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Mobile Augmented Reality applied as a learning strategy for early childhood education students.

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Abstract
The purpose of this research is to determine the effect of the use of mobile augmented reality applied as a learning strategy for early childhood education students. The research is applied, pre-experimental and quantitative design. The population consisted of children in the initial grade of an educational institution in Peru. The sample consisted of 20 students of 5 years old as experimental and control group. As a result of the intervention, it was possible to improve learning through competencies in 80% of an expected level of achievement and 20% of an outstanding level of achievement, concluding that the use of mobile augmented reality improved learning in early education. The use of this technology is recommended as a pedagogical tool for the early education sector in Peru.

Keywords: Augmented reality, Mobile, learning, competences, strategies

1. Introduction

Nowadays, the vertiginous growth and use of information and communication technologies in the various countries of the world are generating a series of advantages compared to the last century of the last industrial resolution through steam engines with this new technological revolution that has been widely evidenced [1]. According to [2], the sustainable increase of digital technologies in industrialized and developing countries has had a profound impact on organized society as in the way people work, entertain themselves, learn and communicate, affecting the production of goods or services in the economies.

In Latin America and the Caribbean, according to [2] in its report entitled "Measuring the information society report", with respect to the percentage of households with Internet access, Uruguay is leading the percentage of access to a computer per household with 70% and Internet with 60%, Peru has 30% and 20% and the last country is Cuba with 10% and 8%, reaching the conclusion that in Latin American and Caribbean countries there is still much to be done in terms of access to information and communication technologies. According to [3] the use of technology in the education sector has been focused on how to take advantage of these tools in the classroom with a good predisposition in the past decades, which has led to the use of these tools to innovation and change the teaching paradigm, so today their use is rare.

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If we compare the use of technologies by teachers and students outside the classroom, the evidence is the incorporation of new strategies in digital skills to make proper use of them. The era of ICT has allowed the teaching-learning to take a turn in the didactic methodology, allowing society to adopt and couple technological tools in the educational system, resulting in the development of new knowledge for the teacher and for the student [4]. In the Peruvian environment, there is a problem with the ability to use technological infrastructure, which is connectivity, this situation limits education from taking advantage of mobile technologies, so otheralternative solutions are usedwithout giving the fundamental value of Internet access. Likewise, other factors that can contribute to the use of connectivity are the availability of electricity supply, this situation is due to the fact that there are some populations in rural areas that do not maintain a continuity of electricity and navigation speed [5].

Thus, in Peru, during 2015, 15% of the educational centers were connected and 85% of the educational centers with low student enrollment were located in rural areas. Therefore, a distribution of the quality of the connection in these aspects is given through a telephone system that contributes to the existence of a slow speed of Internet access [5].

Likewise, [6] inferred in their technical statistical report carried out in Peruvian households; it was found that 39.3% of the population uses the Internet through mobile devices, 10.3% only at home and 6.3% in public booths. In this way, mobile learning seeks to be used as a strategy in teaching and learning through the impact provided by ICT's, this allows us to make education more inclusive, accessible and egalitarian. Likewise, this learning seeks to seek and give rise to the use of smart phones as a teaching resource allowing traditional teaching to give way to a teaching of digital content, dynamic applications, online environments at any time and place. This situation allows mobile learning to be an axis to promote its implementation in remote areas or rural areas that in common or mostly are located in a scenario of poverty.

2. Literature review

The background support in the respective research is given by [7] , in his research he determined the effect of using Augmented Reality in science and technology competencies leading to a new digital culture for students and teachers in the service of education. Likewise, the design was quasi-experimental and the quantitative approach allowed to be applied on a population of 50 students. It was concluded that the effect of the use of the application on the competences of the TC course obtained a 16% achievement of the Control Group and 88% achievement of the Experimental Group. For [8], this work aims to determine the influence of AR as a pedagogical tool in the science and environment course, its study design was quasi-experimental, concluding that the research contributed in a high percentage of the performance of a sample of 30 schoolchildren on the academic competencies applied in the study. Next, we will define the concepts of augmented reality, which is the additional information obtained by observing an environment and captured by the camera of a device that has previously enabled a certain program. The additional messages identified as augmented reality can be translated into different formats. It can be a scene, a carousel of images, an audio file, a video or a link [9]. However, for [10] augmented reality is the use of a camera capture of a device in its environment and in real time, so it consists of two main elements; the visualization that allows creating virtual objects by adding virtual and real elements, and the tracking that fixes the position of objects in the real world.

The complement of augmented reality is defined by the concept of a mobile application is that according to [11] the user can interact with the mobile apps by making use of the storage space of the respective device or also be integrated as part of the hardware. For example a person walking through a city and using a mobile app whose geo location function works with maps within the device; or an app

that allows me to use it as a phonebook specifically for professionals, achieving such communication between them through a phone call, email or text message.

For the learning variable according to [12], learning is those that must be achieved by the learner and therefore must be evaluated by the learner. Likewise [13], learning is the process of capturing knowledge, skills and talents, it is the key to the development of human behaviour. The process of learning differs from one individual to another. Learning comes from effective practice or experiences. A person learns from physical and mental activities.

3. Problem formulation

The problem of the present research work was developed in an initial educational institution in the department of Metropolitan Lima in Peru. The materials and pedagogical kits, used and employed through teachers as part of the teaching methodology, are not adequate enough to respond to some students, of which are not properly concentrated so that at their age tend to be restless and distracted causing the difficulty of receiving the message in the course and period of study, which hinders the learning of these same in mathematics courses. Students begin to experience the world around them, therefore, new methods are proposed with the support of information and communication technologies, resulting in learning in a dynamic and entertaining way for them. Therefore, the development of a Mobile Augmented Reality application was proposed to intensify the school or curricular training developed from the school period of the respective initial educational institution. With all of the above, the formulation of the problem is expressed as follows:

What is the effect of the use of Mobile Augmented Reality applied as a Learning strategy for initial education students? In addition, its general objective was: To determine the effect of the use of Mobile Augmented Reality applied as a learning strategy for early education students. Likewise, the general hypothesis was: The use of Mobile Augmented Reality improved the learning of early childhood education students.

4. Method of analysis

The research is of the applied type. Likewise, the research design is experimental according to [13], it employs quantitative methodologies that examine the study variable(s) over others by means of comparison techniques, the aim is to investigate the cause-effect coherence between variables. The type of design is quasi-experimental according to [14] deliberately manipulate at least one independent variable, the subjects are not randomly assigned to groups or paired, but these groups are already formed before the experiment. In the following, we will present a table describing the respective research design:

Table 1: Research design

Group	Pre - Test	Intervention	Post - Test
The experimental group (GE)	O_1	X	O_2
The control group (GC)	O3	-	O4

GE:	Experimental group
GC:	Control group
X :	Augmented reality Mobile
O1:	Pre-test of the experimental group
O2:	Post-test of the experimental group
O3:	Pre-test of the control group
O4:	Post-test of the control group

According to [15], the population comprises the universe or total set of elements that are part of an investigation comprising one or more characteristics in relation to the validity of the members of a group. In the research, the population is made up of 20 children of the initial education level from the age of 5 years and the sample, according to the same author [15], is understood as that reduced part or a selected and characteristic subgroup of the population, which determines the number of subjects that will make up the study sample. The sample will be the totality of the population, therefore, it is a census sample. The technique used was the survey and the data collection instrument was the questionnaire

5. Results and discussion

The effect of the use of Mobile Augmented Reality achieved the results of the indicators set out in the specific hypotheses of which were analyzed and treated with the IBM SPSS version 25 tool through the experimentation of a pre-test and post-test. Next, we will present the results of the research, which is constituted by the validation of the respective hypotheses:

5.1 General Hypothesis Statement

- Null Hypothesis (HG0): The use of Mobile Augmented Reality does not improve early childhood education student learning.
- Alternative Hypothesis (HGa): The use of Mobile Augmented Reality improves the learning of early childhood education students.

5.2 Approach Specific Hypothesis 1

• HE10: The use of Mobile Augmented Reality does not improve the level of achievement of the competency "investigates through scientific methods for early childhood education student learning.
• HE1a: The use of augmented reality improves the level of achievement of the competency Inquires through scientific methods for early childhood education student learning.

Table 2: Results of the inferential statistics of the specific Hypothesis 1

t-test for equality of means						
	Difference averages	Sig (bilaterial)		Standard error difference	95% confidence interval of the difference	
					Inferior	Superior
Comparison of the level of achievement of the competency "investigates using scientific methods to construct knowledge for learning".	Equal variances are assumed	,022	-1,240	,522	-2,290	-,190
	Equal variances are not assumed	,022	-1,240	,522	-2,293	-,187

Table 2 is applying the T-Student test statistic for independent samples, with a confidence level of 95%, %. Significant differences (p=0.000<0.05) are observed in the level of achievement of the competency inquires by scientific methods for learning after applying Mobile Augmented Reality, Ho is rejected.

5.3 Approach Specific Hypothesis 2

- HE10: The use of Mobile Augmented Reality does not improve the level of attainment of the competency "unfolds in ICT-generated virtual environments for early childhood education students' learning".
- HE1a: The use of Mobile Augmented Reality improves the level of attainment of the competency performs in virtual environments generated by ICT for Early Childhood Education students' learning

Table 3: Results of the inferential statistics of the specific Hypothesis 2

T-TEST FOR EQUALITY OF MEANS				
	U DE MANN-WHITNEY	W DE WILCOXON	Z	SIG. ASINTÓTICA (BILATERAL)
Comparison of the level of achievement of competency in ICT-generated virtual environments between the control and experimental groups.	102,000	427,000	-4,285	,000

In Table 3, the Mann Whitney U test statistic is being applied, with a confidence level of 95%%. Significant differences (p=0.000<0.05) are observed in the level of achievement of the competency performs in virtual environments generated by ICT for learning, after applying Mobile Augmented Reality, the Ho is rejected

6. Discussion

The result of the descriptive statistics, with respect to the indicator level of achievement of the competency inquiry through scientific methods, in the pretest had an average result of 18.55, while in the posttest applying Mobile Augmented Reality, it was 19.75, so there was an increase of 1.2 considering an improvement after the intervention of Mobile Augmented Reality, considered as an

outstanding achievement, these results indicate that the use of augmented reality improves the level of achievement of the competency inquiry through scientific methods for student learning.

On the other hand, the results obtained were contrasted with previously conducted works, so we adapt as a reference the mentioned by [7], who demonstrate that augmented reality improves the learning of the science course and contrasted environment in the analysis of the level of the competence inquiry, through scientific methods where the study of the experimental group post test had 43% in the process range, 33% in the range of expected achievement and 23% of outstanding achievement allowing this technological resource to evidence significant results on the scale of achievement , This coincides with the acceptance of the alternative hypothesis and the results obtained in the present research, as well as with [8] who evidenced the effect of augmented reality on science and technology competence, showing results of the experimental group with the use of the Augmented Reality application that evaluates the inquiry competence through scientific methods, with a percentage of 4% reaching a beginning level and 96% achieving a level in process of the students.

7. Conclusion

It was determined that Mobile Augmented Reality has a favorable effect in improving the learning of early education students, after the use of the application of Mobile Augmented
Reality, the experimental group increased their performance placing them in an outstanding level of achievement with respect to learning competencies.

The use of Mobile Augmented Reality improves the level of achievement of the competency inquires through scientific methods for the learning of initial education students, after the application of Mobile Augmented Reality a difference in the scores of 18.55 versus 19.75 is evidenced, thus increasing the percentage of the level in 1.2% of the scores, placing the experimental group on the rating scale in an outstanding level of achievement, which shows an improvement with the use of Mobile Augmented Reality.

The use of the Mobile Augmented Reality improves the level of achievement of the competency "unfolds in virtual environments generated by ICT for the learning of initial educational students", after the application of Mobile Augmented Reality there is a difference in the scores of 18.55 versus 19.90, which increased the percentage of the level in 1.35% of the scores, placing the experimental group on the rating scale in an outstanding level of achievement, which shows an improvement with the use of the application of Mobile Augmented Reality.

8. Recommendation

This research considers that the use of Mobile Augmented Reality as a didactic tool in the educational field allows students to stimulate their interest and concentration when interacting with new technologies in the development of classes, as a result, it provides new technological knowledge to the student and is part of the teacher's professional training.

It is recommended that institutions promote training for teachers to new emerging technologies in education as this allows discovering new methodologies for the development of their classes, leaving behind traditional methods and giving rise to new digital content for further training of students against the impact of ICT.

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