation was not uniform across the class. Some students, particularly those who were more advanced in their English proficiency, expressed a lack of challenge

in the app's exercises, which led to decreased motivation over time. These students felt that the content was too basic and did not align with their learning needs. This finding suggests that while Duolingo is effective in engaging beginners, it may need to offer more advanced and customizable content to maintain the interest of higher-level learners.

Furthermore, the study revealed that the social and competitive aspects of Duolingo, such as comparing XP scores with peers, also influenced motivation. Several students mentioned that seeing their peers' progress motivated them to keep up, a phenomenon consistent with Vygotsky's (1978) theory of social learning, that learners are influenced by observing the behaviors and achievements of others. However, this competitive element also had a downside, as some students reported feeling discouraged when they fell behind their peers, leading to decreased engagement.

3.2 Challenges and Limitations of Using Duolingo

While Duolingo provided several benefits as a supplementary tool, the study also highlighted significant challenges and limitations in its application, particularly in the context of a large speaking class. One of the main challenges identified was the discrepancy between Duolingo's exercises and real-world language use. As mentioned earlier, students found that the app's focus on translation and repetitive drills did not fully prepare them for conversational English. This issue was particularly problematic in a speaking class, where the primary goal is to develop fluency and confidence in oral communication. As noted by Chen and Goh (2011), speaking classes require interactive and communicative activities that simulate real-life conversations, a need that Duolingo's structured exercises struggle to meet.

Another significant challenge was the variation in student proficiency levels. In a large class with diverse language abilities, it was difficult to ensure that Duolingo met the needs of all students. Some students found the content too easy, while others struggled with the pace and complexity of the exercises. This variation in experience highlights the limitations of a one-size-fits-all approach in language learning tools. As Graham (2006) points out, effective language instruction requires differentiation and adaptation to individual learner needs, something that is difficult to achieve with a standardized platform like Duolingo.

The study also revealed that the requirement to use Duolingo weekly added to the students' workload, particularly for those who were already balancing multiple academic and personal commitments. While many students appreciated the flexibility of being able to learn on their own time, others felt overwhelmed by the expectation to complete additional tasks outside of class. This challenge underscores the importance of integrating digital tools into the curriculum in a way that complements, rather than competes with, other learning activities.

3.3 Pedagogical Implications

The results of this study provide meaningful insights for language educators and curriculum developers interested in incorporating digital tools such as Duolingo into their teaching strategies. One key takeaway is that Duolingo serves as an effective supplementary resource for strengthening foundational language skills, especially in vocabulary and grammar. However, educators should be mindful of the tool's limitations and should not rely on it as the sole method of instruction. To maximize its effectiveness, Duolingo should be used in conjunction with other teaching strategies that focus on developing higher-order language skills, such as fluency, pronunciation, and contextual understanding.

Secondly, the study emphasizes the need for differentiated instruction in language teaching. In a large and diverse classroom, students possess different proficiency levels and unique learning requirements. Educators should consider using Duolingo alongside other resources that can be tailored to individual learner profiles, ensuring that all students are adequately challenged and supported in their learning journey.

Third, the findings suggest that using games can be quite effective increase student motivation and engagement, but it is not without its drawbacks. While many students responded positively to the competitive and reward-based elements of Duolingo, others found them to be demotivating or superficial. Educators should carefully consider how to balance these elements with more substantive learning activities that promote deep engagement with the language.

Finally, the study underscores the need for ongoing assessment and feedback. While Duolingo provides immediate feedback on individual exercises, it does not offer the comprehensive, personalized feedback that is critical for developing language proficiency. Educators should supplement Duolingo with regular formative assessments and provide students with constructive feedback that addresses their specific strengths and areas for improvement.

4. Conclusion

The use of digital tools in education has increasingly become a necessity rather than a mere supplement, particularly in the realm of language learning where technology can offer substantial support in overcoming traditional classroom challenges. This study set out to explore the effectiveness of Duolingo, a widely recognized language learning application, as a supplementary tool in a large speaking class of Informatics Engineering students. The class size posed significant challenges in terms of maintaining student engagement, providing individualized feedback, and fostering active participation—issues that are often exacerbated in language classes where communication is key.

The study's findings suggest that Duolingo can play a valuable role in enhancing certain aspects of language learning, particularly in building foundational vocabulary and grammar skills. The app's gamified approach, which incorporates elements such as point systems, levels, and immediate feedback, was shown to effectively engage students, particularly in the initial stages of the study. Many students reported that the app's interactive nature and the ability to learn at their own pace made language learning more accessible and less intimidating. These features align well with the needs of students in a large class, where individual attention from the instructor is often limited.

However, the study also highlighted several limitations of Duolingo when used as a primary tool for language learning in a classroom setting. While it was effective in reinforcing basic language skills, Duolingo was less successful in addressing the more complex aspects of language proficiency, such as fluency, pronunciation, and contextual language use. Students expressed concerns about the app's focus on translation exercises, which they felt did not adequately prepare them for real-world conversations. The study also found that engagement with the app tended to decline over time, as the initial novelty wore off and students encountered repetitive content that did not match their advancing language needs.

Recommendations for Future Research

Given the limitations observed in this study, future research could explore several areas to further understand the role of digital tools like Duolingo in language learning. An interesting area for further exploration could be the long-term effects of using Duolingo on language proficiency, particularly regarding retention and the practical application of language skills. Longitudinal research could offer valuable insights into how ongoing use of the app affects language development over time, and whether the initial improvements in vocabulary and grammar are sustained or further enhanced with prolonged use.

Another area for further investigation is the integration of Duolingo into a more comprehensive language learning framework that includes other digital and traditional resources. Research could examine how combining Duolingo with tools that focus on speaking and listening skills, for example, impacts overall language proficiency. Additionally, studies could explore how customization and adaptability within Duolingo could better meet the needs of advanced learners or those with specific language goals.

Finally, there is a need for research on the effectiveness of Duolingo and similar tools in diverse educational settings, particularly in non-English speaking countries or among learners of different age groups and educational backgrounds. Understanding how these tools perform across various contexts can help educators make more informed decisions about their use and adaptation in different teaching environments.

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