Learning Objects with Augmented Reality for Primary Level Students in Educational Institutions

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Abstracts

Today, primary education is presenting gaps in the achievement of the cognitive abilities that students need, because of a number of factors, including lack of retention, reading comprehension, exploitation and other skills the student, in addition, cannot make the most of the use of information and communications technologies by teachers in the different courses they teach, cause of lack of access to information or motivation not to apply new technologies in education. On the other hand; in Peru, according to the PISA test carried out in 2015, we placed in the ranking 64th out of a total of 70 countries where the test was carried out. This test demonstrated advances in science, mathematics and reading comprehension, compared to the PISA test conducted in 2012, in which we were last. According to the results obtained in science it rose from 373 points in 2012 to 397 points in 2015. That is why, the objective of this research was to improve the process of Teaching – Learning in primary level students in the experimental educational institution of the National University of the Santa; by building learning goals for CTA courses using Augmented Reality technology. The results showed an identification of attitudes of use of technology, high reliability and usability of the application of aum reality aumenteg.

Keywords: Objects, Learning, Augmented Reality, Teaching, CTA.

1. Introduction

Traditional education offered solutions to needs in the past. However, the traditional school has become obsolete in recent decades in the face of the changes experienced worldwide. These profound transformations led professionals from various disciplines to think that we could be facing the birth of a new era or stage in human life. Different authors coined terms such as Third Wave, Knowledge Society and more recently Information Society to define this transformation and it is within this context that "training institutions will have to choose between assuming a leading role in the transformation of education, or being left behind on the path of incessant technological change" (UNESCO, 2004, p. 5).

"Today, AugmentedReality is being refined by various research groups around the world in the various technologies involved, such as user position tracking, signal processing, information

visualization, computer vision, virtual image generation, graphics rendering, information structuring, and distributed computing." (Ordinola Alvarez, 2014)

That is why the uses of new "technologies are being used as methodological alternatives to try to improve learning, one of them is augmented reality, which has been one of the most popular technologies and is gradually being incorporated into education. In the learning process, this tool produces enormous sensory stimulation, favoring cognitive resources, stimulating the desire to learn, increases the level of attention, creates in students an investigative spirit and many other factors that help to make understanding and assimilation much easier." (Ordinola Alvarez, 2014)

"Due to the possibilities of application offered by Augmented Reality in education and in view of the fact that today the attention span of students is very low, they show little interest in learning new knowledge and in many cases, there is no didactic resource that provides the necessary information to develop a specific topic of a subject corresponding to the curricular plan on occasions; All of the above is reflected in a low academic level and difficult understanding of the subject in the student. For this reason, it is sought that teachers and students have alternatives to traditional methods, such as Augmented Reality in Learning Objects." (Cano and Franco, 2013)

On the other hand, "the Learning Objects aim to facilitate a flexible and personalized education, allowing students and teachers to adapt the didactic resources according to their own needs, concerns, learning and teaching styles. It is for this reason that Learning Objects can be implemented through Augmented Reality" (Álvarez, Mabel, Gallego, Domingo J, 2013, p.10).

In Peru, education is based on traditional teaching and does not make use of new existing technologies to improve and motivate the development of skills. This problem influences Peru to be among the last places in education according to the PISA report (Flores, Meneses, 2013, p. 4). This is due to the fact that there are no didactic resources available to motivate the student's attention in the subjects taught to them (Pareja, 2015, p. 159). All this is reflected in a low academic level and difficult understanding of the subjects, which results in the lack of development of competencies that the student must complete throughout their academic training. For this reason, it is necessary to use technology as a resource to offer more attractive content to a generation of students who see ICTs as a daily fragment in their lives.

Nowadays, in some schools in Peru, especially in the capital city (Lima), the teaching and learning of the science and environment course is being induced through the ECBI (Inquiry-Based Science Studies) learning method. According to Rodríguez, he states that "Particularly, in the third grade of primary education, the method proposes work in small groups, no more than four students, who work together to achieve common goals. The aim is for the entire team to participate in the assigned task, strengthening collaborative learning among the members. In this strategy, the mediation of the teacher is highlighted, who provides the students, during the inquiry activity, with conditions for them to learn from each other by sharing ideas, discoveries and skills" (Rodríguez, 2011).

Educational institutions in Peru currently have deficiencies in technology, in teaching they use fewer and fewer educational instruments, there is very little collaboration of the student in the

classes, also the Ministry of Education does not provide them with the necessary books so that students can learn well, fundamentally of all the courses that are taught the one that has the most problems in learning in the Educational Institution. is in Science, Technology and Environment, since there is a large number of students with the minimum grade in that course, and this is due to the lack of educational materials for students, since this course is studied and taught in a practical way and that can be designed in a palpable physical scheme so that the student has an experience and learns easily, However, the lack of economy on the part of the students and the institution cannot execute prototypes for their excellent learning. "In addition, these activities have already been developed by many teachers and are always the same and often are not carried out in the correct way, which allow students to acquire this knowledge not only by reading it from a book or through the teacher's oral explanation. Among these activities, it is proposed to observe pictures, make drawings in the notebook and build models. However, these resources are quite limited to give students a complete idea of this topic, since, among other characteristics, they are static elements that are not able to show the movement of the different elements." (Ordinola Alvarez, 2014)

The general objective of this research is to improve the Teaching-Learning process in primary level students in educational institutions, through the construction of learning objects using augmented reality technology. To meet this objective, specific modules of certain subjects at the primary level will have to be characterized, which allows the identification of problem areas; to evaluate the impact of the use of augmented reality on primary school students in educational institutions, as well as to identify the effects of the limited use of technology in the teaching-learning process and finally to describe the degree of usability of the application of augmented reality.

According to the problems described in the previous paragraphs, the following question arises: How will the implementation of learning objects based on augmented reality technology improve the teaching-learning process in primary level students in educational institutions?

This research is justified because its purpose is to improve the innovative capacity of the student, by allowing a model that interacts in real time and space. In addition, it promotes the appropriation of new information technologies. Also to strengthen visual, interactive, collaborative learning by building their knowledge and achieving meaningful and long-term learning, seeks the feasibility of use in class. Finally, Maintain attention, encourage curiosity and develop research capacity.

Therefore, the importance of building learning objects that allow improving the academic abilities of students in educational institutions, for reasons that a tool is developed that is a support that complements the teaching-learning process in the Science, Technology and Environment course. In addition, it will provide teachers, parents and students with a greater degree of satisfaction, leading to an improvement in the institutional image.

2. Method

Type of study to be investigated

a. According to applicability or purpose

Applied: The type of research is applied, because it seeks to put into practice what has been researched to propose solutions in the creation of learning objects with augmented reality technology.

b. According to nature or depth

Pre-Experimental: To carry out this type of research it is necessary for the researcher to become familiar with reality, for this the Pre Test and Post Test method was used.

Population and Sample

a. Universe

Students of the Primary Level of Educational Institutions

b. Sample

Students of the Third Grade of Primary School of the Experimental Educational Institution of the National University of Santa

Techniques

a. Document analysis

It will be developed based on primary sources: bibliography, hemerogography, interviews and the internet.

b. Survey

It will be used to find out if they have information about augmented reality.

c. Interview

It will be developed to obtain information from specialists about the topics of the courses to build the learning objects

Instruments

Questionnaire

Data Processing and Analysis Techniques

Descriptive statistics will be used: Statistical tables, bar graphs, and others appropriate to the research

- Data Collection Procedure

a. Data collection: books, journals, and websites will be used to put together the theoretical framework necessary to support the research.

b. Fieldwork: Observe the interviews conducted by teachers with students at the primary level of the Experimental Educational Institution. To know the opinion of the students of the Experimental Educational Institution about the use of the Learning Objects

c. Office work: what was collected in the fieldwork will be systematized for analysis and discussion

3. Results and Discussion

1. Object Evaluation

Table 1: Quality assessment of learning objects

Assessing the quality of learning objects	
OA Title	SOLAR SYSTEM
Theme dealt with	Describe some characteristics of our environment. The land and what surrounds it.
Pedagogical goal	To consolidate the concepts and assimilate the theoretical contents of the Solar System.
Associated cognitive level	Cognition, Understanding, Application, Observation, Summary, Evaluation.
Skills developed	It is possible to elucidate the concept and understanding of the Solar System, as well as to know the conformation of the solar system and what is the relationship they have with living beings.

Table 2: Relevance and Veracity of the contents

Relevance and Veracity of the contents	Very good 3 points	Good 2 points	Regular 1 point	Suitcase 0 points
Presentation of the topic to be discussed		2		
Description of the Educational Goal	3			
Clear definition of the subject matter	3			
Logical structuring of the contents		2		
	Yes 3 points	No 1 point		
Presentation of application and practical examples.	3			
View Judgment and Evaluation exercises	3			
Audiovisual resources are used to ensure the contents		1		
Incorporation of topics in different courses due to the disintegration of their contents		1		
Standardization of Learning Object metadata	3			
The contents are considered current (updated)		1		
Verification of the sources of information used.	3			
Suitability of the sources of information used		1		
Total Score : 26		Minimum score for consider acceptable OA : 25		

Table 3: Aesthetic and Functional Design

Aesthetic and Functional Design	Very Good 3 points	Good 2 points	Regular 1 point	Suitcase 0 points
Congruence in the use of textual content and audiovisual resources	3			
Adequacy of the visual format of the Learning Object with		2		

respect to the size of the visual requirements.				
Assignment of requirements within textual and audiovisual content			1	
Understandability of the text	3			
Intensity of colors to highlight the level of theme		2		
Adequacy of the placement of Learning objects with respect to the ability of the text		2		
Speed in the display of audiovisual requirements.	3			
Cross-browser support		2	1	
	Yes 3 points	No 1 point		
Uniformity of Learning Objects with respect to formats		1		
Proportionality in the allocation of resources and content.	3			
Contribution of visual requirements to text		1		
Use of attractive colors in learning objects.	3			
The Learning Object has a Navigation System with Menu and Bookmarks		1		
Standardizing Learning Object Metadata	3			
Indexing the Learning Object in a Learning Management Tool.		1		
Total Score :	32	Minimum score for consider acceptable OA: 30		

Table 4: Instructional Design and Competency Assurance

Instructional Design and Competency Assurance	Yes 3 points	No 1 point	
Clarity in the proposed guidance and guidelines.		1	
Identification of the skills and competencies that the student will display through interaction with the learning object.	3		
The student can develop his or her own conclusions through his or her own guidelines and deductions.		1	
Concordance of the activities proposed in reference to the educational level for which the learning object was developed.	3		
Relevance in the identification and development of the lines of knowledge of the Learning Objects.	3		
The level of knowledge proposed is correctly framed in the contents of the agreed topics.		1	
Concordance of Learning Objects with respect to content and activities	3		
Individual work is encouraged by students	3		
Feedback on the activities in relation to collaborative work	3		
Total Score :	21	Minimum score for consider the OA acceptable: 20	

Table 5: Quality Level achieved by the OA

Quality Level achieved by the OA		Scale for OA Quality Determination	
		Greater than 90	Excellent
		75 – 89	Very good
Total score: Adding passing scores in the three Categories	100	66 – 74	Good
		51 – 65	Acceptable
		Less than 51	Not acceptable

With the result obtained we can see that the evaluated learning object obtained a good quality with a score of 79

2. Degree of Student Satisfaction

Question 1:

Does the duration handled to start the app show the marker and visualize the planet was?

Table 6: Absolute idea of speed that the application has

ANSWER	Quantity	Percentage
Fast	90	30.00 %
Normal	21	70.00 %
Slow	0	0.00%
Total	30	100.00%

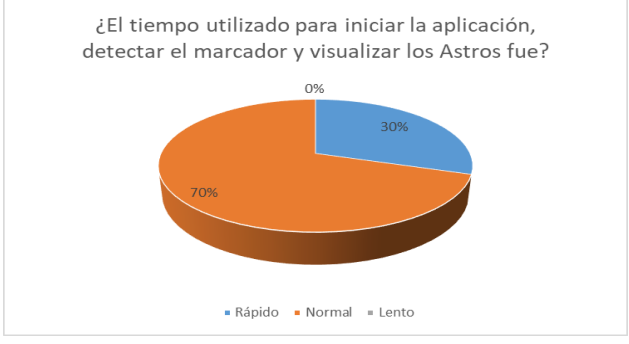

Figure 1: Question 1. In original language Spanish

Interpretation: The graph shows us that 70% of the students surveyed said that the duration managed to start the application, show the marker and visualize the planet was in Normal mode, and 30% said it was fast, and no one said it was slow.

Analysis: It can be indicated that most of the students surveyed state that the speed of the application is Normal.

Question 2:

How satisfied are you with the position on the screen and effectiveness of the stars (planets, sun, Solar System)?

Table 7: Evaluation of student satisfaction

ANSWER	Quantity	Percentage
1 – Discontent	0	0,00%
2 – Unhappy	0	0,00%
3 - Indifferent	0	0,00%
4 - Happy	13	43.0%
5 – Very happy	17	57.0%
Total	30	100,00%

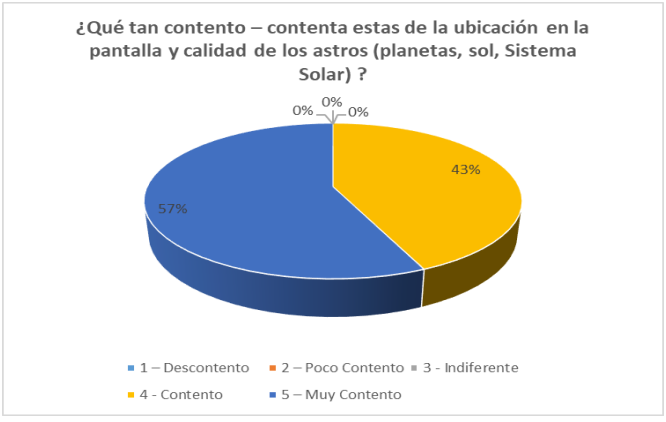

Figure 2: Question 2. In original language Spanish

Interpretation: In the graph it states that 57% of the students surveyed said that they were satisfied with the position on the screen and the effectiveness of the stars (planets, sun, Solar System). With the highest satisfaction value (5), and 43% were only happy in the satisfaction value (4).

Analysis: It is stated that most of the students surveyed are very satisfied with the graphic medium.

Question 3:

Is the conformity in relation to the alternatives of interaction with the virtual medium?

Objective: To acquire the level of satisfaction in relation to the interaction alternatives

Table 8: Degree of satisfaction in relation to interaction alternatives

ANSWER	Quantity	Percentage
Excellent	20	67.0%
Well	89	27.0%
Acceptable	2	6.0%
Insufficient	0	0.0%
Total	30	100%

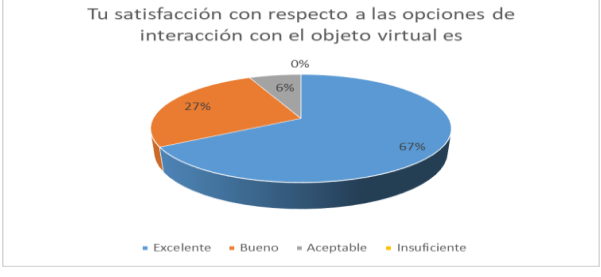

Figure 3: Question 3 In original language Spanish

Interpretation: The graph shows that 67% of the students surveyed recognized an optimal satisfaction in relation to the interaction alternatives of the virtual object, 27% express good satisfaction and only 6% say that it is pleasant.

Analysis: It is noted that a large part of the surveyed students have excellent satisfaction with the interaction alternatives of the virtual object.

Question 4:

Is the theoretical content displayed in the app ?

Table 9: Satisfaction with the theoretical content of the application

ANSWER	Quantity	Percentage
Excellent	21	70.0%
Well	9	30.0%
Acceptable	0	0.0%
Insufficient	0	0.0%
Total	30	100%

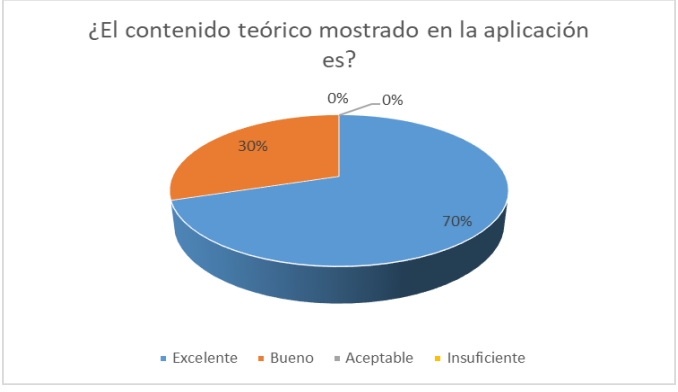

Figure 4: Question 4. In original language Spanish

Interpretation: The graph indicates that 70% of the students surveyed said that they have an excellent satisfaction with the theoretical content of the application, 30% express good satisfaction.

Analysis: It is expressed that a large number of the students surveyed have excellent satisfaction with the theoretical content of the application

Question 5:

How much is total failures presented during the use of the application?

Table 10 - Information on the total failures presented during the use of the application.

ANSWER	Quantity	Percentage
High	0	0.0%
Middle	2	7.0%
Low	9	30.0%

None	19	63.0%
Total	30	100%

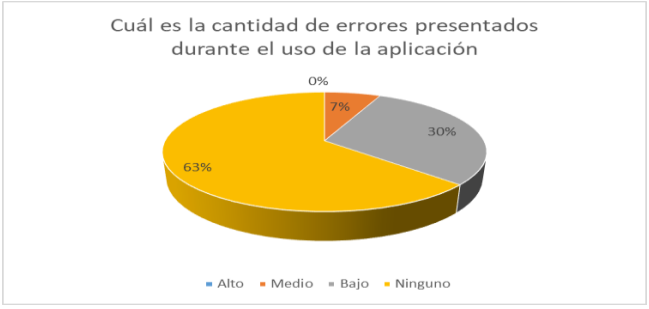

Figure 5: Question 5. In original language Spanish

Interpretation: The graph shows that 63% of the students surveyed said that the application does not contain flaws in practical performance, 30% differ that the error presented was low and 7% state that it was medium.

Analysis: It is stated that the number of errors found in the execution of the application was null.

Question 6:

How satisfied are you with the application?

Table 11: Degree of satisfaction with the application

ANSWER	Quantity	Percentage
Very satisfied	19	63.0%
Satisfied	11	37.0%
Somewhat satisfied	0	0.0%
Unsatisfied	0	0.0%
Total	30	100%

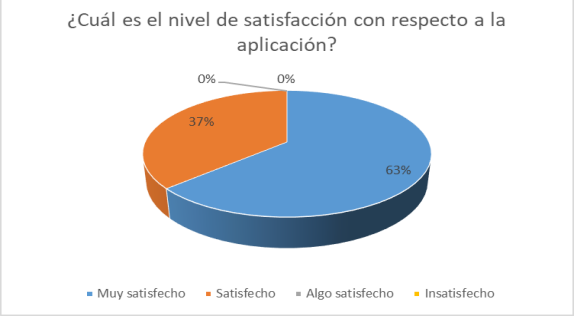

Figure 6: Question 6. In original language Spanish

Interpretation: The graph shows that 63% and 37% of the students surveyed said that the degree of satisfaction with the application is very satisfied and proportionally satisfied, obtaining the objectives set.

Analysis: It is stated that the degree of satisfaction with the application by the students was total.

The level of satisfaction that the application has as a learning medium to understand more deeply the subject of Science, Environment and Technology is indicated

3. Degree of Usability

Table 12: Degree of Usability

1.- He believes that the use of the application is difficult.	5	4	3	2	1
2.- The markers are easily identifiable by the webcam.	5	4	3	2	1
3.- The application looks impeccable.	5	4	3	2	1
4.- A positive opinion or impact is provided.	5	4	3	2	1
5.- The object in augmented reality stimulates your curiosity.	5	4	3	2	1
6.- The 3D modelers of the application are visibly recognizable.	5	4	3	2	1
7.- I like the 3D models of the application	5	4	3	2	1
8.- The sounds of the application are clearly recognizable.	5	4	3	2	1
They like the app so they can use it often.	5	4	3	2	1

a. Reliability Analysis

- Calculation of Cronbach's Alpha Coefficient

The reliability of the usability questionnaire is 0.852, which Cronbach's alpha is showing a very high degree since it is very close to 1, in which it is statistically defined that the application used is trustworthy.

Table 13: Reliability Analysis

Cronbach's alpha	Cronbach's alpha based on the typified elements	N of elements
,905	,881	30

Source: Usability Degree Questionnaire

4. Level of Attitudes

This tool to collect data is that of a similarity table, where a chain of items must be answered in the way indicated in the DCN (national curriculum design), in which students can be seen in the courses developed with the Augmented Reality application, which will allow to see the degree of attitude. (before the course and conduct)

Table 14: Level of Attitudes

ITEMS		YES	NO
1.	Shows initiative and interest in research work		
2.	Projects their tasks to obtain the expected learning		
3.	Pay attention to the reverse observations of him		
4.	Expresses concern in field practices		

5.	It is expressed correctly		
6.	Participate permanently and fully		
7.	Fulfill their individual and group tasks		
8.	Shows effective and proactive quality		
9.	He is determined and courageous in his work		

a. Reliability Analysis

- Calculation of Cronbach's Alpha Coefficient

The reliability in the verification series is 0.722, therefore, Cronbach's alpha presents a very high degree since it is very close to 1, which makes a statistically definition that the application is totally reliable.

Table 15: Reliability in the checklist

Cronbach's alpha	Cronbach's alpha based on the typified elements	N of elements
,825	,814	30

4. Conclusions

- It was possible to achieve the general objective set, to improve the Teaching-Learning process in primary level students in the experimental educational institution of the National University of Santa by building learning objects under Augmented Reality technology.

- The efficacy and impact of the learning objects on primary level students in the experimental educational institution of the National University of Santa was evaluated, which had a very good appreciation.

- A high level of satisfaction was obtained from the students of the primary level when handling the augmented reality application.

- A valuable degree of reliability and usability of the augmented reality application was manifested.

- The attitudes of adaptation of technology in the students of the primary level of the experimental educational institution of the National University of Santa were identified.

The benefit and expectation could be perceived, referring to the novelty that is presented within the pedagogical practice elaborated with Augmented Reality. Likewise, this skill, as a learning tactic, idea attention, enhances concentration and reflection. The skill and acceptance of the new tool among teachers and students was demonstrated.

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