Strengthening Mathematical Learning in Children under 8 Years of Age in Peru: Development of a Specialized Mobile Application

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Abstract - **The present research work deals with the design of a mobile application to strengthen the learning of mathematics in children under 8 years of age. For the development a RUP methodology was used, in each stage the procedure that was used for the design of the mobile application was specifically detailed. Likewise, a survey was developed to 10 people among teachers and parents where it was sought to know if they were willing to use an application so that their children or students can learn mathematics having satisfactory results for research. It is concluded that the use of technologies in the educational area is beneficial since students are more attracted to technological devices. As future work, it is recommended to continue researching and implementing new technologies for student learning.**

Index Terms - **RUP methodology, Mobile application, survey, technology, learning.**

INTRODUCTION

Mathematics is fundamental in the development of children, since it helps them to be logical, to reason orderly and to have a mind prepared for thought.

Math helps develop fundamental cognitive skills in children, such as logical reasoning, problem solving, attention, and memory. By interacting with math concepts, children exercise their analytical thinking and strengthen their ability to process information in a structured way. Also, math in each child can have different ways of learning that is why it is important to find the cause, so you can help improve [1].

It is known that mathematics in all educational sections is one of the important courses as it covers one of the 2 main courses. Dyslexia refers to the difficulty that some children have to arrive with the fluency and precision that corresponds to their course and age. [2].

Technology can be a very useful tool to help children learn math through mobile apps. Mobile apps can offer interactive activities that engage children more dynamically.

Interactive exercises, games, and challenges can make learning math more entertaining and engaging for children. Also, the applications can be adapted to the needs and skill level of each child. Some apps use algorithms to identify a student's strengths and weaknesses and provide activities that fit their level of learning. [3].

It is known that the applications can be adapted to the needs and skill level of each child. Some apps use algorithms to identify a student's strengths and weaknesses and provide activities that fit their level of learning. In this way, mobile apps can offer immediate feedback on the child's performance. This allows children to understand their mistakes and learn from them right away, making it easier to correct mistakes and reinforce positively. [4].

Importantly, while technology can be a valuable tool, it should not completely replace interaction with teachers and peers in a traditional educational setting. Technology can complement teaching and provide a richer learning experience when used in a balanced and responsible way[5].

The research work aims to design the prototype of a mobile application to improve math learning in children under 8 years of age.

The present work is structured as follows, in section number II the review of the literature, in section III the methodology used for the mobile application will be described, in section IV the results obtained are presented and finally in section V the conclusions.

LITERATURE REVIEW

The author [6], focuses that the use of educational mobile applications in classrooms has emerged as a promising tool to improve performance in mathematics. The objective of this work is to conduct a systematic review that focuses on

the benefits that these applications can provide in the acquisition of early mathematical competence. A thorough review of the literature published in national and international databases since January 2015 was carried out.

The data obtained were analyzed and the characteristics of these mobile applications were described. Initially, 1329 references were collected, but only 25 of these studies met the established inclusion criteria. Most of the evidence obtained indicates that the use of educational mobile applications in the classroom has had a positive impact, improving the performance and motivation of students in mathematics, as well as their attitudes towards learning in this area.

On the other hand, the author [7] focuses that a mobile application for the strengthening of logical-mathematical capacities could include a characteristic variety and activities designed to stimulate critical thinking, problem solving and the development of mathematical skills. The app could offer games and challenges that require users to use logical reasoning to solve problems and puzzles. These games could gradually increase in difficulty to maintain interest and challenge users to improve their skills.

In this way, the author [8] points out that, in current education, mobile technology has had a significant impact by offering innovative resources that support the teacher and allow achieving meaningful learning through new methodological strategies. The appropriate use of synchronous and asynchronous technologies improves pedagogical practice, digital competences and the professional profile of the educator, by adopting a new way of learning that is well received by students. The objective of this article is to analyze the use of mobile devices and their influence on mathematics learning. The results obtained through a bibliographic research reveal the thinking of the students, although some advantages and disadvantages in their application are also highlighted. Tactics and guidelines were identified that facilitate its optimal use.

METHODOLOGY

For the following research work, the RUP methodology was used, which will be detailed as follows.

a) BEGINNING

The main objective of the research is to design a mobile application so that children under 8 years old can learn mathematics through its use.

The scope that the design of a mobile application may have are the following.

1. *Early learning:* A well-designed mobile app can introduce basic math concepts in a playful and toddler-friendly way. This can lay a solid foundation for your future mathematical development.

2. *Cognitive stimulation:* The interactive and challenging activities of the app can stimulate logical thinking and problem-solving in children, helping them develop cognitive skills from an early age.

3. *Fun interaction:* The interactive and friendly design of the app can make math learning fun and entertaining for kids, which will increase their motivation and willingness to actively participate.

4. *Flexibility in learning:* Mobile apps allow children to learn math at their own pace and anytime, anywhere. This provides greater flexibility and comfort for the learning process [9].

b) ELABORATION

Figure 1 shows the system architecture of the mobile application design and how it would work. Users will have to enter the application from their cell phones and there they will have learning, practices and evaluations.
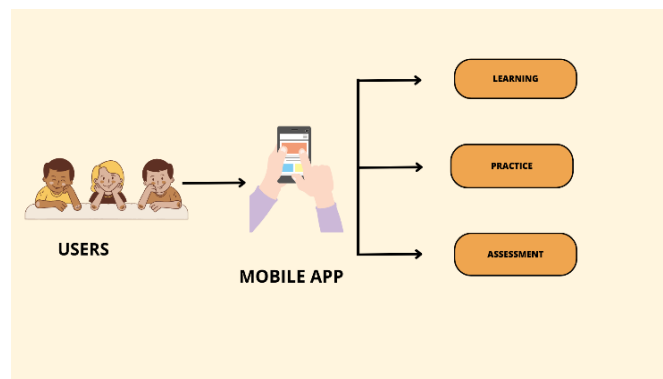

Fig. 1 Mobile Application Architecture

c) CONSTRUCTION

The application was designed so that children under 8 years old can use it easily, in figure 2 you can see what would be the home screen with the logo of the application.

Fig. 2 Home Screen

Also, in Figure 3, the two modules that the application will have, which are: sessions and evaluations. Each module has a different content, what is sought is that children learn easily and above all improve their learning.

In this way, Figure 4 shows the session module that has 3 buttons: addition, subtraction and multiplication, where the student can find activities that will increase in level as the student progresses.

Fig. 3 Modules

Fig. 4 Form module

Finally, Figure 5 shows the evaluation module where the student will have to take evaluations to demonstrate what they have learned.
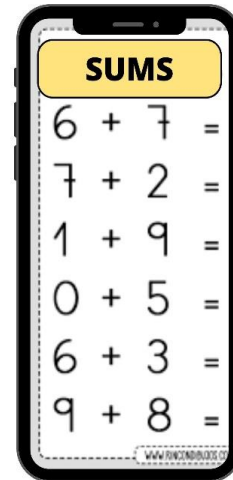

Fig . 5 Evaluations module

d) *TRANSITION*

To find out if teachers and parents would allow their children to use this application, a survey was conducted by 10 people where the questions were the following:

1) Do you think that a mobile application would help you learn mathematics? The following question was asked to know if they agree that the use of technologies could improve student learning, obtaining as an answer that 7 agreed while 3% said that maybe. Figure 6 shows the results.
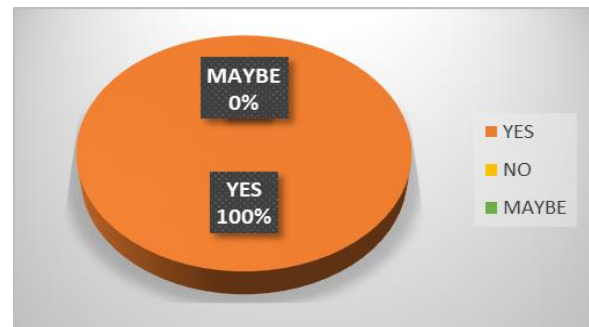

Fig . 6 Use of mobile applications

2) Would you let your child/student use a mobile app to learn math? This question was asked to know if parents and teachers would apply a technological methodology for children's learning, having as an answer that 100% agreed, in Figure 7 the results are shown.
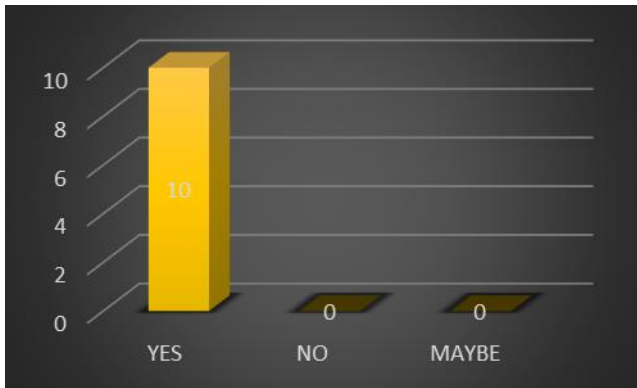
Fig. 7 Use of the mobile application

3) What will happen to the prototypes presented?. When asking this question, the respondents were presented with the prototypes designed obtaining a satisfactory answer in Figure 8 the results are observed.
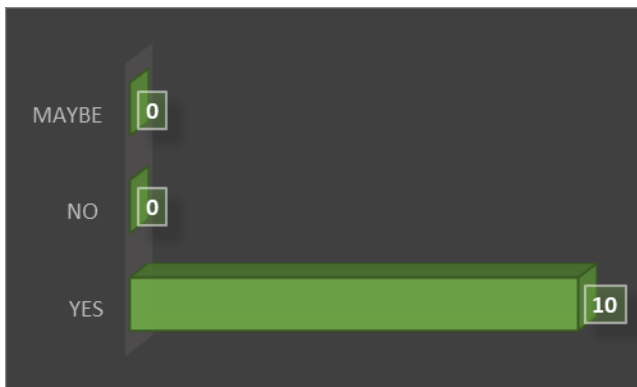

Fig. 8 Prototypes

DISCUSSION

The article [6], mentions that the use of educational mobile applications in classrooms is a promising tool to improve performance in mathematics. The aim of the research was to conduct a systematic review focused on the benefits that these applications can offer in the acquisition of early mathematical skills. To this end, we comprehensively reviewed the literature published in national and international databases since January 2015.

The results revealed that 1329 references were initially found, but only 25 of these studies met the established inclusion criteria. From the evidence collected, it was highlighted that the use of educational mobile applications in the classroom has had a positive impact on students' performance and motivation in mathematics, as well as their attitudes towards learning in this area.

This conclusion suggests that the use of educational mobile applications can be beneficial for the development of mathematical skills in students, which could lead to better academic performance and a greater willingness to learn mathematics.

However, it is important to note that although the results are encouraging, further research and evaluation of the use of these applications is needed to better understand their long-term effectiveness and how they can be optimally integrated into the educational process. In addition, it is relevant to consider that the successful implementation of these applications will depend on factors such as adequate design, teacher training and equitable access to technology in the classroom.

The author's approach [7] focuses on the design of a mobile application for the strengthening of logical-mathematical capacities, highlighting the importance of stimulating critical thinking, problem solving and the development of mathematical skills in users. The proposed application includes a variety of features and activities aimed at achieving these goals. Including games and challenges in the app is an attractive and effective strategy for encouraging logical reasoning and problem solving. By presenting problems and puzzles in the form of interactive games, a playful environment is created that motivates users to actively participate and face challenges in a fun way. Also, the fact that these games gradually increase in difficulty is a smart strategy to keep users interested as they improve their skills. The progression in difficulty also ensures that users are constantly challenged, which promotes continuous learning and progressive development of their mathematical skills.

The author [8] highlights the significant impact of mobile technology on education today by providing innovative resources that support teachers and enable meaningful learning through new methodological strategies. The appropriate use of synchronous and asynchronous technologies improves pedagogical practice, digital competences and the professional profile of the educator, by adopting a new way of learning that is well accepted by students. The aim of this article is to analyze the use of mobile devices and their influence on mathematics learning. The results obtained through bibliographic research reveal that the use of mobile technology in the classroom improves the thinking of students, although some advantages and disadvantages in its application are also highlighted.

The identification of tactics and guidelines that facilitate the optimal use of mobile devices in teaching is essential to maximize their effectiveness in the educational process. The article shows that mobile technology is a valuable tool to improve the quality of education and enrich the learning experience of students. However, it is important to continue researching and evaluating its implementation to ensure efficient and equitable use in the educational environment.

CONCLUSIONS

Developing a mobile application to teach mathematics to 8-year-olds is an extremely valuable and beneficial idea for their learning.

Lida Violeta Asencios-Trujillo, Lucia Asencios-Trujillo, Carlos Jacinto La-Rosa-Longobardi, Djamila Gallegos-Espinoza and Cristina Piñas-Livia

Through technology, it is possible to create an interactive and fun educational experience that motivates children to explore and understand math concepts in more meaningful ways.

Designing an app for this purpose should take into account several important aspects. First, it is crucial to adapt the content and presentation to be appropriate for children's age and level of understanding. The interface should be intuitive, colorful and attractive, using visual elements and friendly characters that generate interest and participation. An effective application should offer activities and exercises that address a variety of mathematical topics, from basic operations to more complex problem solving. In addition, the app can incorporate gamification elements, such as rewards and levels, to encourage motivation and constant progress. Constant feedback is essential for learning, so the app should provide constructive feedback and clear explanations when children face challenges or make mistakes. It is also important to consider inclusion and accessibility in the design of the app, making sure it is usable for children with different abilities and needs.

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