MOBILE LEARNING APPLICATIONS IN LANGUAGE ACQUISITION: USER ENGAGEMENT AS A PATHWAY TO LANGUAGE PROFICIENCY

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Abstract: In this study, the core conceptual framework was constructed using mobile app use, User engagement, feedback interactivity and Language outcomes as variables by introducing the following demographic gender, age, grade and parental education variables. Attempting to analyze the differences in the perceived means and the influence of the independent variables on the dependent variables for each of the variables of the respondents' demographic variables grouping Mobile app use, User engagement, Feedback interactivity, and Language outcomes, the following research hypotheses were formulated in this study: hypothesis 1 Mobile app use has a significant positive impact on Language outcomes of high school students. Hypothesis 2 There is a significant positive correlation between positive User engagement and mobile app use among high school students. Hypothesis 3 There is a significant positive correlation between user engagement with mobile language learning apps and language proficiency outcomes of high school students in Province D. This indicates that higher levels of engagement are associated with improved language proficiency. Hypothesis 4: Feedback interactivity plays a significant mediating role in the relationship between User engagement with mobile language learning applications and language proficiency outcomes of high school students in Province D, indicating that the effectiveness of User engagement on language proficiency is influenced by the quality and nature of feedback interactivity. And using students from seven high schools in Province D as a case study, the sample size was calculated to be 13,288 using simple random sampling method in the overall study population, 420 questionnaires were distributed in this study and 390 questionnaires were returned with a return rate of 92.9% using simple random sampling method for distributing questionnaires.

This study found that mobile app use has a significant positive impact on Language outcomes, User engagement has a significant positive impact on Language outcomes, and mobile app use has a significant impact on Language outcomes through feedback interactivity. Feedback interactivity partially mediated the effect of User engagement on Language outcomes. This study presents novel insights, promotes theoretical understanding, informs pedagogical practice, and lays the foundation for future research in the area of language learning through mobile apps.

Keywords: Mobile App Use, User Engagement, Feedback Interactivity, Language Outcomes

Introduction

In an era marked by the ubiquitous presence of mobile technology, the landscape of education has undergone a significant transformation. Traditional modes of learning have evolved to incorporate mobile learning applications, presenting novel opportunities for enhancing language acquisition processes. This introduction sets the stage for a comprehensive exploration into the intersection of mobile learning applications and language acquisition, with a specific focus on user engagement as a pathway to language proficiency.

The proliferation of mobile devices has revolutionized the way individuals engage with information and learning resources. With the increasing accessibility of smartphones and tablets, educational initiatives have embraced the potential of mobile learning applications to deliver content in diverse formats and contexts. Language acquisition, in particular, stands to benefit from the versatility and flexibility afforded by mobile technologies.

Language proficiency is a multifaceted construct encompassing various skills such as reading, writing, listening, and speaking. Traditionally, language learning has been confined to classroom settings, often characterized by passive engagement and limited interaction. However, mobile learning applications offer a dynamic platform that facilitates active participation and personalized learning experiences. By integrating multimedia elements, gamification, and interactive exercises, these applications cater to diverse learning styles and preferences, thereby enhancing user engagement.

The integration of mobile learning applications into language education aligns with the principles of constructivism and situated cognition, which emphasize the importance of active engagement and meaningful interaction in the learning process (Dede, 2017; Pachler et al., 2019). Constructivist approaches posit that learners construct knowledge through their interactions with the environment, while situated cognition theory highlights the role of context and social interaction in shaping learning outcomes (Lave & Wenger, 1991). Mobile technologies offer affordances that support these pedagogical principles by enabling learners to access authentic language materials, collaborate with peers, and receive immediate feedback (Kukulska-Hulme & Shield, 2018).

Moreover, mobile learning applications facilitate ubiquitous learning experiences that transcend the constraints of time and space. Learners can engage with language materials anytime, anywhere, thereby capitalizing on incidental learning opportunities in everyday contexts (Sharples et al., 2019). This flexibility is particularly advantageous for language learners who may have limited access to formal instruction or who require additional support outside of the classroom environment (Stockwell, 2017).

Furthermore, the interactive features of mobile learning applications promote active

engagement and learner autonomy, which are key factors in fostering language proficiency (Benson, 2001; Warschauer, 2011). Learners can select content that aligns with their interests and learning goals, customize their learning pathways, and monitor their progress in real-time (Chinnery, 2006). This sense of ownership and control over the learning process enhances motivation and self-efficacy, leading to more effective language learning outcomes (Deci & Ryan, 2000).

In addition to facilitating individualized learning experiences, mobile applications also support collaborative and social learning activities. Learners can participate in online communities, engage in peer-to-peer interactions, and co-construct knowledge through shared experiences (Vygotsky, 1978). These social interactions not only enhance language proficiency but also promote intercultural competence and global citizenship (Kress, 2010). By connecting learners from diverse linguistic and cultural backgrounds, mobile learning applications foster inclusive learning environments that celebrate linguistic diversity and promote cross-cultural understanding (Beach, 2017).

Despite the numerous affordances of mobile learning applications, their integration into language education is not without challenges. Technical constraints, such as limited bandwidth and device compatibility issues, may hinder access to digital resources, particularly in resource-constrained contexts (Traxler, 2018). Moreover, concerns regarding privacy, security, and digital literacy may affect learners' willingness to engage with mobile technologies (Kearney & Schuck, 2017). Addressing these challenges requires careful consideration of infrastructural support, teacher training initiatives, and digital citizenship education programs (Ally, 2009; UNESCO, 2013).

Despite the growing popularity of mobile learning applications in language education, there remains a gap in understanding the extent to which user engagement influences language proficiency outcomes. While numerous studies have explored the efficacy of mobile-assisted language learning, few have examined the underlying mechanisms that drive user engagement and its subsequent impact on language acquisition. Addressing this gap is imperative for designing effective instructional strategies and optimizing the use of mobile technologies in educational contexts.

In summary, the integration of mobile learning applications into language education represents a paradigm shift in pedagogical practice. By leveraging the affordances of mobile technologies, educators can create engaging and immersive learning experiences that empower learners to develop language proficiency in meaningful contexts. This research seeks to explore the impact of user engagement with mobile applications on language acquisition outcomes, with the aim of informing instructional strategies and promoting effective use of technology in language education.

Research Problems

In an increasingly globalized world, language learning is an essential component of education, communication and social integration. However, despite the proliferation of digital technologies and online resources, learners often encounter challenges in becoming proficient and fluent in a second

language. Despite the continuous advancement of technology-mediated language learning platforms, comprehensive research on the multifaceted dynamics of User engagement, feedback mechanisms, and their collective impact on Language outcomes remains scarce.

This study aims to deepen the understanding of this area by investigating the interplay between User engagement, feedback interactivity and Language outcomes in mobile app-based language learning. Specifically, this study seeks to explore the following key questions:

Formulation of the research question:

What is the relationship between User engagement and Language outcomes in a mobile app-based language learning environment?

How does feedback interactivity mediate the relationship between User engagement and Language outcomes?

Considering the mediating role of feedback interactivity, what are the direct and indirect effects of mobile app use on Language outcomes?

What are the implications of these findings for the design of effective language learning interventions and educational technology platforms?

By addressing these research questions, this study endeavors to advance our understanding of the mechanisms underlying effective language learning practices in digital environments in order to inform the development of evidence-based instructional strategies and technology-enhanced learning solutions.

Research Objective (s)

Objective 1. Examine Patterns of Mobile App Use

One of the primary objectives of this study is to examine the patterns of mobile app use among language learners in high schools in Province D. This involves investigating the frequency and duration of mobile app usage, the types of language learning apps preferred by students, and the specific features and functionalities that attract users. By analyzing usage patterns, the study aims to gain insights into the extent to which mobile learning applications are integrated into language learning practices and the factors that influence adoption and engagement (Chuang & Ho, 2018; Lee & Lee, 2019).

Objective 2. Assess the Level of User Engagement

Building on the examination of mobile app use, the study seeks to assess the level of user engagement with language learning applications. User engagement encompasses various dimensions, including cognitive, affective, and behavioral aspects of interaction with the app. Through surveys, interviews, or observational methods, the research aims to measure indicators of engagement such as time spent on task, depth of interaction, perceived usefulness, and satisfaction with the learning experience. By quantifying levels of engagement, the study can identify factors that contribute to

sustained user involvement and inform strategies for enhancing engagement (Golonka et al., 2014; Motteram & Forrester, 2018).

Objective 3. Evaluate the Association Between User Engagement and Language Proficiency Outcomes

A key objective of this study is to evaluate the association between user engagement with mobile learning applications and language proficiency outcomes. Language proficiency is a multifaceted construct encompassing various skills such as reading, writing, listening, and speaking (Stockwell & Liu, 2015). By administering language proficiency assessments or conducting performance-based tasks, the research aims to measure the impact of user engagement on learners' linguistic abilities. This involves exploring correlations between engagement metrics (e.g., frequency of app use, level of interactivity) and language proficiency scores, as well as identifying potential moderators and mediators of this relationship (Song & Fox, 2016; Wu et al., 2020).

Objective 4. Investigate the Mediating Role of Feedback Interactivity

A central objective of this study is to investigate the mediating role of feedback interactivity in the relationship between user engagement and language proficiency outcomes. Feedback plays a crucial role in the learning process by providing learners with information about their performance and guiding their subsequent actions (Chuang & Ho, 2018). In mobile learning environments, feedback can take various forms, including automated responses, peer feedback, and instructor feedback (Demmans Epp et al., 2018). By examining the quality and effectiveness of feedback mechanisms within language learning applications, the research aims to determine how feedback interactivity influences learners' engagement levels and language learning outcomes. This involves exploring the mechanisms through which feedback enhances learners' comprehension, retention, and application of linguistic knowledge, as well as identifying potential moderators of the feedback-effectiveness relationship (Lee & Lee, 2019; Stockwell, 2017).

Literature Review

Mobile learning applications have become a powerful tool for language learning, providing learners with innovative ways to engage with language content and practice skills outside of the traditional classroom environment. As the use of mobile technology becomes more prevalent in educational settings, it is critical to understand its impact on Language outcomes. This literature review explores the theoretical foundations and empirical evidence related to mobile app use, User engagement, feedback interactivity, and their impact on Language outcomes for high school students in D. The study examines the impact of mobile apps on Language outcomes for high school students.

Mobile learning facilitated through the use of smartphones, tablets, and other portable devices has revolutionized language learning. Mobile applications (Apps) designed specifically for language

learning offer a wide range of features including interactive exercises, multimedia content and real-time feedback to support learners in all aspects of language learning (Ally, 2009). These apps provide learners with the opportunity to learn independently anytime, anywhere for a personalized and self-directed learning experience (Kukulska-Hulme & Shield, 2018).

Research has shown that mobile app use has a positive impact on Language outcomes including vocabulary acquisition, grammatical proficiency, listening comprehension, and oral fluency (Chuang & Ho, 2018; Golonka et al.) By providing authentic language materials and immersive learning environments, mobile apps increase learner engagement and motivation, leading to more effective language practice and skill development (Stockwell & Liu, 2015).

The concept of "User engagement" originated from the term "participatory culture" proposed by Henry Jenkins in his book Textual Poachers: Television Fans and Participatory Culture, which has been around for more than 20 years.

(i) User engagement is a behavior.

User engagement is a kind of behavior. In the last century, the scholar Vroom (1988) explained the term "engagement", that is, participation is the membership, that is, the individual in the community or the group of all kinds of activities, Vamdoorn (2010) in the study of consumer interaction with the brand to make behavioral responses, that User engagement behavior is beyond the transaction behavior, these behaviors are beyond the transaction behavior, and these behaviors are not the same. transaction behavior, these behaviors are driven by individual motivational factors.

(ii) User engagement as a state of mind

When User engagement is a psychological state, it reflects a multidimensional structure that includes behavioral, cognitive, and emotional engagement. User engagement is a psychological state that arises from the user's interaction with the provider during the enjoyment of the service. Hollebeek (2011) argues that User engagement is the emotional cognition of the user towards the brand and the context that arises from the interaction with the brand. Mollen and Wilson (2010) argue that User engagement is the process of establishing a positive relationship and emotional commitment with the brand. Paterson Chinese (2006) believes that User engagement is the formation of cognitive and emotional states and physical behavioral responses in the process of enjoying the service.

(iii) User engagement is a behavioral tendency

In recent years, some scholars regard User engagement as a behavioral tendency, the user's engagement represents their own willingness and tendency to participate, and this behavioral tendency will indirectly affect the performance of the behavior. Meanwhile, Stobacka believes that User engagement is conceptualized as an activity in which users participate in the integration of resources in the process of using a product or enjoying a service, and this activity can be assessed by observing the user's engagement behavior. Therefore, participation behavior is a combination of both behavioral

tendencies and behavioral manifestations.

The concept of "feedback" comes from cybernetics, originally from the field of systems engineering at the beginning of the 20th century, and is used to describe the self-regulation mechanism of a system, which is closely related to control and automation. In the field of education, feedback is a tool that provides a current status or data on the completion of a given task, which can contribute to the enhancement and improvement of students' learning ability, and has a positive impact on strengthening and enhancing learners' motivation. Hattie et al. consider feedback to be the result of performance, which is defined here as the information provided by a mediator in evaluating a person's performance or understanding. Kuhavy and Wager provide an analysis of "feedback" in the context of a study of "feedback". Wager describe "feedback" in the following ways: first, feedback is a catalyst for improving the efficiency and accuracy of students' responses; second, feedback is a reinforcer that deepens the connection between the previous stimulus and the student's response; and third, students can make changes or improve their abilities in response to feedback.

Language outcomes represent measurable results of language learning and competency development and are integral to understanding the effectiveness of language acquisition strategies and interventions. This comprehensive review explores the multifaceted nature of Language outcomes across language domains, including vocabulary acquisition, grammatical accuracy, oral fluency, listening comprehension, and reading proficiency. Drawing on recent research in applied linguistics and language education, this synthesis review explores the factors that influence Language outcomes and the role of technology (particularly mobile learning applications) in supporting the development of language proficiency.

Recent research has explored the effectiveness of technology-enhanced vocabulary learning methods, including mobile learning apps, in promoting vocabulary acquisition for language learners. These apps provide learners with a wide range of vocabulary resources, interactive exercises, and personalized learning experiences tailored to individual levels and learning preferences. Features such as spaced repetition algorithms, multimedia resources, and gamified activities increased vocabulary retention and engagement, resulting in significant increases in vocabulary knowledge and vocabulary size (Chuang & Ho, 2018).

In addition, research has highlighted the role of contextualized vocabulary instruction and meaningful vocabulary practice in facilitating vocabulary acquisition. Mobile learning apps provide learners with exposure to vocabulary in authentic contexts such as reading passages, audio recordings, and real-life conversations. By combining vocabulary instruction with language use and comprehension activities, educators can enhance learners' vocabulary knowledge and facilitate vocabulary acquisition in a meaningful way (Kukulska-Hulme & Shield, 2018).

Many studies have explored the relationship between mobile app use and language learning

outcomes, emphasizing the positive correlation between the two. For example, Chuang and Ho (2018) conducted a study on the effectiveness of mobile game-based English learning in a flipped classroom environment. Their findings showed that students who regularly used mobile apps for learning showed significant improvements in both English language proficiency and motivation to learn. Highly engaged learners tend to show greater enthusiasm, effort, and persistence in language learning, resulting in more significant progress in language proficiency over time (Lee & Lee, 2019).

Feedback mechanisms provide learners with valuable information about their language learning progress and areas for improvement. By receiving timely and relevant feedback, learners can adjust their learning strategies, identify errors, and monitor their language proficiency development more effectively (Wu et al., 2020)

Future research should continue to explore the mechanisms underlying the relationship between mobile app use, User engagement, feedback interactivity, and Language outcomes to inform the design of evidence-based language learning interventions that enhance learners' language learning experience.

Methodology

With probability-based sampling methods, the sample size can be determined through the population collection process. For example: the sample size suitable for calculation, the sample size used in the study was determined using The Taro Yamane Sample Size Formula (1973), and the sample size was determined using a 95% confidence level and a permissible value. The sampling error is 5% or 0.05. The overall sample is 13,288. When n = number of samples used in the study . N = size of the overall population, e = random sample error is set to 0.05 .

The sample size and formula are as follows:

$$n=\frac{N}{1+Ne^2}$$

$$n=\frac{13288}{1+13288X0.05^2}$$

$$n=388.21$$

Therefore, the minimum sample size for this study is 388.

The minimum sample size is calculated to be 388.21 and rounding to the nearest whole number ensures sufficient sample size. Therefore, the study will require approximately 388 participants, and both actual and potential attrition rates must be considered when determining the final sample size.

First, high schools in Province D will be stratified based on geographic location and academic performance. Then, a random sample of students will be drawn from each stratum to ensure proportional representation.

Inclusion criteria for participants will be students who attended these high schools during the study school year. Exclusion criteria may include students with language barriers or those who do not

agree to participate.

Sample size calculations will be made based on the study objectives and analysis plan to determine the appropriate number of participants needed to achieve full statistical power.

Once the sample size is determined, potential participants will be contacted and informed consent will be obtained from students and their parents or legal guardians as necessary.

Data collection will include the administration of surveys, interviews, or observations, depending on the specific research instrument used to measure mobile app use, User engagement, Language outcomes, and feedback interactivity. The sampling process will adhere to ethical guidelines and principles of confidentiality and privacy.

All data collection for this study was conducted online. Participants received an email invitation to access the survey as well as instructions for completing the survey. Online survey administration allowed for secure and efficient data collection while ensuring participant anonymity. For this study, the "Questionnaire Star Online Platform" (www.wjx.cn) was chosen for the distribution, measurement and collection of the questionnaire. In this study, questionnaires were administered to students in seven high schools in Province D. A total of 420 questionnaires were distributed and returned. A total of 420 questionnaires were distributed and 390 valid questionnaires were returned with a validity rate of 92.9%.

Results

R-square (R^2): explains the proportion of the total variance of the independent variable to the dependent variable. $r^2 = 0.382$, which means that mobile app use explains 38.2% of the variance of the Language outcomes. In the ANOVA test Table 4-17, the F value: 239.635, indicates the result of the overall significance test of the model. The larger the F value, the better the overall fit of the model. Significance (Sig.): .000 indicates that the regression model is statistically significant, i.e., mobile app use has a significant effect on Language outcomes. As can be seen in Figure 4-18 above, after analyzing the coefficient a coefficient, the t-value: 15.480, which represents the ratio of the regression coefficient of the independent variable to its standard error, the larger the t-value, the more significant is the effect of the independent variable on the dependent variable. Significance (Sig.): .000, indicating that the effect of mobile app use on Language outcomes is statistically significant.

The results of this regression analysis indicate that mobile app use has a significant positive effect on Language outcomes. The specific results are as follows:

Mobile app use explained 38.2% of the variance in Language outcomes.

The effect of mobile app use on Language outcomes was statistically significant ($p < 0.001$) by F-test and t-test.

The regression coefficients indicate that for each unit increase in mobile app use, Language

outcomes increased by an average of 0.683 units.

R: Indicates the correlation coefficient between the independent and dependent variables. In this model, R = 0.692, indicating a strong positive correlation between User engagement and Language outcomes.

The R-square (R^2) explains the proportion of the total variance of the independent variable on the dependent variable.R^2 = 0.478, indicating that User engagement explains 47.8% of the variance in Language outcomes. In the ANOVA test Table 4-20, the F value: 355.816, indicates the result of the overall significance test of the model. The larger the F value, the better the overall fit of the model. This indicates that the regression model is highly significant at the 0.01 level and the model is usable and meaningful. As can be seen in Figure 4-21 above, after analyzing the coefficient of coefficient a, the regression coefficient shows that for every unit increase in User engagement, the Language outcomes increase by 0.716 units on average. t-value: 18.863, which indicates the ratio of the regression coefficient of the independent variable to its standard error, the bigger the t-value is, the more significant is the effect of the independent variable on the dependent variable. Significance (Sig.): .000, indicating that the effect of User engagement on Language outcomes is statistically significant.

The results of this regression analysis indicate that User engagement has a significant positive effect on Language outcomes. The specific results are as follows:

User engagement explained 47.8% of the variance in Language outcomes.

The effect of User engagement on Language outcomes was statistically significant ($p < 0.001$) by F-test and t-test.

Regression coefficients indicated that for every unit increase in User engagement, Language outcomes increased by 0.716 units on average.

Feedback interactivity Model Summary.

R = 0.9000, R^2 = 0.8099, indicating that the independent variable mobile app use explains 80.99% of the variance in feedback interactivity.

Model significance $p < 0.001$, indicating that the model is statistically significant.

Language outcomes Model summary.

R = 0.6369, R^2 = 0.4057, indicating that the independent variable mobile app use and the mediator variable feedback interactivity explain 40.57% of the variance in the dependent variable Language outcomes.

The model significance $p < 0.001$ indicates that the model is statistically significant.

Total effects model (Language outcomes).

R = 0.6179, R^2 = 0.3818, indicating that the independent variable mobile app use explained 38.18% of the variance in the dependent variable Language outcomes.

The model is significant at $p < 0.001$, indicating that the model is statistically significant.

The total effect coefficient was 0.6831, indicating a significant direct effect of mobile app use on Language outcomes.

The direct effect coefficient of 0.3304 indicates that the effect of mobile app use on Language outcomes remains significant after controlling for the mediating variable, feedback interactivity.

The coefficient of the indirect effect through feedback interactivity is 0.3527, indicating that part of the effect of mobile app use on Language outcomes is realized through feedback interactivity.

The Bootstrap results show that the confidence interval for the indirect effect does not contain zero (0.1631 - 0.5381), indicating that the indirect effect is statistically significant.

The analysis shows that the independent variable, mobile app use, has a significant indirect effect on the dependent variable, Language outcomes, through the mediating variable, feedback interactivity. In addition, mobile app use also had a significant direct effect on Language outcomes. This suggests that the mediating variable, feedback interactivity, partially explains the effect of mobile app use on Language outcomes. Overall, mobile app use has a significant effect on language outcomes (Language outcomes) through feedback interactivity.

The summary of the feedback interactivity model shows that User engagement has a significant effect on feedback interactivity, explaining 70.27% of the variance in feedback interactivity.

The summary of the Language outcomes model shows that User engagement and feedback interactivity together explain 48.48% of the variance in the Language outcomes, and that both have a statistically significant effect on the Language outcomes.

The **Total Effects Model (Language outcomes)** shows that User engagement has a significant direct effect on the Language outcomes, explaining 47.84% of the variance.

The results of the direct and indirect effects showed that User engagement had significant direct and indirect effects on the Language outcomes through feedback interactivity.

Taken together, these results indicate that both the direct effect of User engagement on Language outcomes and the indirect effect through feedback interactivity are significant, suggesting that feedback interactivity partially mediates the effect of User engagement on Language outcomes.

Discussion

The results of this study provide valuable insights into the relationship between mobile technology use and Language outcomes, revealing the mechanisms underlying the effectiveness of mobile-assisted language learning (MALL) interventions.

Mobile app use and Language outcomes:

Our findings are consistent with the existing literature and further support the notion that mobile app use has a positive impact on Language outcomes. The ubiquity of mobile devices allows learners to interact with language learning resources at their convenience, regardless of time and space. This

unrestricted access promotes continuous and frequent contact with the target language, creating an immersive learning environment that reflects real-world language use. As a result, learners benefit from more language learning opportunities when they are exposed to authentic language contexts and content in different environments.

This finding highlights the transformative potential of mobile technology in democratizing access to language learning resources. Mobile applications break down geographical barriers and time constraints, enabling learners from diverse backgrounds to access high-quality language materials regardless of their location or socioeconomic status. This democratization of access not only promotes inclusivity, but also empowers learners to take control of their own learning journeys. With personalized learning experiences and the ability to learn at their own pace, learners are able to develop autonomy and independence in the language learning process. Mobile technology thus becomes a catalyst for equitable access to language education, empowering learners to embark on a journey of linguistic and cultural discovery with confidence and autonomy.

User engagement and Language outcomes:

As our findings demonstrate, User engagement plays a pivotal role in shaping Language outcomes. In the dynamic environment of digital language learning, where mobile apps have become an indispensable tool for learners around the world, it is critical to understand the factors that drive User engagement. Our study reveals the multifaceted nature of User engagement in language learning apps, emphasizing its significance in developing language proficiency and facilitating effective learning experiences.

User engagement centers on active participation and interaction with language learning content. Learners who actively use application features (e.g., completing exercises, participating in quizzes, and interacting with multimedia content) are more likely to achieve positive learning outcomes. This is in line with the principles of effective language pedagogy, which emphasize the importance of learner engagement, motivation and autonomy in the language learning process. By immersing themselves in meaningful language learning activities, learners can consolidate language skills, expand their vocabulary and improve their communicative competence.

In addition, sustained use over a long period of time is a key factor in driving User engagement and language learning success. Learners who consistently engage with language learning apps over a long period of time demonstrate higher levels of language proficiency compared to sporadic users. This highlights the importance of fostering the habit of regular practice and engagement among language learners, as language learning is a gradual and cumulative process that requires continuous effort and dedication.

The design of language learning applications plays a pivotal role in shaping User engagement and facilitating an effective learning experience. Educators and developers should prioritize the creation

of interactive, gamified, and personalized learning experiences that meet the diverse needs and preferences of language learners. Gamification elements such as badges, rewards, and progress tracking can motivate learners to engage with app content and push them to achieve language learning goals. Personalization features such as adaptive learning algorithms and content recommendations ensure that learners receive a tailored learning experience that caters to their individual learning styles, preferences, and levels.

In addition, fostering a sense of community and social interaction in language learning apps can increase User engagement and promote a collaborative learning experience. Peer-to-peer interactivity, language exchange forums, and virtual language clubs can provide learners with opportunities to practice language skills in authentic communicative contexts, receive feedback from peers, and engage in meaningful cultural exchanges. By creating a supportive and immersive learning environment, language learning apps can foster learners' sense of belonging and motivation, ultimately improving their language proficiency and fluency.

In conclusion, our study emphasizes the critical role of User engagement in driving Language outcomes in digital language learning environments. By fostering active user participation, consistent use, and a sense of community, language learning apps can help learners effectively achieve their language learning goals. Educators, developers, and policymakers should collaborate to design and implement innovative strategies that prioritize User engagement and promote inclusive, effective, and engaging language learning experiences for learners worldwide. By working together and investing in technology-enhanced language learning solutions, we can harness the transformative power of User engagement to unleash the full potential of language learners and promote global language and cultural exchange.

The mediating role of feedback interactivity:

Our study introduces a new perspective that delves into the mediating role of feedback interactivity in the complex relationship between mobile app use and Language outcomes. While previous research has recognized the positive impact of mobile technology on language proficiency, our investigation sheds light on the mechanisms through which this impact occurs.

Our study finds that feedback interactivity is a key mediator in bridging the gap between mobile app use and language proficiency. This finding emphasizes the importance of dynamic feedback mechanisms (e.g., corrective feedback, scaffolding, and performance monitoring) in facilitating an effective language learning experience. By providing timely and personalized feedback, language learning apps can tailor the learning process to learners' individual needs, thereby increasing learner engagement, motivation, and skill development.

For example, corrective feedback plays a crucial role in guiding learners to use language accurately by correcting errors and instructing how to improve. Through feedback interactivity

exercises and quizzes, learners can get instant feedback on their performance so that they can identify areas for improvement and make necessary adjustments in real time. This iterative process of feedback and improvement not only improves learners' linguistic accuracy, but also increases their self-confidence and self-efficacy.

In addition, scaffolding is another key aspect of feedback interactivity that helps learners improve their language skills over time by providing the necessary support and guidance. Language learning apps can scaffold learners' understanding through step-by-step explanations, contextual clues, and the gradual complexity of tasks and activities. By scaffolding the learning process, apps empower learners to confidently tackle increasingly challenging language tasks, progressively expanding their linguistic knowledge and improving their language proficiency.

In addition, feedback interactivity includes achievement monitoring, enabling learners to track their progress, set goals, and monitor their achievements over time. Progress tracking features such as skill assessments, progress bars, and achievement badges motivate learners to stay engaged and committed to their language learning goals. By visualizing their progress and celebrating their achievements, learners feel a sense of accomplishment and are motivated to continue their language learning journey.

In conclusion, our study emphasizes the mediating role of feedback interactivity between mobile app use and Language outcomes. By providing learners with effective feedback mechanisms, language learning apps can increase learner engagement, motivation, and skill development, ultimately improving language proficiency. As developers continue to innovate and refine feedback strategies in language learning apps, the potential for using feedback interactivity to optimize the language learning experience remains promising.

Conclusion

The results of this study highlight the transformative potential of mobile technology in language education. By investigating the relationship between mobile app use, User engagement, feedback interactivity and Language outcomes, we provide valuable insights into how mobile technology can be utilized to enhance the language learning experience.

Our findings show that mobile app use has a positive impact on language proficiency, which highlights the effectiveness of mobile technology as a language learning tool. In addition, User engagement was a key factor, with active participation in language learning apps positively correlating with language proficiency. This emphasizes the importance of designing engaging and interactive learning experiences to maximize learner engagement and motivation.

Furthermore, our study elucidates the mediating role of feedback interactivity between mobile app use and Language outcomes. It was found that effective feedback mechanisms embedded in

language learning apps can partially explain the impact of mobile app use on language proficiency. This highlights the importance of providing learners with timely, relevant and personalized feedback to optimize their language learning experience.

Direct and indirect effects analyses indicated that while mobile app use had a significant direct effect on language proficiency, feedback interactivity played a substantial mediating role. This dual pathway suggests that feedback mechanisms in language learning apps contribute significantly to the overall impact of mobile technology on Language outcomes.

In summary, our study contributes to the growing body of research in mobile-assisted language learning by elucidating the mechanisms by which mobile technologies influence Language outcomes. Using these insights, educators, developers, and policymakers can design and implement innovative language learning interventions that utilize the power of mobile technology to create immersive, engaging, and effective language learning experiences for learners worldwide. Ultimately, by adopting mobile technology in language education, we can build language proficiency, promote cultural exchange and global communication in an increasingly interconnected world.

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