



Impact of a Mobile Application to Improve the Reading and Writing Skills of Immigrant Students in Primary Education

Impacto de una aplicación móvil para mejorar la competencia lectoescritora del estudiante migrante en la etapa de Educación Primaria

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ABSTRACT

This work addresses the impact of a mobile application designed to improve the literacy skills of migrant students in Primary Education in Spain. Since the 1990s, Spain has experienced a significant increase in migrants, leading to an educational environment characterized by cultural and linguistic diversity. Literacy, defined not only as the ability to read and write but also as a crucial skill for social and professional integration, becomes a key focus of study (Toledo-Vega et al., 2022). The research adopted a quasi-experimental design with control and experimental groups, selecting 44 students aged 6 to 7 years through convenience sampling, who were randomly assigned to the groups. The Diagnostic Scale for Assessing Literacy Competence (EDECL) from the Junta de Andalucía was used as the data collection instrument. Participants were evaluated using pre-tests and post-tests to measure the impact of the intervention. The results of the statistical analysis showed that the experimental group, which used the mobile application AppRende, demonstrated significant improvements in their literacy competence, increasing their average from 6.33 to 8.75, with a p -value $< .001$. In contrast, the control group, which used printed materials, showed no significant improvements. These findings indicate that the use of technological tools may be more effective than traditional methods in teaching literacy to migrant students, suggesting the need to incorporate mobile technologies in diverse educational contexts to support their integration and academic success.

KEYWORDS Mobile application; literacy competence; migrant students; technologies; Primary Education.

RESUMEN

Este trabajo aborda el impacto de una aplicación móvil diseñada para mejorar las competencias de alfabetización de los estudiantes migrantes en la Educación Primaria en España. Desde la década de 1990, España ha experimentado un incremento significativo de migrantes, lo que ha generado un entorno educativo caracterizado por la diversidad cultural y lingüística. La alfabetización, definida no solo como la capacidad de leer y escribir, sino también como una habilidad crucial para la integración social y profesional, se convierte en un foco esencial de estudio (Toledo-Vega et al., 2022). La investigación adoptó un diseño cuasi-experimental con grupos de control y experimental, seleccionando a 44 estudiantes de entre 6 y 7 años mediante un muestreo por conveniencia, quienes fueron asignados aleatoriamente a los grupos. Se utilizó la Escala Diagnóstica para Evaluar la Competencia en Alfabetización (EDECL) de la Junta de Andalucía como instrumento de recolección de datos. Los participantes fueron evaluados mediante pre-test y post-test para medir el impacto de la intervención. Los resultados del análisis estadístico mostraron que el grupo experimental, que utilizó la aplicación móvil AppRende, presentó mejoras significativas en su competencia en alfabetización, aumentando su media de 6.33 a 8.75, con un valor de $p < .001$. En contraste, el grupo de control, que utilizó materiales impresos, no mostró mejoras significativas. Estos hallazgos indican que el uso de herramientas tecnológicas puede ser más efectivo que los métodos tradicionales en la enseñanza de la alfabetización a estudiantes migrantes, sugiriendo la necesidad de incorporar tecnologías móviles en contextos educativos diversos para apoyar su integración y éxito académico.

PALABRAS CLAVE Aplicación móvil; competencia lectoescritora; estudiantes migrantes; tecnologías; Educación Primaria.

1. INTRODUCTION

Since the 1990s, Spain has received a significant influx of migrants from Latin America, other European Union countries, and North Africa (González-Monteaugudo & León-Sánchez, 2020). As a result, the current educational landscape is characterised by notable complexity due to cultural, linguistic, and migratory factors.

One of the key issues requiring attention is the literacy of the migrant population in Primary Education (PE) classrooms (Abad-Quintanal, 2022; Calvo, 2019). Literacy is a crucial component for social and professional integration, encompassing not only the ability to read and write but also skills that enable individuals to navigate daily life, facilitate access to information, and promote a love of reading and writing (Toledo-Vega et al., 2022).

Recent studies show that migrant students in the Primary Education stage tend to exhibit lower academic performance compared to their native peers (Escarbajal et al., 2019; Rodríguez et al., 2020; Tajic & Bunar, 2023). Additionally, they experience difficulties in translating and interpreting written texts, suffer from anxiety and confusion in the school environment (Ceballos-Vacas & Trujillo-González, 2021; El Jouhri et al., 2022), and have higher rates of failure and early school dropout (Bayón-Calvo, 2019). The exclusion of these students from school environments and their low participation in extracurricular activities highlight the lack of adequate integration mechanisms. The social inclusion of these students is directly linked to their cultural proximity and language proficiency. Furthermore, it is important to emphasize that a lack of linguistic competence can lead to absenteeism, insufficient information, and conflicts within the educational environment (Abad-Quintanal, 2022).

Regarding methods for teaching literacy to migrant pupils, classic authors such as Ferreiro and Teberosky (1979) advocate for a combination of synthetic and analytic approaches, which allows teaching to be tailored to the diverse needs of students, based on up-to-date literature and proven methods. Moreover, studies like those by Calvo (2019) emphasise the importance of creating shared reading spaces that foster a written culture in welcoming environments, while El Jouhri et al. (2022) demonstrate that the presence of trained staff reduces anxiety levels among migrant students.

In this context, mobile technology, including mobile learning tools, stands out as a significant resource for promoting digital inclusion and facilitating access to literacy education (Rosell-Aguilar, 2017).

The purpose of this study is to evaluate a custom-designed mobile application aimed at improving the literacy skills of migrant students in the Primary Education stage. The importance of this research lies in identifying new learning opportunities through the use of mobile technology, which allows for personalised tracking of student progress. The application incorporates various virtual worlds, each focused on a specific dimension of literacy competence, as measured in the pre-test and post-test. These dimensions include reading comprehension, written production, vocabulary, and reading fluency, allowing for a comprehensive and individualized assessment of each student's progress. This study aims to provide empirical evidence on the usefulness of mobile technology as an educational intervention tool.

2. LITERATURE REVIEW

2.1. Definition of mobile learning

Mobile learning, or m-learning, has been defined as the use of mobile devices to generate knowledge and develop skills in a flexible and effective manner (Rosell-Aguilar, 2017). This approach enables students to engage in learning activities that adapt to their pace and lifestyle, promoting greater autonomy in the process of acquiring competencies.

The UNESCO report (2022) highlights the importance of mobile learning in the global educational context, particularly in areas with low connectivity or limited resources. In this regard, mobile devices serve as facilitators of information access, supporting the continuation of learning beyond the classroom and the educational inclusion of students with specific needs, such as migrant students. Furthermore, Bai (2019) argues that mobile learning allows migrant students to interact with peers and educational content at their own pace, providing them with an opportunity for integration into both the educational and social environment.

2.2. Use of mobile applications in education

The use of mobile applications has been widely researched in the educational field in recent years, with numerous studies highlighting their ability to promote ubiquitous, personalized, and autonomous learning. These tools allow students to access educational resources anytime and anywhere, facilitating learning activities without temporal or spatial constraints (Rosell-Aguilar, 2017). This approach not only increases educational opportunities but also promotes digital inclusion for groups facing barriers to formal education.

Various studies have demonstrated the positive impact of mobile applications on the development of literacy skills. For example, Jim  nez-Garc  a and Mart  nez-Ortega (2017) analyzed the use of “Legendi,” a mobile app designed to teach literacy to illiterate individuals using Android tablets. The results indicated that this application not only facilitated the teaching-learning process but was also effective and user-friendly, significantly improving reading and writing skills.

More recently, research by M    ez-Carvajal and Cervera-M  rida (2022) focused on mobile applications designed for children with specific difficulties in acquiring reading and writing skills. Their findings confirmed that the use of technology-based mobile tools can enhance these competencies. Additionally, Fern  ndez-Batanero et al. (2022) emphasized the value of interactive resources such as e-books and digital games, which not only improve reading and writing skills but also foster a playful and motivating learning experience, granting greater autonomy to students.

The potential of mobile applications is not limited to cognitive development but also contributes to creating more inclusive learning environments. According to Criollo et al. (2021) and Hinojo-Lucena et al. (2020), these tools enable the personalization of educational experiences, adapting to the specific needs of each student, which is particularly crucial in multicultural contexts where linguistic and cultural diversity must be considered.

These tools have also proven effective in developing literacy skills among students with hearing impairments (Mart  nez-Acosta et al., 2022) and migrant students learning Spanish as a second language (C  ceres-Reche et al., 2024). Other studies, such as those by Hern  ndez-Campos et al. (2020) and Garc  a-Rodr  guez and G  mez-D  az (2016), have shown how mobile applications can facilitate literacy learning in students studying Spanish as a foreign language, highlighting their potential to improve academic performance and school integration.

In another study, Hautala et al. (2020) analyzed reading difficulties among first- to fourth-grade primary students using a tablet-based computerized system. When comparing the benefits of this approach to traditional paper-and-pencil assessments, the results showed that using interactive games was effective in identifying students with reading difficulties, particularly in terms of fluency, and to a lesser extent, accuracy. Furthermore, this system supported the gradual development of reading skills across several educational levels.

While the use of mobile technologies is crucial for improving literacy skills among migrant students, it is also essential to address teacher training in interculturality and linguistic sensitivity. These factors not only improve social inclusion but also enrich the educational environment overall (Biasutti et al., 2021). Literacy, as noted by Acedo-Tapia and Maqueda-Berrocal (2022), encompasses not only reading and writing skills but also critical and reflective communication competencies that allow students to develop holistically in their social and professional environments.

However, despite the growing interest in mobile technology for education, further research is needed to explore how these tools can be applied effectively in multicultural and multilingual contexts. In this regard, the Horizon Report (EDUCASE, 2022) highlights the expansion of these technologies in the coming years as crucial tools for improving literacy competence in diverse educational settings.

Despite existing research on appropriate teaching methodologies, there remains a gap in educational interventions specifically addressing the needs of migrant students in the early stages of Primary Education, and the effectiveness of such interventions is still under question.

Based on these considerations, the purpose of this work is to determine the impact of a custom-designed mobile application aimed at improving the literacy skills of migrant students in the Primary Education stage. To this end, the following hypotheses were proposed:

H1: There are significant differences in literacy skills between student groups based on gender and age.

H2: Students who engage in literacy activities through a mobile application achieve significantly greater literacy skills compared to the control group.

3. METHODOLOGY

A quasi-experimental design with control and experimental groups and pre-test and post-test measures was adopted. The sample selection procedure was by convenience. However, the assignment of the treatment to the student groups was carried out randomly.

3.1. Participants

The composition of the groups included a total of 44 students aged between 6 and 7 years. The control group consisted of 20 students (60% boys and 40% girls), while the experimental group comprised 24 students (66.6% boys and 33.4% girls). In this study, as noted by Chou and Feng (2019), it is important to highlight that sample size was not an influencing factor when making comparisons within a single population of students.

The participants were migrant students from primary schools in the northern area of Granada. The sample selection was based on convenience and accessibility, according to a series of criteria: (i) first-year Primary Education students who are learning to read and write; (ii) students with migrant status, whose mother tongue is not Spanish.

The invitation to participate in the study was made personally and conducted outside of school hours. All procedures performed adhered to the ethical standards of the institutional research committee and the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Accordingly, the legal guardians of the underage students were informed of the research purpose, the anonymous treatment of their data, and they gave their informed consent before participating in the study. Additionally, the research received approval from the Ethics Committee of the University of Granada (registration number: 3493/CEIH/2023).

Finally, the age and gender of the students were identified, and a diagnostic scale was used to assess their literacy skills. The sample consisted of 28 boys and 16 girls, aged between 6 and 7 years ($M = 6.36$; $SD = .48$).

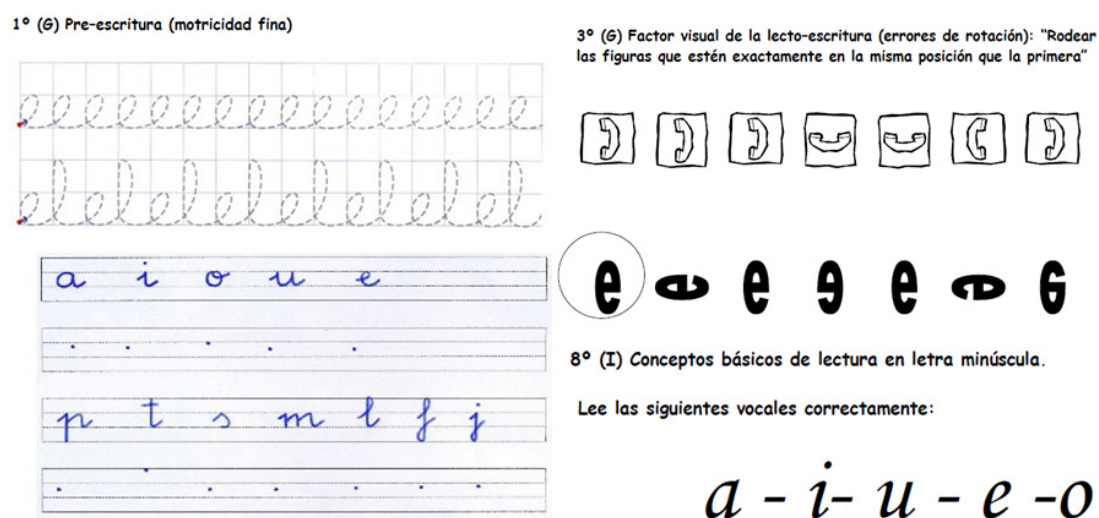
The pre-test was administered on 23 May 2023, while the post-test was administered on 7 June 2023.

3.2. Instrument

The Diagnostic Scale for Assessing Literacy Competence (EDECL) of the Junta de Andaluc  a (2011) was used. The EDECL was developed considering the concepts of Basic Competences established in the educational regulations of the Autonomous Community of Andalusia (LEA, Ley de Educaci  n de Andaluc  a).

This instrument measures literacy competence through eight items with various reading and writing comprehension tests. Each item is linked to a specific factor: 1. Pre-writing (fine motor skills); 2. Identifying and writing their names in uppercase letters; 3. Visual factor of literacy (rotation errors); 4. Lateralised Body Schema (in graphic space); 5. Visual Recognition Memory; 6. Auditory Memory; 7. Basic concepts of writing in lowercase letters; 8. Basic concepts of reading in lowercase letters (Figure 1).

FIGURE 1. Examples of items



Regarding the scores, the questionnaire uses a scale from 0 to 10, where 10 represents the highest score in literacy competence. Each item has its specific method of correction; the following are the specific rules for the application and correction of the literacy test:

- **Item 1.** Pre-writing (Maximum 1 point): 1 point if the tracing is perfect; 0 points if the tracing is not perfect.
- **Item 2.** Identification and writing of their name in uppercase (Maximum 1 point): 1 point if they write their name correctly and with all letters; 0 points if letters are missing.
- **Item 3.** Visual factor of literacy (Maximum 1 point): 1 point if all figures are correct; 0.5 points if 2 figures are correct; 0 points if all figures are circled.
- **Item 4.** Lateralised body schema in graphic space (Maximum 1 point): 1 point if both sequences are correct; 0 points if 1 or both sequences are incorrect.
- **Item 5.** Visual recognition memory (Maximum 1 point): 1 point if 3 or 4 drawings are correctly circled; 0.5 points if 1 or 2 drawings are correctly circled; 0 points if all drawings are circled.

- **Item 6.** Auditory memory (Maximum 1 point): 1 point if all 3 series are correct; 0 points if not all series are correct.
- **Item 7.** Basic concepts of writing. Dictation of vowels (Maximum 2 points): 2 points if all vowels are correct; 1 point if there is 1 mistake; 0 points if there is more than 1 mistake.
- **Item 8.** Basic concepts of reading. Identifying vowels (Maximum 2 points): 2 points if all vowels are read correctly; 0 points if not all vowels are read correctly.

In addition to being a widely accepted and reliable instrument utilized in research by the Junta de Andaluc  a, the scale demonstrated strong internal consistency in this study. The reliability analysis, conducted using Cronbach's alpha, indicated satisfactory values. Specifically, the pre-test yielded a reliability coefficient of $\alpha = .78$, while the post-test showed an even higher reliability of $\alpha = .85$. These values suggest that the scale provides a robust measure of literacy competence, ensuring consistency in the responses across both testing phases. Such reliability supports the validity of the instrument in evaluating literacy skills in young migrant students and reinforces its utility for future research in similar educational contexts.

3.3. Procedure and materials

In the experimental group, composed of twenty-four students, one teacher was assigned to twelve students, while the other teacher managed the remaining students, forming groups for the corresponding intervention. The experimental group implemented a digital intervention program to enhance reading and writing skills. The program spanned approximately 12 hours, distributed over eight sessions of 1.5 hours each within two weeks. The methodological approach was active and participative, utilising a mobile application called AppRende (Figure 2). This specific application was chosen for its customised design and development for the study, aimed at exploring and evaluating its impact in a specific and detailed manner. Each student had a personal tablet equipped with the pre-installed application; the device used was a Samsung Galaxy Tab A (2019) with the Android 10 operating system. The download link for the application is available upon request.

FIGURE 2. Student in the intervention phase



The designed and tested application aims to foster the comprehensive development of literacy through a playful and educational structure, based on five thematic worlds, each with a specific focus but all oriented towards the foundations of writing and reading (Hinojo-Lucena et al., 2023).

- **First world:** recognition of letters and basic literacy skills. In this world, students participate in activities such as solving word searches that contain vowels and consonants. These activities are designed to familiarise them with the alphabet and help develop fundamental reading and writing skills.
- **Second world:** image and word association. Here, students associate images of animals with the corresponding words. This activity promotes the relationship between images and written words, facilitating vocabulary learning and word comprehension in context.
- **Third world:** sound recognition. Students listen to audio clips and select the word corresponding to the heard sound. This approach helps develop the ability to recognise sounds and associate them with written words, thereby improving auditory and phonological comprehension.
- **Fourth world:** writing skills. This world focuses on writing. Students complete words with missing syllables and practice writing full words. These activities are designed to improve spelling, word formation, and writing accuracy.
- **Fifth world:** reading skills development. Centred on reading, this world offers students various reading activities tailored to their level. These activities aim to enhance fluency, comprehension, and reading speed, providing a solid foundation for the development of more advanced literacy skills.

A key aspect of AppRende is the use of gamification as an educational strategy. This is implemented through challenges that require successfully completing one level to advance to the next. For this reason, the worlds are initially locked with padlocks, motivating students to meet prior objectives to unlock them (Figure 3).

Additionally, upon completing each activity, users receive a score that reflects their performance, allowing both students and teachers to assess individual progress based on points earned from completing tasks and achieving goals.

With this interactive and game-based structure, the application was implemented as an educational intervention with the purpose of evaluating its effectiveness in developing and improving literacy skills.

FIGURE 3. Apprende interface



Conversely, in the control group, participants were assigned to work on the same content as the experimental group, but using printed materials instead of the mobile application.

Regarding the teacher's role, two teachers managed the entire process and the intervention. The teachers' role during the intervention was to provide assistance when needed, handle technical issues with the tablet, and guide the content. Additionally, they reviewed the scores obtained since the application provided a score at the end of each activity and each world, except for the writing and reading activities in worlds two and three, where the teachers had to review and assess the correctness of the written words and the accuracy of reading each sentence.

The application is in a restricted access state, requiring communication with the main authors for authorisation to use it. Below are images of the application for illustration purposes (Figure 4).

FIGURE 4. Example of activities



3.4. Data analysis

In the data analysis, normality in the distribution of scores was calculated using the Kolmogorov-Smirnov test with Lilliefors significance correction. Subsequently, descriptive statistical values of means and standard deviations, Mann-Whitney U, p-value, and Cohen's d were calculated to test the hypothesis 1. For hypothesis 2, the decision was made to use the non-parametric Mann-Whitney U test (intergroup) and Wilcoxon signed-rank test (intragroup). The data analysis was conducted using SPSS statistical software v.25.

4. RESULTS

The Kolmogorov-Smirnov normality test with Lilliefors significance correction confirmed that the data did not follow a normal distribution, as the p-value was below .05 for both the pretest (K-S = .170; df = 43; p = .003) and the posttest (K-S = .232; df = 43; p = .000).

The results from the comparisons between student groups based on sex and age in the pretest phase (Table 1) and posttest phase (Table 2) showed no significant differences according to sex and age. Thus, hypothesis 1 was rejected. However, the highest means in the pretest were for the group of girls and seven-year-olds. In the posttest, the highest mean was for the group of boys and seven-year-olds.

TABLE 1. Differences between groups based on sex and age variables in the pretest measure

Data	n	M	DT	<i>u</i>	<i>p</i>	<i>d</i>
Sex						
Boy	28	6.42	1.83	216.0	.843	-.18
Girl	16	6.75	1.73			
Age						
6	28	6.28	1.86	176.0	.234	-.41
7	16	7	1.59			

TABLE 2. Differences between groups based on sex and age variables in the posttest measure

Socio-demographic data	n	M	DT	<i>u</i>	<i>p</i>	<i>d</i>
Sex						
Boy	28	8	1.12	208.0	.691	.31
Girl	16	7.5	1.93			
Age						
6	28	7.71	1.82	224.0	1	-.22
7	16	8	.36			

Regarding the intragroup comparisons (Table 3), the control group obtained a lower mean in the posttest compared to the pretest (.10), with no significant differences between the two measurement points (Z = -.872; p = .383). In contrast, the experimental group improved by more than two points compared to the pretest, showing statistically significant differences (Z = -4.327; p = .000).

TABLE 3. Intragroup comparisons on literacy competence

Group	n	M	DT	z	p	d
Control						
Pretest	20	6.80	1.96	-.872	.383	.05
Posttest	20	6.70	1.32			
Experimental						
Pretest	24	6.33	1.63	-4.327	.000	-1.90
Posttest	24	8.75	.76			

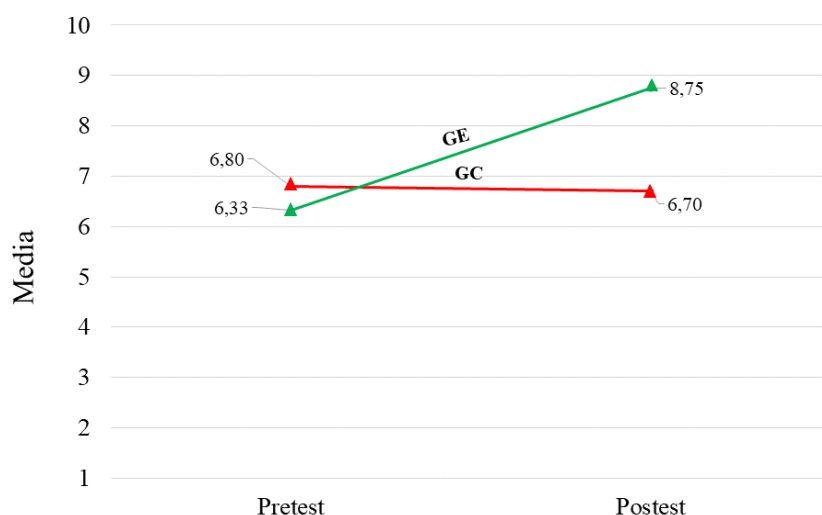
TABLE 4. Intergroup comparisons on literacy competence

Measure	n	M	DT	<i>u</i>	<i>p</i>	<i>d</i>
Pretest						
CG	20	6.80	1.96	184.0	.180	.26
EG	24	6.33	1.63			
Posttest						
CG	20	6.70	1.32	16,0	.000	-1.90
EG	24	8.75	.76			

Furthermore, the comparison between the control group (CG) and the experimental group (EG) in the pretest and posttest measures (Table 4) indicated no significant differences in the pretest measure between the groups (p = .180). Thus, both groups started from a similar baseline, although the mean of the EG was lower. However, in the posttest measure, the EG obtained a higher mean than the CG, specifically by more than two points, showing significant differences between them (p = .000).

Finally, the average scores obtained in the posttest measure were higher than in the pretest measure for the EG compared to the CG (Figure 5). This establishes an improvement in literacy competence after completing the AppRende programme for migrant students.

FIGURE 5. Comparison of literacy competence levels between pretest and posttest measurements after the AppRende programme



5. DISCUSSION AND CONCLUSIONS

This study focused on evaluating the impact of a mobile application aimed at leveraging the advantages of technology to enhance the teaching and learning of literacy skills among migrant students. Mobile applications offer multiple advantages over traditional learning approaches, including the possibility to personalise learning, adapt to the individual needs of students, provide immediate feedback, and foster motivation and engagement. In this context, mobile applications have been shown to promote greater autonomy and adaptability, especially in multicultural settings where linguistic and cultural diversity play a critical role in students' integration (Criollo et al., 2021; Rosell-Aguilar, 2017). This combination of flexibility and adaptability makes mobile apps particularly effective tools in diverse and multicultural educational settings. Furthermore, the use of mobile devices is widely accepted and utilised by students, making mobile applications an accessible and familiar tool for their learning.

Consequently, the findings of this research reveal that the use of a mobile application, which addresses both reading and writing, had a positive impact on improving literacy skills in migrant students in Primary Education. It was observed that the experimental group (EG) showed a significant improvement in literacy competence after participating in the AppRende programme compared to the control group. In the pretest measure, the experimental group achieved an average of 6.33, while in the posttest measure, the average increased to 8.75. This difference of more than two points was statistically significant ($p < .001$) and resulted in a substantial improvement in the literacy competence of the migrant students. This is consistent

with findings from previous studies on mobile literacy interventions, such as those of Jim  nez-Garc  a and Mart  nez-Ortega (2017), who also observed significant improvements in literacy skills through mobile-based instruction.

This evidence highlights the importance of incorporating mobile technology to address the specific literacy needs of migrant students, who often face challenges such as language barriers and cultural adaptation (Abad-Quintanal, 2022).

On the other hand, when comparing the control group (CG) and the experimental group in the posttest measure, it was found that the experimental group obtained a higher average than the control group. The average of the control group in the posttest measure was 6.70, while that of the experimental group was 8.75, showing a significant difference between both groups ($p < .001$). This result confirms that mobile learning tools are not only effective but offer distinct advantages over traditional methods of literacy instruction, as shown by earlier studies (Calvo, 2019; Fern  ndez-Batanero et al., 2022). Similarly, Forn   et al. (2022) concur in their findings, observing notable progress in the reading skills of the group of children who participated in the phonological training programme. This comparison aligns with our results, reinforcing the value of targeted literacy interventions.

The statistical methods used—specifically, the pre-test-post-test control group design—provided a reliable framework for assessing the impact of the intervention. This allowed for clear comparisons between groups and reinforced the validity of the study’s conclusions. The significant differences found between the experimental and control groups align with similar research supporting the effectiveness of mobile applications in literacy education (M    ez-Carvajal & Cervera-M  rida, 2022).

It is important to consider the role of cultural and linguistic factors in literacy acquisition, as noted by authors like Bai (2019) and Gonz  lez-Montea  udo and Le  n-S  nchez (2020). Proficiency in the host country’s language plays a critical role in the social inclusion of migrant students, and tools like the AppRende programme help bridge this gap by offering accessible literacy support tailored to their needs. While it has been observed that migrant students often exhibit lower academic performance (Abad-Quintanal, 2022), this study demonstrates that mobile applications can be effective interventions for reversing this trend. This finding is in line with previous studies, such as those by Tajic and Bunar (2023), which emphasize the necessity of addressing literacy as a core component of migrant student integration.

Moreover, these students experience higher levels of anxiety and confusion in the school environment (El Jouhri et al., 2022), and the introduction of technology-based literacy interventions has also been shown to reduce anxiety by providing a more engaging and student-centred learning experience. By reducing anxiety and providing more tailored literacy support, mobile learning tools can help lower the dropout rates among migrant students, which remains a critical issue, as highlighted by Ceballos-Vacas and Trujillo-Gonz  lez (2021).

The interpretation of these findings highlights the importance of effectively addressing the literacy of the migrant population in Primary Education. It is essential to emphasise the need for further research to strengthen the link between literacy interventions and their long-term effects on academic performance and social integration. Educational policies must increasingly focus on creating inclusive environments

where mobile technologies are integrated into curricula, providing a seamless and supportive framework for migrant learners (UNESCO, 2022).

Teacher training in interculturality and the pedagogical use of digital tools is also a crucial factor in maximizing the benefits of mobile literacy applications (Biasutti et al., 2021). These actions will contribute to their academic success and integration into the educational environment. By fostering a more inclusive approach to education, educators can ensure that migrant students are better prepared to thrive both academically and socially.

Ultimately, comprehensive literacy development is not merely an academic achievement but a means of fostering social inclusion and effective participation in broader societal contexts (Acedo-Tapia & Maqueda-Berrocal, 2022). In the context of migrant students, literacy competence becomes even more relevant. These students often face additional challenges, such as learning a new language and adapting to a new culture. The acquisition of the host language is essential for their academic success and integration into society. Thus, literacy education serves as a bridge for migrant students, enabling them to fully engage with both the academic content and their peers.

Thus, the study's objective was achieved by providing empirical evidence on the effectiveness of this technological tool, determining whether it had a positive impact on improving the literacy competence of migrant students compared to a control group, supporting the proposed hypothesis. The results indicate that mobile applications are not only effective tools for literacy development but also offer scalable and adaptable solutions that can be implemented across different educational settings to meet the needs of diverse student populations.

5.1. Limitations and future lines of research

Regarding the limitations, the sample used in the study was small, which may restrict the generalisation of the results to a broader population. The lack of diversity in terms of ethnic origin and cultural backgrounds can also influence the applicability of the findings. On the other hand, although a quasi-experimental design with a control and experimental group was used, this type of design does not allow for definitive causal relationships to be established. There may be other uncontrolled factors that could influence the observed results.

Finally, as practical implications and future lines of research: (i) the results support the effectiveness of using mobile applications specifically designed to support the literacy skills of migrant students. This implies that educational app developers can focus on creating technological tools that adapt to the linguistic and educational needs of this population; (ii) the use of mobile applications can provide additional and specific support to migrant students in their literacy learning. These applications can adapt to different levels of linguistic competence and offer interactive and personalised activities to help students improve their skills effectively; (iii) conducting comparative studies that compare the effectiveness of the mobile application with other interventions designed to support the linguistic development of migrant students. This could include traditional paper-based interventions, individualised tutoring programmes, or other technological tools; (iv) although the study shows that the designed mobile application was effective, additional research

can be conducted to improve and optimise the application. This could include incorporating additional features, adapting to different languages and levels of linguistic competence, and personalisation to meet the individual needs of migrant students; (v) to better understand the long-term impact of the mobile application on the linguistic development of migrant students, research can be developed that conducts long-term follow-ups of the participants. This would allow for the evaluation of whether the observed improvements are maintained over time and if they have a lasting effect on the students' literacy skills.

In summary, this work provides a solid foundation for implementing mobile applications and appropriate pedagogical strategies that support the linguistic learning and development of migrant students in the context of Primary Education. These implications can guide educators, app developers, and educational policymakers in creating and promoting inclusive and effective learning environments for migrant students.

6. FUNDING

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