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Las posibilidades educativas de la realidad aumentada, virtual y mixta

Thematic Editors
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Augmented reality AR

Considered as a technology (Basogain, Olabe, Espinosa, Rouéche and Olabe, 2007; Prendes, 2015; De Pedro, 2011), or a system (Azuma, 1997; De Almeida y Cabero, 2020; Marín-Díaz and Sampedro-Requena, 2020). These authors emphasize three of their characteristics: the combination of the real world and the virtual, real-time interaction, and the ability it provides to increase real objects by offering 3-dimensional images. Cabero and Barroso (2016) show some advantages of its use in education: it helps in understanding abstract concepts, promotes more personalized learning, and encourages students a higher level of interaction with information and the reality.

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Editorial

The teaching and learning process in schools is under a moment of revolution and continuous reconfiguration in the teaching methodologies, with the incorporation of new knowledge into the curriculum, as well as with the use of new resources to improve education.

These resources have been redefined as society has advanced. The result of this advancement is the so-called Horizon Emerging Technologies, with an emphasis on these and, more specifically, augmented reality, virtual reality and mixed, the educational scenario takes on a new perspective. In them the learning process is enriched as it translates the reality of curriculum content to the ecology of the classroom. The student can live in the first person as he/she would, for example, interact with dinosaurs, experiment in a "real" laboratory what textbooks are transmitting to them.

These experiences, created under the protection of the natural sciences, have gradually been introduced in the field of social sciences; although their first steps have been made in history and tourism, there are numerous experiences that can be found in the literature that highlight its usefulness to facilitate the visits to museums, for example.

The Monographic Section is provided under the title **The educational possibilities of virtual and mixed augmented reality**, whose main objective has been to show the great viability that these technologies have and offer to education in general.

The first article entitled Augmented reality in the teaching of reinforced concrete is a first look into the imbrication of augmented reality (AR) in the formative process. It teaches how spatial visualization capability, as well as the ability to rotate objects can be not only reinforced but also enhanced by using mobile applications of this technology. To do this we are introduced to the Skechfab App, which is linked to a very specific content – graphic expression – with the aim of contributing to the achievement of visual-spatial capacity. This study reflects that university students see the proposal as interesting and attractive, while motivating for the achievement and development of marked competition.

We take a leap to the initial levels of education through the research included in the article *Augmented Reality and stellarium: astronomy for five-year-old children*. Its authors bring us closer to Astronomy from the perspective of the stage of early childhood education and bring us closer to learning the basic concepts of this content which is difficult to understand and like by young students. However, the results that the didactic experience, as well as the research carried out have demonstrated in this age range, where the student is starting to read and write, that the AR becomes an element that allows to recognize the universe, to become semantically aware of the scientific language linked to Astronomy, and to become aware of the content of this topic.

Given the impact that emerging technologies, in this case AR, are showing, it is necessary to conduct a study in the international scientific literature, and so it is reflected in the one carried out under *The Transcendence of the Augmented Reality in Student Motivation. A systematic review and meta-analysis:* a review of two important databases, Scopus and Web of Science, under the standards proposed by the PRISMA statement and taking motivation as the variable.

From there, nine publications containing articles linked to this topic were analyzed and it was found that this variable influences the use of AR in classrooms of any educational level. It is worth noting, as the authors point out, the need to increase the corpus of publications linking the educational use of this technology.

Under this perspective Virtual Reality and motivation in the educational context: Bibliometric study of the last twenty years of Scopus, focuses on the publications carried out by the index indicated. The study shows 1241 researches on VR and education, in a period between 1998 and 2018. The research shows a significant increase in both research and innovation publications. While the authors believe that it is necessary, given the topics addressed in these studies, to do more in-depth work by asking the reader whether it is possible to improve educational quality through the use of new methodologies such as virtual reality. This monographic section closes with a research work carried out with teachers in primary education (*Augmented Reality in Primary Education from the vision of the students*). This contribution conducts an analysis on the curricular feasibility of AR in the primary school. It is important to mention that the results achieved highlight that the future teachers do not consider that AR can be a significant tool for the achievement of the acquisition of curricular content; however, they indicate that once dominated by teachers it would be easy to incorporate it into classroom resources. It is also noteworthy that this same group of future teachers show their concern about inclusive education, as they say they do not consider AR as an element that facilitates so much learning.

In the Miscellaneous Section, the *Virtual Environments for Academic Writing work. A model in Minecraf*t by René Ponce Carrillo and Lilia Mercedes Alarcón Pérez analyzes the possibilities that a video game contributes to the writing and academic publication. The research was conducted with a group of 28 undergraduate students who performed collective writing exercises in the video game whose findings indicate that the use of virtual platforms for academic writing is relevant at the university level and thinking literacy processes.

Research *Knowledge prior to conceptual development. A case in primary education* by Yesney Bethencourt and Aracelis Arana describes the cognitive dynamics involved in learning third graders. The study was framed in a field research, under a research-action design, where 20 informants were applied a questionnaire. Individual and group temporal triangulation was used for the analysis of the information, thus identifying the operators. Five new categories emerged from the analysis that bring together all the ways to conceptualize the environment.

The study *Multidisciplinary education in the prevention of obesity in Students of Mexico City* by María del Rosario Ayala-Moreno, Alma Rosa Hernández-Mondragón and Arely Vergara- Castañeda is a reflection on the efficiency of programs aimed at controlling obesity. To this end, an analysis was carried out in studies that argue that obesity has not decreased despite the strategies conducted by health areas. Therefore, multidisciplinary intervention programs focused on awareness can be efficient means of preventing and reducing childhood obesity.

The research on *Inclusive Education. Analysis and reflections on Ecuadorian higher education* by Ruth Germania Clavijo Castillo and María José Bautista-Cerro reviews international agreements and national regulations, addressing the situation, advances and challenges posed by inclusive education. Despite the achievements, transforming the policies, culture and practices of universities to address diversity remains being a challenge. The main conclusions include the need to move towards a university model based on the principles of educational inclusion with a view to improving quality processes that help build equitable societies.

The article *Environmental Education in television Media. Case study: Oromar TV* by Erik Alexander Cumba analyzes the social impact of environmental awareness and care in television media in Manabí province. The results obtained show that there are gaps in the channel's programming, due to the limited productions. Additionally, the absence of an increase in educational television programs, could lead to a disservice in the television audience about the prevention and care of the environment.

We finish this editorial inviting you to submit your articles for Volume 15-number 2 (July-December 2020) whose Monographic section entitles Active Methodologies for Teaching, Evaluation and Learning: Innovation in the Classroom, coordinated by the Dr. Ana Rosa Arias Gago and Dr. Angel Luis Pérez Pueyo of University of León (Spain), by Dr. Alberto Moreno Doña of the University of Valparaíso (Chile) and Dr. David Hortigüela Alcalá of the University of Burgos (Spain); as well as for the Miscellaneous section that arbitrates research that addresses educational topics. We also remind you that in 2020 Alteridad will apply to join SCOPUS.

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Monografic section
(Sección Monográfica)

"The educational possibilities of augmented reality, virtual and mixed"
"Las posibilidades educativas de la Realidad Aumentada, virtual y mixta"

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Aid-augmented reality for reinforced concrete class: students' perception

Realidad Aumentada en la enseñanza de hormigón reforzado: percepción de los alumnos

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Abstract

For the structural engineer, spatial visualization ability is especially important for understanding the correct positioning of structural elements in a design. In order to improve the student's spatial visualization ability, in this investigation the development of activities was proposed using an application for mobile devices with the resources of Augmented Reality (AR). The activities were planned for the Reinforced Concrete subject in the eighth semester of the Civil Engineering course of the Pontifical Catholic University of Minas Gerais in Brazil. Eighteen students enrolled in that subject in the first semester of 2019 did the proposed activities. Four activities were developed using the RA resources for the Sketchfab application. The instrument chosen for the evaluation of student perception was a questionnaire based on the technology acceptance model (TAM), which was adapted in this study. By the students' answers about the usefulness and ease and intention of using the resources, it was concluded that the RA is an important resource to improve their spatial visualization ability because they facilitate the visualization of the details of the structures and make the learning more fun.

Keywords: Civil engineering, structural design, reinforced concrete, spatial visualization, augmented reality, computer assisted instruction.

Resumen

Para el ingeniero de estructuras, la habilidad de visualización espacial es especialmente importante para la comprensión del posicionamiento correcto de los elementos estructurales en un diseño. Así, para mejorar la habilidad de visualización espacial del alumno, en esa investigación fue propuesto el desarrollo de actividades utilizándose una aplicación para dispositivos móviles con los recursos de la Realidad Aumentada (RA). Las actividades fueron planeadas para la asignatura Hormigón Reforzado en el octavo semestre del curso de Ingeniería Civil de la Pontificia Universidad Católica de Minas Gerais en Brasil. Dieciocho alumnos matriculados en esa asignatura en el primero semestre de 2019 hicieron las actividades propuestas. Fueron elaboradas cuatro actividades utilizándose los recursos de RA para la aplicación Sketchfab. El instrumento elegido para la evaluación de la percepción del estudiante fue un cuestionario basado en el modelo de aceptación de tecnología TAM (*Technology Acceptation Model*), que fue adaptado en este estudio. Observándose las respuestas de los alumnos sobre la utilidad y facilidad e intención de uso de los recursos, concluyese que la RA es un recurso importante para mejorar la habilidad de visualización espacial de ellos pues facilitan la visualización de los detalles de las estructuras y hacen el aprendizaje más divertido.

Descriptores: Ingeniería civil, diseño estructural, hormigón reforzado, visualización espacial, Realidad Aumentada, informática educativa.

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1. Introduction

Buildings of concrete, steel, wood or other material structures with their complex arrangements of structuring elements are commonly represented in a set of two-dimensional drawings. These indicate the quantity, length and diameter of the steels, and also their positions within the structural elements. In universities, static, two-dimensional (2D) or three-dimensional (3D) drawings and images have been used to convey the complexity of steel arrangements and their modes of interaction. According to Fogarty, Mccormick and El-Tawil (2018), 2D rendering requires students to build an image of the structural element or set of various elements with limited information and experience. On the other hand, the emphasis on two-dimensional drawings of three-dimensional structures in civil engineering courses often hampers students' ability to spatially visualize arrangements. Visualizing spatial and complex arrays can be a challenge for some people when there is the deformation of these arrays in various load scenarios or other external stimuli. Maier (1994 *apud* Sorby, 2001) has indicated that activities involving 3D visualization are especially important for technological professions such as engineering, where spatial visualization ability (SVA) and mental rotation become completely necessary. A review of the tests used for the evaluation of SVA can be seen in Lin's work (2016). In that set of tests is the Purdue University tests - Purdue Spatial Visualization Test (PSVT), which was used by Sorby and Veurink (2012) to assess the spatial visualization ability of American students and that of other countries of the world. In the research, the authors conclude that cultural differences in pre-university education among students who studied the same career but belonged to other countries are probably an important factor that characterize underdeveloped visualization abilities. For their part, Segil, Sullivan, Tsai, Reamon and Forbes (2017) investigated the spatial visualization ability of students from various countries who were studying in the US., proposing the authors a workshop for students who would not have obtained the necessary grade on the PSVT test to improve their grades, a fact that happened but that was not enough.

In order to improve SVA in students, Mello, Maia and Calixto (2016) propose and develop a website for teaching reinforced concrete projects. Among other activities, the site has a web application to calculate structural elements (beams and columns) of reinforced concrete. Through the application, students can interact with the computer program and determine the rotation of the structure; that application was produced in Java programming language, with Java 3D resources. For its part, Fogarty *et al.* (2018) have investigated the use of virtual reality tools to help students understand the complex concept of "buckling" in structures. This study, conducted using the combination of mixed methods, analyzes pre and post exams covering topics that require spatial visualization abilities, as well as surveys and interviews with students who used the virtual reality tools. Quantitative results indicate that students can more accurately identify and visualize "buckling" modes after the virtual reality experience. The results found show that students show a better understanding, greater enthusiasm for the topic, and greater desire for other topics to be presented using virtual reality tools.

Although researchers have highlighted the main factors that compromise the teaching and learning process in engineering (Molyneaux, Setunge, Gravina & Xie, 2007; Mello, 2016), and especially the difficulty that its students have in spatial visualization (Sorby, 2001; Katsio-Loudis & Jones, 2015; Mello *et al.,* 2016, Fogarty *et al.,* 2018), other educational strategies should be explored to improve students' SVA in structural engineering teaching. In this scenario, the overall objective of this research was to plan and develop activities using mobile application with augmented reality (AR) resources, for reinforced concrete disciplines in the civil engineering course.

To achieve the objectives of the research the phases followed were: (1) choice of tools for

the development of the application; (2) planning of reinforced concrete discipline activities carried out in RA application; (3) development of 3D models for RA; (4) class use of the application for the performance of planned activities; (5) evaluation of the proposed activities with regard to didactic, technical and aesthetic quality, and their use and acceptance through a questionnaire answered by students.

1.1. Augmented reality

Azuma (1997) points out that augmented reality is any system that has the following three features: it combines the real and virtual world, it is interactive in real time and it is recorded in three dimensions. Augmented Reality (AR) is a field of computer science research that combines reality and digital data, i.e., it employs computer vision, image processing and graphic techniques to merge digital content in the real world. Cabero and Barroso (2016) when presenting the possibilities of using RA in education showed some advantages of using this resource: (1) they help in the acquisition of knowledge that becomes essential to relate and understand the concepts learned through interaction with RA resources with the real environment; (2) promote more personalized learning so that each student can progress at the pace set by their own abilities and interests and; (3) encourage students to have a higher level of interaction and exploration on both information and objects.

Akçayir, Akçayir, Pektas and Ocak (2016) investigated the effects of the use of RA technologies in science laboratories and involved 76 first-year university students, all students from 18 to 20 years old. Each was assigned to an experimental group and another control group. While the experimental group used a RA-assisted laboratory manual, the control group used a traditional laboratory manual. The 5-week experience revealed that RA technology significantly improved the lab skills development of college students. In addition, it helped them develop positive attitudes towards physics labs, increasing student´s motivation.

On the other hand, Ayer, Messner and Anumba (2016) asked the students to carry out an activity in which they had to design, visualize and evaluate the exterior wall project to adapt it to an existing facility and improve its sustainable performance. The research was performed by 34 students of architectural engineering, 47 of architecture and 27 of civil engineering. They all received the same design activity using an augmented reality-based educational game called ecoCampus. The authors compared students using ecoCampus with the 65 students who completed a similar design activity using only blank spaces with sheets of paper, and another group of 23 students who used a paper approximation of the computerized ecoCampus. Based on the results, they concluded that students from all disciplines that used ecoCampus were able to break the trend towards design fixation. Students also used the app to evaluate their designs and generate additional concepts with better overall performance across all disciplines compared to students who used paper formats.

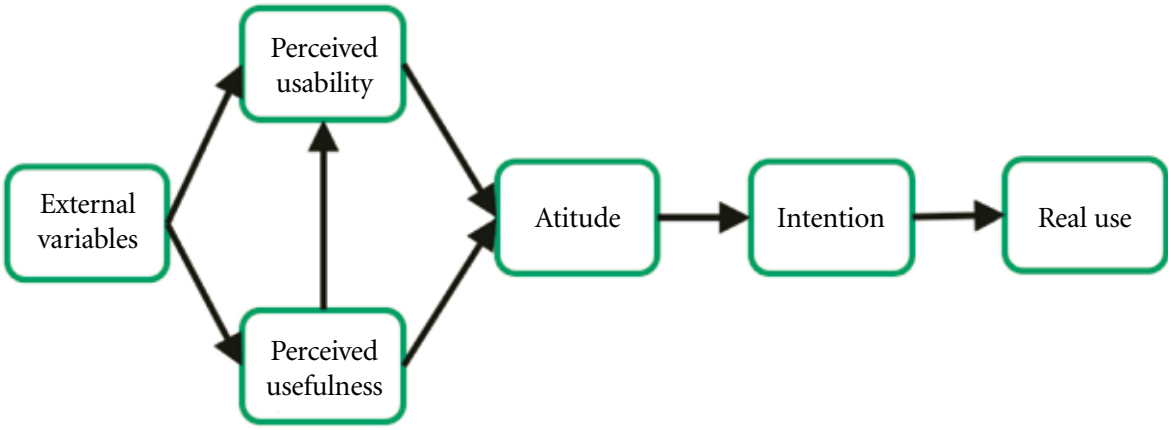
Meža, Turk and Dolenc (2015) created a prototype that was tested in a real building, and conducted an investigation aimed at evaluating the potential use of RA in the area of civil engineering designs. The authors interviewed a group of potential users who were asked to compare the prototype with conventional design presentation methods; they concluded that the use of RA provides the ability to move from two-dimensional to photorealistic designs in three-dimensional projections. The barriers to the use of RA, explained by the authors (Meža *et al.*, 2015) were the perceived conservatism in the construction business sector and the size of the three-dimensional models generally required for that sector. Li, Nee and Ong (2017) investigated the application of RA resources in some areas of engineering and published a review of the literature on the subject. According to Li *et al.* (2017), the selected studies used different visual-

ization methods, such as image overlay, OpenGL programming, and a special software kit for displaying volumetric data and numerical simulation results. However, most studies use RA as a visualization tool and the possibility of interaction is neglected. Overall, Barroso, Gutiérrez, Llorente and Valencia (2019) have pointed out a number of difficulties that teachers have had for the incorporation of RA into teaching, ranging from the novelty of technology to the lack of research on its in action.

1.2. Student perception through the TAM

Technology Acceptation Model (TAM) was adapted from Davis' 1986 Reasoned Action-TRA (1986) theory of action to explain a person's behavior for the use of technology (Davis, 1989). In the TAM model, some external variables are proposed to outline the impact of external factors on the two main perceptions of the user in relation to the use of technology: (1) perceived usability and (2) perceived usefulness. According to Davis (1989), the former directly influences the latter and both directly influence the positive or negative attitudes of users regarding the use of technology. The attitude towards the use of technology influences the behavioral intent of using the technology, and the intention of using the technology determines the current use (Davis, 1989; Abdullah & Ward, 2016). Figure 1 shows the diagram of the TAM model, according to Davis (1989).

Figure 1. TAM Model



Source: Adapted from Al-Emran, Mezhuyev and Kamaludin (2018)

Various researchers have applied the TAM model to explain the user´s acceptance of different educational technological tools and resources (Chow, Herold, Choo & Chan, 2012; Cheung & Vogel, 2013; Schoonenboom, 2014; Wu & Chen, 2017; Cabero & Pérez, 2018). Schoonenboom (2014), used a TAM questionnaire adapted to measure the importance of the task, the performance of the task, the usefulness of learning management systems (LMS), its ease of use and the intention to use it, for 18 different educational tasks among 180 instructors of a Dutch university. According to the author, the results showed that the TAM model is more widely applicable for the tool/task combination. Cheung and Vogel (2013) adapted the TAM model to explain the factors that influence the acceptance of Google applications for the collaborative learning. The custom model was empirically evaluated using data collected from 136 students enrolled in a full-time undergraduate program who used Google apps to support the activities.

The TAM model proposes that the different external variables that may affect the usefulness and ease of use perceived by technology users be identified. According to Cabero and Pérez (2018), although different studies have suggested new proposals and the model has evolved over time, it remains essentially composed of a simple set of identified variables, as in the original formulation, which are presented as robust and reliable.

2. Methodology

This project is a descriptive and quantitative approach to validate the methodology and tools chosen for the planned activities, with the aim of establishing whether the use of RA motivates and helps the student's learning in reinforced concrete subjects.

2.1. The subject and the students

The research was developed in the subject of "Graphic Expression" of the eighth semester of the Civil Engineering course. This subject is part of the mandatory content of the Civil Engineering course of the Pontifical Catholic University of Minas Gerais in Brazil. In this subject students must not only interpret the drawings of designs of the structures but must also represent in 2D drawings, the entire reinforced concrete structure already calculated. In the first semester of 2019, eighteen students enrolled in the subject were invited to participate in the research and all agreed to participate. All students enrolled in the subject answered a questionnaire after using the proposed RA resources for some course activities.

2.2. Computational resources

Detailed projects for the theme of "two-dimensional slabs and beams" were represented using AutoCAD (https://www.autodesk.com.br/products) graphic design software. For the development of the 3D model, the software for three-dimensional modeling, Sketchup (https://www.sketchup.com) was used. The reasons for choising it were: its ease of use and its ability to integrate with AutoCAD. To render the 3D model, the Sketchfab platform was chosen (https: (https://sketchfab.com/feed). There are two ways to access the 3D models available on it: through the web environment or through the mobile app. The Sketchfab app for mobile devices allows to observe models in both augmented reality and virtual reality. For the production of the activities applied in this research, two ways were chosen for the 3D visualization of the structural elements: (1) access through the Sketchfab web environment and (2) through the Sketchfab mobile application with access to the RA function. In addition, in the web environment there is the possibility to insert resources such as text and audio in 3D models.

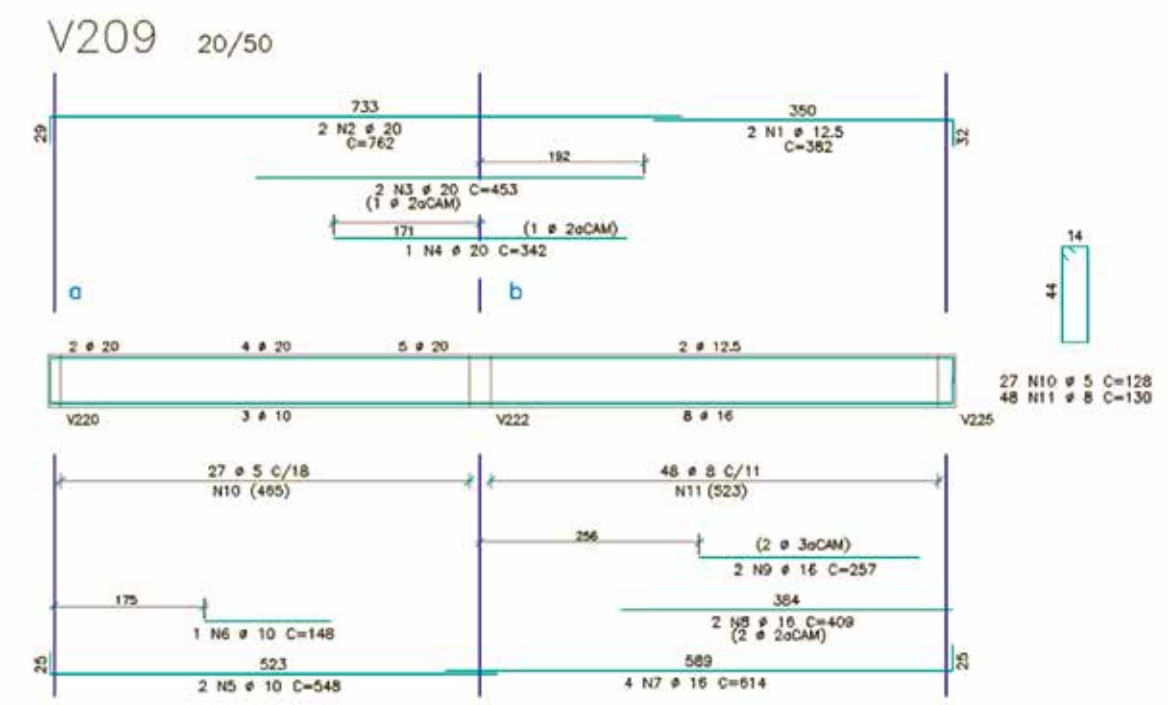
2.3. Activities

The subject "Graphic Expression" is divided into two parts: theoretical classes and practical classes in computer lab. During the theoretical classes, the contents related to the calculation of reinforced concrete are presented and discussed with students. In these classes, RA models were used to facilitate three-dimensional visualization of proposed structures and facilitate the observation of details. For example, in activity 1, students were presented with the 2D drawing for the detail of a reinforced concrete beam (Figure 2) with appropriate explanations on the distribution of the steel reinforcement of the beam. Students were then asked to access the Sketchfab app on their smartphones or tablets for three-dimensional viewing of the beam (Figure 3), using the RA functions.

In the practical classes held in the computer lab, the three-dimensional models available on the Sketchfab web platform were used. There were additional instructions in that model to perform the requested tasks, for example, to relate the reinforcement represented in the

2D project to the corresponding one in the 3D model. These activities were carried out in the laboratory by accessing the Sketchfab web platform. The themes covered with the RA content are drawings of reinforced concrete slabs and beams, with a focus on the details of drawings for the steel bars that are used for the reinforcement of the concrete. For the first half of 2019, four three-dimensional models were developed: two slab models and two beam models. Figure 2 presents the 2D design model for the detail of a reinforced concrete beam. Figures 3 and 4 present the 3D model for the beam detailed in Figure 2. The model depicted in Figure 3 is accessed via mobile phone. The model in Figure 4 is accessed through the web platform.

Figure 2. Beam Detail



Source: Own elaboration

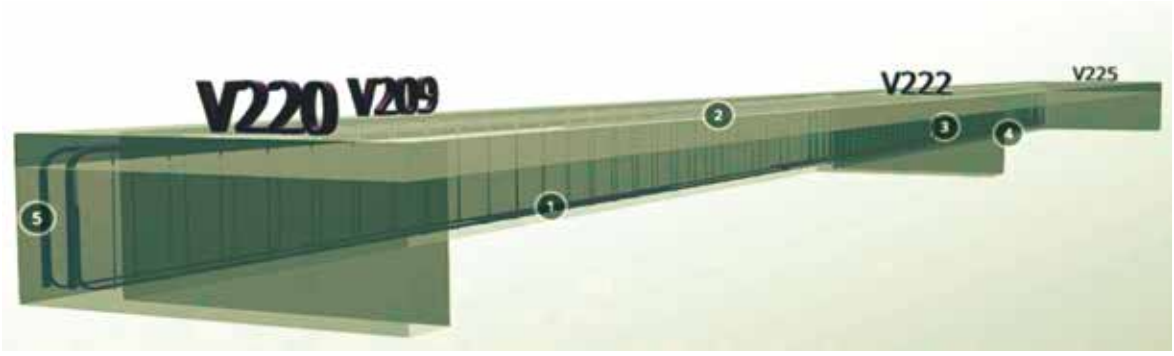
Using the Sketchfab platform has allowed to add some additional features to 3D models, such as text and audio. When clicking the numbered circles in Figure 4, the platform displays a text box. This resource was used to provide information to students about what they should observe at each of the points of the structure. However, this feature is only available for having access to models through the web environment.

For the specific case of reinforced concrete structures, the models are too dense due to the number of steel bars available. Thus, for the proposed activities, models were produced for the visualization of parts of a real structure. No model containing the entire structure of the building is presented.

Figure 3. 3D model in the Sketchfab app for mobile phones

Source: own elaboration

Figure 4. 3D model on Sketchfab web platform



Source: Own elaboration

2.4. The evaluation instrument

The instrument used to know the degree of acceptance of RA in students was a questionnaire answered by all students enrolled in the discipline. The questionnaire has three questions for the student characterization and twenty-three Likert scale issues with 5 options. Following Likert scale, the student should choose option 5 if he/she would totally agree with the statement and 1 if he or she would strongly disagree with it. The twenty-three Likert-scale issues were adapted from Cabero and Pérez›s research (2018) for the analysis by the TAM model of technology acceptance assessment by one person. Thus, the topics were grouped into the following categories: level of student knowledge about topics (2); student experience with visual applications and resources for structural engineering learning (3); usefulness of the resources and tools perceived by the student (6); ease of use of resources and tools perceived by the student (6) and; perceived enjoyment and intent to use resources and tools again (6).

Table 1. Presents the Likert scale topics and the classification of each.

Categories	Identification	Affirmation
Student knowledge of topics	A1	I have difficulty visualizing the arrangement of the rebar within the concrete structures.
	A2	Before the discipline I did not have enough knowledge of design detail in reinforced concrete structures.
Student experience with applications and visual resources	A3	I've never used 3D visual resources for learning structure design.
	A4	During the Civil Engineering course, I have never used RA resources for learning.
	A5	During the Civil Engineering course, I have not used applications for learning.
Utility of resources and tools perceived	A6	3D models help in visualizing the details of the rebar of reinforced concrete structures.
	A7	I think the use of 3D visual resources for learning structure designs is very relevant.
	A8	The use of RA favors the visualization of the rebar of the concrete structural elements.
	A9	I think it is very relevant to use applications for teaching designs of concrete structures.
	A10	Using the RA tool positively influenced my learning.
	A11	3D models are suitable for the content presentation of the subject.
Ease of use	A12	I had no problem seeing the 3D model on my cell phone.
	A13	I had no difficulty using the RA Sketchfab app.
	A14	Using the RA Sketchfab tool does not require any special experience or skill.
	A15	All the information provided for the use of Sketchfab was sufficient.
	A16	I had no problems accessing the texts available in the model.
	A17	The texts presented in the tool are organized appropriately.
Enjoy perceived and intended to use	A18	It is fun to use the RA tool.
	A19	I was more motivated with RA activities.
	A20	Using the RA tool makes learning more interesting.
	A21	I didn't get bored using the tool.
	A22	I would like to use the tool in the future.
	A23	RA tools could be used in other subjects.

3. Results

Out of the eighteen students participating in the research, 11 (61.9%) were men and 7 (38.9%) women; 15 students (83.3%) were from 21 to 25 years old and 3 (16.7%) were over 25 years old. Most of them (77.8%) have already had contact with structure drawing activities through apprenticeship or building technician work.

Table 2 shows the response percentages for the 5 options of the 23 Linkert scale questions. A6-A11 statements are related to the usefulness

of the resources and tools perceived by the student as well as the options selected (Table 2). More than eighty percent of the students totally agreed with all the statements of that category, indicating a great perceived usefulness by them.

Although most students were successful in using the application and viewing 3D models through the RA resource, it is considered the importance of presenting them with a more complete tutorial for installing and using resources, as that, for some, only the oral explanation was not enough. This result is perceived in the responses of the A12 to A17 statements that can be seen in Table 2, especially the responses of the A12 and A13 statements, where the difficulty of viewing RA structures on the mobile phone is observed. That difficulty occurred because not everyone had a device suitable for the app. In those cases, students worked together with their peers.

All students not only liked the activities, but also were motivated by the use of RA to learn the contents of that subject. It can be seen in the responses of A18 and A19, where one hundred percent chose options 5 or 4. In addition, all students would like to use the tool again (A22). They all also recommended the use of RA in other course subjects (A23), which confirms the relevance of 3D models to motivate the learning of civil engineering and technology here employed.

Table 2. *Results of Likert's Scale questions*

Linkert Scale Questions					
Identification	**5 (%)**	**4 (%)**	**3 (%)**	**2 (%)**	**1 (%)**
A1	11,1	11,1	16,7	27,8	33,3
A2	22,2	5,6	33,3	11,1	27,8
A3	61,1	11,1	11,1	5,6	11,1
A4	88,9	5,6	5,6	0,0	0,0
A5	22,2	11,1	22,2	16,7	27,8
A6	88,9	5,6	0,0	0,0	5,6
A7	94,4	0,0	5,6	0,0	0,0
A8	88,9	5,6	5,6	0,0	0,0
A9	100,0	0,0	0,0	0,0	0,0
A10	88,9	0,0	11,1	0,0	0,0
A11	100,0	0,0	0,0	0,0	0,0
A12	50,0	27,8	16,7	0,0	5,6
A13	50,0	27,8	16,7	0,0	5,6
A14	61,1	22,2	16,7	0,0	0,0
A15	77,8	11,1	11,1	0,0	0,0
A16	83,3	11,1	5,6	0,0	0,0
A17	77,8	11,1	11,1	0,0	0,0
A18	77,8	22,2	0,0	0,0	0,0
A19	66,7	33,3	0,0	0,0	0,0
A20	88,9	11,1	0,0	0,0	0,0

Likert scale issues					
Identification	**5 (%)**	**4 (%)**	**3 (%)**	**2 (%)**	**1 (%)**
A21	88,9	5,6	5,6	0,0	0,0
A22	100,0	0,0	0,0	0,0	0,0
A23	94,4	5,6	0,0	0,0	0,0

Conclusions

Based on the student responses, the use of 3D resources through RA is believed to be positive and relevant to improve spatial visualization ability (SVA) and consequently the student´s performance, but that was a preliminary study to test the use of RA in concrete structure subjects. The proposal was to plan four activities with RA resources and assess the student's perception on the usefulness of resources and tools, the ease of their use and the enjoyment and intention of using the resources again. The results will allow the necessary adaptations for the use of the resource in other classes and subjects. The study showed that with the use of the platform Sketchfab, it takes a long time to process models with a large number of objects when using the mobile phone. Although the statement of Meža *et al.* (2015 has been confirmed on one of the main limitations to the use of RA for educational purposes: The size of the 3D models, the chosen application is suitable for simpler models like those that were presented to students and that are sufficient for understanding the chosen content.

It was also obtained the right device to carry out the project. However, not all students had the mobile with the necessary configuration, as can be seen in the analysis of the results, but the use of RA for three-dimensional visualization is motivating for students, since it facilitates the understanding of the reinforcement distribution within the structural elements, allowing the realization of activities in a funnier way.

This research agrees with the results obtained by other authors (Barroso, Cabero & Moreno, 2016; Marín, 2017; Barroso, Cabero & Gutiérrez, 2018; Martínez & Fernández, 2018; Cabero & Roig, 2019), where it was used with university students from different disciplines, from Medicine to Fine Arts and Educational Sciences. Therefore, the degree of acceptance of this technology by students is quite significant; thus, it is recommended for the training of students.

As future lines of research, different topics are proposed, ranging from linking the use degree of RA technology, and different variables that can be predictors of students' self-perceptions: age, gender or knowledge, that students showed the contents of the subject involved in the experience; at the same time it may be interesting to relate the degree of acceptance of RA technology to the degree of acceptance of mobile devices by students (Seifert, Hervás-Gómez & Toledo-Morales, 2019).

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References

Abdullah, F. & Ward, R. (2016). Developing a General Extended Technology Acceptance Model for E-Learning (GETAMEL) by analysing commonly used external factors. *Computers in Human Behavior*, *56*, 238-256. https://doi.org/10.1016/j.chb.2015.11.036

Akçayir, M., Akçayir, G., Pektas H. M. & Ocak, M. A. (2016). Augmented reality in science laboratories: The effects of augmented reality on university students' laboratory skills and attitudes toward science laboratories. *Computers in Human Behavior*, *57,* 334-342.

https://doi.org/10.1016/j.chb.2015.12.054

Al-Emran, M., Mezhuyev, V. & Kamaludin, A. (2018). Technology Acceptance Model in M-learning context: A systematic review. *Computers & Education*, *125,* 389-412. https://doi.org/10.1016/j.compedu.2018.06.008

Azuma, R.T. (1997) A survey of augmented reality. Presence-Teleoperators and Virtual *Environments, 6*(4), 355-385.

Ayer, S. K., Messner, J. I. & Anumba, C. J. (2016) Augmented Reality Gaming in Sustainable Design Education. *Journal of Architectural Engineering*, *22*(1). https://doi.org/10.1061/(ASCE)AE.1943-5568.0000195

Barroso, J., Gutiérrez, J. J., Llorente, M. d. C., & Valencia, R. (2019). Difficulties in the Incorporation of Augmented Reality in University Education: Visions from the Experts. *Journal of New Approaches in Educational Research*, *8*(2), 126-141. https://doi.org/10.7821/naer.2019.7.409

Barroso, J., Cabero, J. & Moreno, A.M. (2016). La utilización de objetos de aprendizaje en Realidad Aumentada en la enseñanza de la Medicina. *Innoeduca. International Journal of Technology and Educational Innovation*, *2*(2), 77-83.

Barroso, J., Cabero, J. & Gutiérrez, J.J. (2018). La producción de objetos de aprendizaje en Realidad Aumentada por estudiantes universitarios grado de aceptación de esta tecnología y motivación para su uso. *Revista Mexicana de Investigación Educativa*, *23*(79), 1261-1283.

Cabero, J. & Barroso, J. (2016). The educational possibilities of Augmented Reality. *New Approaches in Educational Research*, *5*(1), 44-50. https://doi.org/10.7821/naer.2016.1.140

Cabero, J. & Pérez, J. L. (2018). Validación del modelo TAM de adopción de la Realidad Aumentada mediante ecuaciones estructurales. *Estudios sobre Educación*, 34, 129-153. https://doi.org/10.15581/004.34.129-153

Cabero, J. & Roig, R. (2019). The Motivation of Technological Scenarios in Augmented Reality (AR): Results of Dierent Experiments. *Applied Sciences*, *9*. https://doi.org/10.3390/app9142907

Cheung, R. & Vogel, D. (2013). Predicting user acceptance of collaborative technologies: An extension of the technology acceptance model for e-learning. *Computers & Education*, *63*, 160-175. https://doi.org/10.1016/j.compedu.2012.12.003

Chow, M., Herold, D. K., Choo, T. & Chan, K. (2012). Extending the technology acceptance model to explore the intention to use Second Life for enhancing healthcare education. *Computers & Education*, 59(4), 1136-1144. https://doi.org/10.1016/j.compedu.2012.05.011

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*, 319-340.

Fogarty, J., Mccormick, J. & El-Tawil, S. (2018). Improving Student Understanding of Complex Spatial Arrangements with Virtual Reality. *Journal of Professional Issues in Engineering Education and Practice*, 144(2), 1-10. https://doi.org/10.1061/(ASCE)EI.1943-5541.0000349

Katsio-Loudis, P. & Jones, M. (2015). Using computer-aided design software and 3D printers to improve spatial visualization. *Technology & Engineering Teacher*, 14-20.

Li, W., Nee, A. Y. C. & Ong, S. K. (2017). A State-of-the-Art Review of Augmented Reality in Engineering Analysis and Simulation. *Multimodal Technologies and Interact*, *1*(3). https://doi.org/10.3390/mti1030017

Lin, H. (2016). Influence of design training and spatial solution strategies on spatial ability performance. *International Journal of Technology & Design Education*, *26,* 123-131. https://doi.org/10.1007/s10798-015-9302-7

Marín, V. (2017). The augmented reality in the educational sphere of student of degree in chilhood education. Case Study. *Pixel-Bit. Revista de Medios y Educación, 51,* 7-19. http://dx.doi.org/10.12795/pixelbit.2017.i51.01

Martínez, S., & Fernández, B. (2018). Objetos de Realidad Aumentada: percepciones del alumnado de Pedagogía. *Pixel-Bit. Revista de Medios y Educación*, *53,* 207-220. http://dx.doi.org/10.12795/pixelbit.2018.i53.14

Mello, G. N. A. (2016). Teachers' perspective about factors that prevent success in teaching and learning process in higher education of enginee-

ring in Brazil. *Problems of Education in the 21st Century*, *74*, 61-70. (http://bit.ly/350Os5X).

Mello, G. N. A., Maia, E.V. & Calixto, J. M. F. (2016). CONCWEB: hybrid learning tool for reinforced concrete design. *ETD-Educação Temática Digital*, *18* (1), 156-177. https://doi.org/10.20396/etd.v18i1.8638248

Meža, S., Turk, Ž. & Dolenc, M. (2015). Measuring potential of augmented reality in civil engineering. *Advances in Engineering Software*, *90,* 1-10. https://doi.org/10.1016/j.advengsoft.2015.06.005

Molyneaux, T., Setunge, S., Gravina, R. & Xie, M. (2007). An evaluation of the learning of structural engineering concepts during the first two years of a project-based engineering degree. *European Journal of Engineering Education*, *32*(01), 01-08. (http://bit.ly/2YH0krD).

Segil, J. L., Sullivan, J. F., Tsai, J. Y., Reamon, D.T. & Forbes, M. H. (2017). Investigation of spatial visualization skills across world regions. *Frontiers in Education Conference*, 18-21 de octubre, 2017. (http://bit.ly/2P5ORP9)

Sorby, S. A. (2001). A course in spatial visualization and its impact on the retention of female engineering students. *Journal of Women and Minorities in Science and Engineering, 7,* 153-172.

Sorby, S. A., & Veurink, N. (2012). Spatial skills among minority and international engineering students. *American Society for Engineering Education*, *25.* (http://bit.ly/2PwLMqf).

Schoonenboom, J. (2014). Using an adapted, task-level technology acceptance model to explain why instructors in higher education intend to use some learning management system tools more than others. *Computers & Education*, 71, 247-256. https://doi.org/10.1016/j.compedu.2013.09.016

Seifert, T., Hervás-Gómez, C. & Toledo-Morales, P. (2019). Diseño y validación del cuestionario sobre Percepciones y actitudes hacia el aprendizaje por dispositivos móviles. kPixel-Bit. *Revista de Medios y Educación*, *54*, 45-64. https://doi.org/10.12795/pixelbit.2019.i54.03

Wu, B. & Chen, X. (2017). Continuance intention to use MOOCs: Integrating the technology acceptance model (TAM) and task technology fit (TTF) model. *Computers in Human Behaviour*, (67), 221-232. https://doi.org/10.1016/j.chb.2016.10.028

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Augmented reality and stellarium: astronomy for children of five years

Realidad Aumentada y stellarium: astronomía para niños y niñas de cinco años

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Abstract

Educators are called to favor digital literacy, introducing the different technological tools for educational purposes since they are part of the daily use of children. Augmented reality and the Stellarium program are powerful tools for teaching astronomy, since they allow observing the stars, constellations and solar system, facilitating the explanation of celestial phenomena to the educator. The objective of this study was to analyze the educational intervention with augmented reality and the Stellarium program, in the development of astronomical language, specifically the semantic and morphosyntactic aspect of the solar system, stars and constellations, for five-year-old boys and girls. The educational intervention was carried out in the Didactic Classroom of the University of Playa Ancha and applied to the children of the Major Transition Level, of three municipal establishments: Liceo San Felipe and the Almendral and José Bernardo Suárez Schools. Through a quasi-experimental study (pre and post test), the progress of the fifty-three boys and girls who participated in the study through two tests was analyzed. The results obtained evidenced the progress in scientific language by recognizing elements of the universe —semantic aspect— expressing ideas and explanations about astronomical events —morphosyntactic aspect— that children knew in the educational intervention.

Keywords: Language, astronomy, augmented reality, Stellarium program.

Resumen

Los educadores están llamados a favorecer la alfabetización digital, introduciendo las distintas herramientas tecnológicas con fines educativos ya que son parte del uso cotidiano de los niños y niñas. La Realidad Aumentada y el programa Stellarium, son poderosas herramientas para la enseñanza de la Astronomía, ya que permiten observar las estrellas, constelaciones y sistema solar, facilitando la explicación de los fenómenos celestes al educador/a. El presente estudio tuvo como objetivo analizar la intervención educativa con Realidad Aumentada y el programa Stellarium, en el desarrollo de lenguaje astronómico, específicamente el aspecto semántico y morfosintáctico sobre el sistema solar, estrellas y constelaciones, para niños y niñas de cinco años de edad. La intervención educativa fue llevada a cabo en el Aula Didáctica de la Universidad de Playa Ancha y aplicada a los niños y niñas del Nivel de Transición Mayor, de tres establecimientos municipales: Liceo San Felipe y las Escuelas Almendral y José Bernardo Suárez. Por medio de un estudio cuasi experimental (pre y post test), se analizó el avance que tuvieron los cincuenta y tres niños y niñas que participaron del estudio a través de dos test. Los resultados obtenidos evidenciaron el avance en el lenguaje científico al reconocer elementos del universo —aspecto semántico— expresar ideas y explicaciones sobre eventos astronómicos —aspecto morfosintáctico— que los niños y niñas conoció en la intervención educativa.

Descriptores: Lenguaje, astronomía, Realidad Aumentada, programa Stellarium.

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1. Introduction

In the current educational scenario, communication and information technologies, such as the whiteboard, the Internet and its learning resources (digital and virtual as educational software), can be good resources for the teaching of Astronomy, as they allow children to observe the stars and constellations, just as they would look them at night. According to Vargas and Maya "the use of simplified models for teaching is an important resource for the teaching of science, because resorting to everyday-visual experiences favors the formation of mental images" (2007, p. 2). Interactive educational resources are part of these technological means that can promote better learning, because the use of multimedia materials (simulators and Augmented Reality) provide teaching options that facilitate an effective process and better quality education. In this regard, Bartolomé-Pina, García-Ruiz, and Aguaded point out that "trends continue to grow and new devices, increasingly accessible and ubiquitous, come with new technological trends and teaching strategies such as augmented reality (2018, p. 34). It is important to note that according to De Lima and Moreira (2019) the incorporation of ICTs into teaching contributes to the empowerment of pedagogical actions by educators.

Astronomy is one of the oldest sciences, but given to the technological growth it is also a modern science. Astronomy arouses curiosity in children, reason for which the Ministry of Education contemplates in the Curriculum of Initial Education, in the Exploration of the Natural Environment, the teaching of astronomy. In this way, "it is hoped to promote in girls and boys the skills, attitudes and knowledge that allow them to understand, appreciate and care for their natural environment, enhancing their curiosity and capacity for wonder" (Subsecretaría de Educación Parvularia, 2017, p. 83). From a young age, children have concrete astronomical experiences of observing the sky especially the moon, the sun and the stars, causing in them curiosity, questions and, above all, a lot of diverse questions and ideas, which it is essential to rescue when developing the topic in the classroom. In this regard Martin, Sexton, Franklin and Gerlovich (2005) point out that people who have received an education in astronomy can better understand the environment in which they live and position themselves individually within the universe. Children create their perceptions of different aspects of the macrocosm, which contrast with new scientific concepts, in an attempt to understand the phenomena of the natural world (Vosniadou & Brewer, 1992). This process requires early intervention that provides environments and tools for the development of ideas and new concepts. According to Galperin (2015), to generate changes in the way celestial phenomena are related to "supernatural" explanations, it is necessary for the education system to start incorporating them into its curriculum at an early age.

This study aimed to analyze educational intervention with augmented reality and the Stellarium program, in the development of astronomical language, specifically the semantic and morphosintactic aspect about the solar system, stars and constellations for five-year-old students.

1.1. Augmented Reality

The term "Augmented Reality" (AR) was first used in 1992, by Tom Caudell to designate experiences in which digital information (by means of text, image, audio, video, 3D objects or others) is added to a real-time physical world view. To perform this overlapping of virtual and real information, it is necessary to use technological devices such as: computers with webcams, or laptops, tablets or smartphones. According to Gómez (2013), AR is that environment in which takes place the integration of the virtual and the real. On the other hand, Cabero and Barroso (2016), points out that the use of AR in educational contexts allows to improve the training actions, therefore, students increase the levels of learning by creating these technological scenarios.

The application of AR in education is mostly due to the use of portable devices, smartphones and tablets and for teaching purposes. It is what it is known as mobile-learning, or m-learning, which Quinn (2000), points to as a type of e-learning through mobile devices. For their part, Basogain, Olabe, Espinosa, Rouèche and Olabe (2007) state that "augmented reality does not replace the real world with a virtual one, but on the contrary, maintains the real world that the user sees by complementing it with virtual information superimposed on the real" (2007, p. 1).

In the educational context, the literature notes that the use of RA positively influences the motivation of the students. One of them is that of Cubillo, Gutiérrez, Gil, and Colmenar, mentioning that AR "facilitates, motivates and makes the explanation and assimilation of the contents more pleasant for both teachers and students, while stimulating and motivating learning" (2014, p. 248). On the other hand, Reinoso says that "... AR strengthens learning and increases motivation to learn" (2012, p. 371). Also, Fonseca, Redondo and Valls (2016), say that the experience of using real-world images is satisfying and motivating because it allows a greater understanding of the space. Also according to Prendes (2015), this tool is used to provide internships to students with some medical applications. However, it is essential that teachers are trained to use the application, so they can interact with students throughout the learning process (Oluwadare, 2015).

1.2. Use of simulators in Astronomy

According to *Real Academia Española* (RAE) the term simulation comes from the Latin *simulatio,* -**ō**nis, and it is the "action and effect of simulating". Therefore, it consists in placing the student in a context that imitates some aspect of reality in this environment, stablishing situations that the student would have to face in a real context. Salas (1995), notes that students concentrate better on a given object by using simulation in the teaching process.

The Stellarium program has open source and is a software that allows the computer to use it as a planetarium since the sky is exhibited in 3D, as can be seen with the naked eye with telescope or binoculars. It points to the positions of the stars, the sun, the planets and the moon, and depending on the location and time, it shows how an observer sees the sky. It also simulates astronomical phenomena such as lunar or solar eclipses, meteor showers and it draws constellations. As an educational tool, it allows to teach the night sky, it helps the observation for amateur astronomers, or simply as a curiosity to encourage the study of planetary sciences.

The various programs that have been created through technology "... are important because of the diversity of possibilities they offer to create new communicative scenography for teaching" (Aguaded & Cabero, 2014, p.71). Therefore, the use of the Stellarium program is a simplified model of great importance for the teaching of science, since by requiring visual experiences as everyday it allows the formation of mental images, facilitating the notion approximation of astronomy (Vargas & Maya, 2007).

1.3. Astronomy in childhood

Astronomy comes from the lat. "astronomĭa, and this from the gr. ἀστρονομία"; as a science, it studies the universe beyond the earth's atmosphere, including the sun, moon, the planets and the stars (Brewer, 2001; Eliason & Jenkins, 2011). These topics are of great interest to the little ones, since day and night, the sun, the moon and the stars are part of the experiences they live daily because they are in their environment. For Educarchile "astronomy in school offers valuable opportunities for strengthening the personality and development of children's cognitive skills, who acquire a deeper view of their place in the world and receive tools" (online). For this reason,

Ampartzaki and Kalogiannakis (2016) work on a project that has a multidisciplinary approach and it is based on concepts that they consider essential to the teaching of astronomy, which are spatial learning and spatial thought.

Kallery (2010), notes that there are few studies aimed at astronomy and these are relatively limited compared to the number of studies on other disciplines. At the national level, the report 'Reaching the Stars: Findings of the Chilean-American Summits on Education and Dissemination of Astronomy' only points out the teaching of astronomy at the level of Elementary and Higher education, leaving aside various proposals that are being implemented.

According to Cabello (2011), astronomy originated from the natural curiosity that children have to understand natural phenomena and answer the questions with more rigorous explanations. Developing positive attitudes towards astronomy is a significant part of scientific literacy for contemporary societies (Uçar & Demircioğlu, 2011). In addition, according to Nussbaum (1989), it must be considered that children have concrete astronomical experiences, ideas and theories linked to them from an early age. Therefore, an educational intervention is proposed for five-year-old students in the learning of astronomy language on the solar system, stars and constellations, using augmented reality and the Stellarium program.

1.4. Educational intervention

Educational interventions were applied in the Didactic Classroom of the Children Education Career of the University of Playa Ancha, San Felipe Campus. In this Didactic Classroom, "activities that go beyond memoristic learning are carried out, which aim to train the understanding of the contents through technological tools of the S XXI" (Pérez- Lisboa & Caldeiro, 2016, p. 184). The tools used were the Stellarium and AR simulator which were used to implement the educational experiences.

The contents seen by the children teachers in the educational intervention were separated into three units, each divided into four 60-minute sessions. The contents viewed in each unit are detailed in the following table.

Table 1. Contents and sessions

Unit	Sessions
Solar System	The Sun
	Planets
	Comets
	The Moon
The Stars	What are the stars
	Star Evolution
	HR Diagram
	Star Groupings
Constellations	What are the constellations
	History and legends of the sky
	Constellations of the original people
	Locating the constellations

The Stellarium simulator was used in every 60-minute session by the teacher in the first and third units. This tool was chosen as it shows the night sky and its evolution over time. In the first unit, this tool allowed showing children the trajectories that planets have in the sky and the months in which they can be seen. Also, it points out the movements of the moon and its phases. In the third unit, the simulator was used to teach what the constellations are, their location and their shapes. This program was selected because of its excellent graphics, since not only are the lines that join the stars observed, but it also shows the images of the mythological beings and objects they represent, allowing at the same time the teacher to tell legends associated with them, in the different mythologies (classic and original people).

Augmented reality was used in units one and two since 3D images of planets, satellites and stars were available, so that students could appreciate their main characteristics using the different senses.

2. Methodology

The design of this research corresponds to a quasi-experimental study with pre-test/post-test (Hernández Sampieri, Fernández Collado & Baptista, 2014) because researchers only observe and analyze the teaching-learning process that is carried out by ICT.

The tests that were applied to the population under study were two. The first analyzed the level of the semantic aspect of the child, and the second analyzed the morphosintactic level of students of the astronomical language taught in the educational intervention. The tests were prepared by researchers and validated by expert judgement. The first test consists of eight sheets, each sheet has four astronomical objects, where the child must point to the object named by the examiner. The second test has fourteen questions, in the first three he/she must complete the sentences, in the next three the student must identify the wrong term, in the three successive ones, the student should indicate what happens to each celestial body, in the three that follow the student must create a sentence with the element mentioned and in the last two the student must say all the things he/she knows of the named celestial body. For both tests, the student is given a point if the answer is wrong and two points if the answer is correct.

The sample of the study corresponded to fifty-three children from the municipal establishments: Liceo San Felipe (sixteen), Escuela Almendral (eighteen) and Escuela José Bernardo Suárez (nineteen). The educational intervention was carried out in 12 sessions, which were developed in the Didactic Classroom of the University of Playa Ancha, San Felipe Campus. The working group was made up of the main investigator, a kindergarten educator, a scientific advisor and a computer engineer.

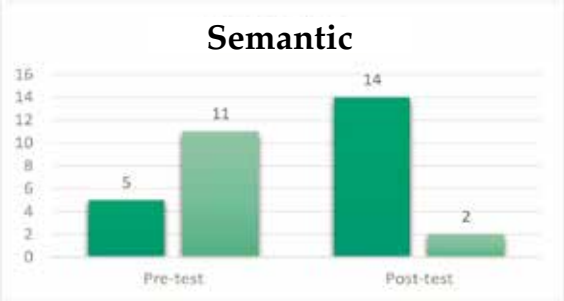
3. Results and discussion

This quasi-experimental research analyzes the results of an educational intervention using augmented reality and the Stellarium program for five-year-old students in the learning of astronomy. The fifty-three children who participated in the educational intervention were developing the semantic and morphosyntactic aspects of the solar system, stars and constellations.

The application of the test that evaluated the semantic aspect allowed to know the advancement in the vocabulary of the concepts of sun, moon, Earth, Mars, Saturn, constellation, star and comet. The pre- and post-test results will then be examined.

San Felipe School

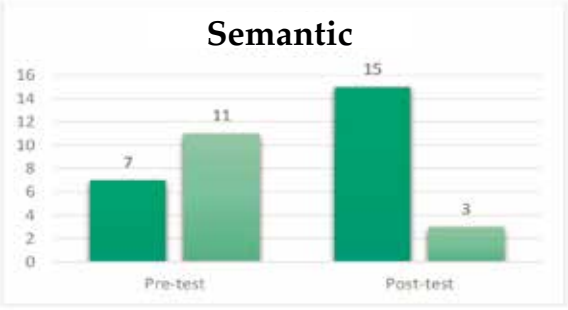
Figure 1. Results of the semantic assessment



The sixteen children who participated in the intervention of San Felipe school, Figure 1, were learning the concepts. In the pre-test, only five knew the terms, in the post-test fourteen children managed to identify the concepts taught.

Almendral school

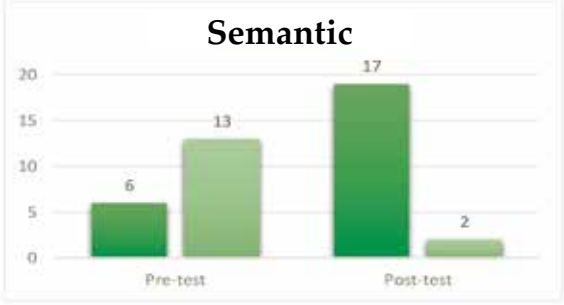
Figure 2. Results of the semantic assessment



From the eighteen children who participated, Figure 2, most of them were assimilating the concepts evaluated. In the pre-test there were only six identifying the terms, in the post-test seventeen children knew all the concepts explained in the educational intervention.

José Bernardo Suárez School

Figure 3. Results of the semantic assessment



From the nineteen children who participated in the intervention at José Bernardo Suárez school, Figure 3, most of them were learning the concepts. In the pre-test only six knew the terms, in the post-test seventeen students managed to identify the concepts taught.

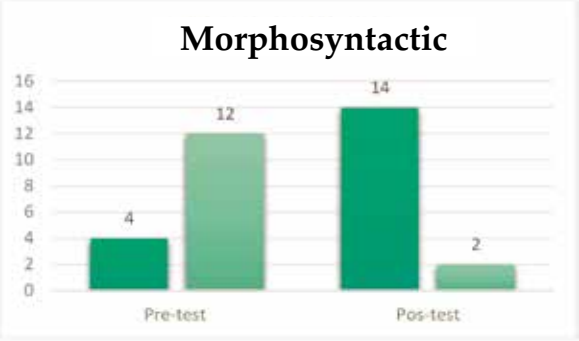
The analysis of the three institutions shows a significant advance in the learning of concepts, the semantic aspect "relates to the awareness and organization of linguistic content in memory and to the fluency to establish significant relationships that the person has" (Pérez-Lisboa, 2017, p. 6). In this regard, Kallery (2010) points out that astronomical concepts such as day and night change and the sphericity of the land that are considered difficult for young children can be understood if presented with teaching strategies that motivate them. According to Pérez, Castillo and Ríos (2017), "AR create close and meaningful learning experiences in children", allowing learning. On the other hand, Longhini and Menezes (2010), point out that the use of the Stellarium program is a tool that reveals a high educational potential, since it has more than 600,000 stars; illustrations of the constellations; planets of the solar system and its satellites, solar

and moon eclipses, among others. Additionally, Stellarium significantly reinforces the contents taught in class (Sá Muniz & da Silva, 2015).

Continuing the analysis, the morphosyntactic aspect was done to evaluate the completion of phrases, detect errors in phrases, establishments of causal relationships, construction of phrases and enumeration of elements belonging to certain verbal categories. The results of each institution are presented below.

San Felipe School

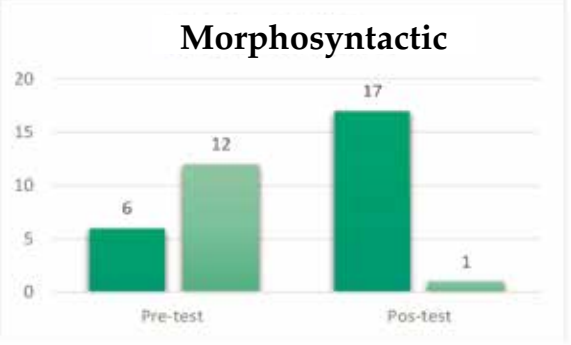
Figure 4. Results of the morphosyntactic assessment



In San Felipe school, Figure 4, is observed that children made significant progress in constructing sentences, using the astronomical language they were learning. At the end of the educational intervention, the result of the post-test indicates that fourteen children were able to advance the grammatical structure by using word classes and composing them in the order of the sentence elements, which only four of them perform according to the pre-test.

Almendral School

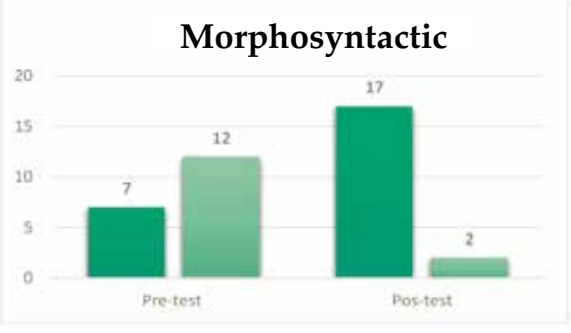
Figure 5. Results of the morphosyntactic assessment



The eighteen children who participated in the educational intervention of the Almendral School, Figure 5, advanced in the creation of sentences since only six performed it in the pre-test. At the end of the educational intervention, seventeen children were using words and artifices for the composition and order of the sentence elements in explaining the astronomical phenomena.

José Bernardo Suárez School

Figure 6. Results of the morphosyntactic assessment



Out of the nineteen children who participated in the study, Figure 6, seven structured a sentence properly in the pre-test. At the end of the intervention, sixteen used type of words and composed them in order of the sentence elements, when they explained the astronomical concepts taught.

The morphosintactic aspect involves understanding the different parts of the sentence

and the function that each one has in the total text (Díaz & Álvarez-Salamanca, 2006). According to Peterson and French (2008), children learn the linguistic components of color mixing explanations by engaging in discussions with educators and peers. In this context, the Stellarium program in simulating the movements of the Earth and the phases of the Moon allows students to explain what they are observing (Andrade, Silva & Araújo, 2009). In addition, Reinoso (2012) notes students can explore and explain their physical properties with RA and the visualization of 3D objects. Therefore, both tools allowed visual experiences to advance the construction of scientific language by communicating the observed phenomena.

Conclusions

Since Astronomy is a science that requires night observation, simulators such as the Stellarium program and augmented reality can fill this inconvenience by realistically showing the night sky, allowing children to observe the stars, constellations and solar system as they would see it at night, facilitating the explanation of celestial phenomena to the educator.

For this reason, kindergarten educators must diversify opportunities by incorporating innovative means into the teaching and learning process. Using technological resources in education is a methodological contribution and it represents a challenge in modifying the repertoire of pedagogical practices to promote creativity in teachers.

From the results obtained in the educational intervention it is noted that:

- The use of augmented reality and simulators in education has allowed to diversify teaching to improve learning. The girl and the boy is the protagonist and forger of his/her own knowledge, through his/her skills in the management of the technological resources.
- The results of the tests applied in the three schools show that the incorporation of ICT into educational intervention is a support in the learning of astronomical concepts and in the development of scientific language by the children, which is consistent with the study of Pérez-Lisboa (2017).
- The development of this educational intervention was proposed as a support tool for the study of stars and constellations. In this educational intervention, it is observed the great interest of multimedia resources in children, the great motivation they have and the enormous conceptual scopes reflected in the performances obtained and in the domain and ownership over the acquired knowledge, which is consistent with the studies of Cubillo et al. (2014).
- The contents worked with this material and the way they are presented in this educational intervention, through 3D images and simulations, generated curiosity and interest in the students to know each of the topics, allowing them to improve their performance, since they are focused on the activities they carry out, which is consistent with the studies conducted by Giasiranis and Sofos (2016).
- This research highlights the importance of this type of teaching and interactive resources for teaching-learning. Astronomy, being a science that is based on observation and especially night watching, is favored with the incorporation of these technologies for its dissemination and teaching.
- ICT is a recreational teaching medium where the teacher and the student not only interact with inanimate objects, but can generate movement, making the teaching and learning process fun and interactive. In this way, ICTs become a tool that allows to make representations to know the characteristics and attributes of the universe, as noted in MINEDUC (2001).
- With regard to the limitations of this study, the short implementation time interfered since it lasted only one semester and not two as occurred in the interventions of previous years, this was due to the little funding given

to the project, which did not allow to continue paying the teacher who was in charge.

As projections, the research team intends to continue to seek funding alternatives to continue teaching astronomy to children.

Supports and Funding

This research was supported by the General Research Department of University de Playa Ancha

Ethical considerations

Before evaluating the children who participated in the educational intervention, the parents and guardians gave their informed consent, and also agreed to have their photographs taken and recorded for them to be used in this article. In addition, the kindergarten teachers who implemented the project also provided their informed consent to this article.

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We want to thank all the children who participated in the research, the interest in learning, the joy, the curiosity, the affection, and respect they showed, which allowed us to show that what they were doing was very important to them. To their parents and relatives for authorizing the participation in the study. To the directors, heads of the educative institution, educators of kindergartens for believing in our project. To the kindergarten educators who implemented the educational intervention. Finally, we thank the General Research Department and the Faculty of Engineering of the University of Playa Ancha, by having financed this research.

References

Aguaded, I., & Cabero, J. (2014). Avances y retos en la promoción de la innovación didáctica con las tecnologías emergentes e interactivas. *Educar especial 30 aniversario* 67-83.

https://doi.org/10.5565/rev/educar.691

Ampartzaki, M., & Kalogiannakis, M. (2016). Astronomy in Early Childhood Education: A Concept-Based Approach. *Early Childhood Education Journal*, *44*(2), 169-179.

Andrade, M., Silva, J., & Araújo, A. (2009). utilização do software stellarium Para o ensino de astronomia. (http://bit.ly/2DX1Mwn).

Bartolomé-Pina, A., García-Ruiz, R., & Aguaded, I. (2018). Blended learning: panorama y perspectivas. *Revista Iberoamericana de Educación a Distancia*, *21*(1), 33-56. http://dx.doi.org/10.5944/ried.21.1.18842

Basogain, X., Olabe, M., Espinosa, K., Rouèche, C., & Olabe, J. (2007). *Realidad Aumentada en la Educación: una tecnología emergente*. (http://bit.ly/36h35Co).

Brewer, J. A. (2001). *Introduction to early childhood education: Preschool through primary grades*. USA: By Allyn and Bacon.

Cabello, M.J. (2011). Ciencia en educación infantil: la importancia de un "rincón de observación y experimentación" o "de los experimentos" en nuestras aulas. *Revista, 10*.

Cabero, J., & Barroso, J.M. (2016). Posibilidades educativas de la Realidad Aumentada. *Journal of New Approaches in Educational Reasearch*, *5*(1), 46-52

Cubillo, J., Gutiérrez, S., Gil, M., & Colmenar, A. (2014). Recursos digitales autónomos mediante Realidad Aumentada. RIED. *Revista Iberoamericana de Educación a Distancia*, *17*(2), 241-274.

De Lima, M. R., & Moreira de Andrade, I. (2019). Significaciones docentes sobre la integración de tecnologías digitales en prácticas pedagógicas. *Alteridad, 14*(1), 12-25. https://doi.org/10.17163/alt.v14n1.2019.01

Díaz, C., & Álvarez-Salamanca, E. (2006). La importancia de potenciar tempranamente las competencias lingüísticas en la etapa inicial. *Boletín de Investigación Educacional*, *21*(1), 115-137. Facultad de Educación. Pontificia Universidad Católica de Chile. Santiago.

Educarchile. (http://bit.ly/2S26Bwq).

Eliason, C. F., & Jenkins, L.T. (2011). *A practical guide to early childhood curriculum's*. Pearson.

Fonseca, D., Redondo. E., & Valls, F. (2016). Motivation and Academic Improvement Using Augmented

Reality for 3D Architectural Visualization. *Education in the Knowledge Society, 17*(1), 45- 64.

Galperin, D. (2015). Propuestas didácticas para la enseñanza de la Astronomía. (http://bit.ly/34Gfy14).

Giasiranis, S., & Sofos, L. (2016). Production and Evaluation of Educational Material Using Augmented Reality for Teaching the Module of "Representation of the Information on Computers" in Junior High School. *Creative Education, 07*(09), 1270-1291. (http://bit.ly/2s7YWlq).

Gómez, M. (2013). *Educación Aumentada con Realidad Aumentada.* En 3er Congreso Internacional sobre Buenas Prácticas con TIC en la Investigación y la Docencia. Universidad de Málaga. 23-25 de octubre.

Hernández, R., Fernández, C., & Baptista, P. (2008). *Metodología de la Investigación*. México: McGraw-Hill.

Kallery, M. (2010). Astronomical concepts and events awareness for young children. *International Journal of Science Education, 33*(3), 341-369. http://dx.doi.org/10.1080/09500690903469082

Longhini, M., & Menezes, D. (2010). Objeto virtual de aprendizagem no ensino de astronomia: algumas situaçõesproblema propostas a partir do Software stellarium. *Caderno Brasileiro de Ensino de Física, 27*(3), 433-448. https://doi.org/10.5007/2175-7941.2010v27n3p433

Martin, R., Sexton, C., Franklin, T., & Gerlovich, J. (2005). *Teaching science for all children an inquiry approach.* Boston: Pearson Publishing.

MINEDUC (2001). *La Educación Parvularia en Chile*. Unidad de Educación Parvularia División de Educación General Ministerio de Educación República de Chile. (http://bit.ly/34z2N8P).

Nussbaum, J. (1989). La tierra como cuerpo cósmico. En R. Driver, E., Guesne, y A. Tiberghien, *Ideas científicas en la infancia y la adolescencia*. Madrid: Morata.

Oluwadare, F. (2015). ICT Use in Preschool Science Education: A Case Study of Some Private Nursery Schools in Ekiti State. *Journal of Education and Practice, 6*(31), 75- 79.

Pérez-Lisboa, S. (2017). Descubriendo el lenguaje a través de la Realidad Aumentada y la pizarra digital. *Revista Electrónica Educare, 21*(3), 1-13. http://dx.doi.org/10.15359/ree.21-3.14

Pérez-Lisboa, S., & Caldeiro, M. (2016). Aprendiendo Ciencia en el Aula didáctica: retos y potencialidades. *Ecos de la Academia*, *2*, 182-185.

Pérez, S., Castillo, J., & Ríos, C. G. (2017). Realidad Aumentada y pizarra digital interactiva en la construcción de habilidades científicas. Una propuesta metodológica para niños y niñas del nivel transición mayor en el aprendizaje de la física. En: *Investigaciones y experiencias en educación virtual*. Bogotá, Colombia: Ediciones UGC.

Prendes, C. (2015). Realidad Aumentada y educación: análisis de experiencias prácticas. *Revista de Medios y Educación, 46,* 187 -203. http://dx.doi.org/10.12795/pixelbit.2015.i46.12

Peterson, S., & French, L. (2008). Supporting young children's explanations through inquiry science in preschool. *Early Childhood Research Quarterly, 23*, 395-408.

RAE. Real Academia Española. (https://dle.rae.es/?id=XvyuZ0x).

Salas, R. (1995). La simulación como método de enseñanza y aprendizaje. *Educación Médica Superior*, *9*(1).

Sá Muniz, T., & da Silva, E. (2015). Método didático para o ensino de Astronomia: utilização do software Stellarium em conjunto com aulas expositivas no ensino médio. *Revista Eletrônica da Fainor, Vitória da Conquista, 8*(2), 87-97.

Subsecretaría de Educación Parvularia. *Bases Curriculares de Educación Parvularia.* Santiago, Chile: MINEDUC.

Quinn, C. (2000). *mLearning. Mobile, Wireless, In-Your-Pocket Learning. Linezine. Fall 2000.* (http://bit.ly/343PT27).

Vargas, J., & Maya, O. (2007). *Enseñanza de la astronomía con material interactivo*. (http://bit.ly/2Yw06Dr).

Vosniadou, S., & Brewer, W. (1992). Mental models of the earth: A study of conceptual change in childhood. *Cognitive Psychology*, *24*(4), 535-585. (http://bit.ly/34vDvIn)

Uçar, S., & Demircioğlu, T. (2011). Changes in preservice teacher attitudes toward astronomy within a semester-long astronomy instruction and four-year-long teacher training programme. *Journal Science Education Technology*, *20*(1), 65-73. https://doi.org/10.1007/s10956-010-9234-7

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The transcendence of Augmented Reality in student motivation. A systematic review and meta-analysis

La trascendencia de la Realidad Aumentada en la motivación estudiantil. Una revisión sistemática y meta-análisis

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Abstract

The arrival of information and communication technologies (ICTs) in the education system has meant that many new resources of great didactic interest have reached the classroom. This is the case of Augmented Reality, a technology that has become popular due to its ability to combine virtual and real elements at the same time. This work has attempted to investigate the scientific literature to see if the application of Augmented Reality in the classroom promotes a motivational improvement in the student body of the various educational stages. For this purpose, the methodology corresponding to the systematic reviews and meta-analysis proposed by the PRISMA declaration was used, taking as data source the databases Scopus and Web of Science. A total of nine quasi-experimental methodologies were analysed around the measurement of the motivation variable. The results elucidated a favourable diagnosis to the experimental groups, so it could be inferred that experimentation in the classroom with Augmented Reality motivates the student body of different educational stages. Nevertheless, it is necessary to carry out a greater number of experiences with Augmented Reality in the classrooms in order to be able to establish an opinion around a more solid body of scientific work.

Keywords: Augmented Reality, motivation, emerging technologies, systematic review, meta-analysis, education.

Resumen

La llegada de las tecnologías de la información y comunicación (TIC) al sistema educativo ha propiciado que numerosos recursos novedosos y de gran interés didáctico lleguen a las aulas. Este es el caso de la Realidad Aumentada, tecnología que se ha popularizado por su capacidad para combinar elementos virtuales y reales al mismo tiempo. El presente trabajo ha pretendido indagar en la literatura científica para comprobar si la aplicación de Realidad Aumentada en las aulas promueve una mejora motivacional en el estudiantado de las diversas etapas educativas. Para ello, se recurrió a la metodología correspondiente a las revisiones sistemáticas y meta-análisis propuestas por la declaración PRISMA tomando como fuente de datos las bases de datos Scopus y Web of Science. Un total de nueve de metodología cuasi experimental fueron analizados en torno a la medición de la variable motivación. Los resultados dilucidaron un diagnóstico favorable a los grupos de carácter experimental, por lo que se pudo inferir que la experimentación en el aula con Realidad Aumentada motiva al estudiantado de distintas etapas educativas. No obstante, se plantea la necesidad de realizar mayor número de experiencias con Realidad Aumentada en las aulas para poder establecer un dictamen en torno a un cuerpo más sólido de trabajos científicos.

Descriptores: Realidad Aumentada, motivación, tecnologías emergentes, revisión sistemática, meta-análisis, educación.

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1. Introduction and state-of-the-art

Society has undergone profound transformations in recent years, impacting not only the social level, but also the educational. The advent of information and communication technologies (ICT) has led the educational process to turn the direction towards active learning and innovation (Ravelo, Revuelta, & González, 2018). Faced with these changes, educational institutions need to reconsider the educational priorities that are aimed at the conception of education, and that their pedagogical approaches have a holistic and current vision that involves cognitive, procedural and attitudinal aspects, which train people with functional skills and competencies in, with and for digital media (Trujillo, Aznar, & Cáceres, 2015; Esteve, Adell, & Gisbert, 2013; De Pablos, Bravo, & Moreno, 2010).

In this sense, with the advent of ICTs in the educational context, numerous technological resources started being used in the classrooms, with the aim of energizing the teaching-learning process through the active learning of students supported by these tools. It is a school context where students now do not learn as before, and therefore the mission of the education system is to find the resources that allow students to approach content in an attractive and novel way (Hinojo, Aznar, Cáceres, & Romero, 2019).

Among these resources, Augmented Reality is now a technology that has been introduced in most sectors of society including education. Although its use began in the early 1990s (Caudell & Mizell, 1992), it has now become popular due to the cheapening of its use and simplification in the equipment and devices necessary for its use (Akçayır & Akçayır, 2017). In this way, this technology is being the subject of research in various sectors (Chicchi-Giglioli, Pallavicini, Pedroli, Serino, & Riva, 2015), among which is education due to the application of Augmented Reality in the different stages and areas.

As this is a relatively recent concept, an approximation to its definition is necessary for the correct understanding of it. Thus, since the late 20th century authors such as Azuma (1997) has defined Augmented Reality as a technology that improves the sensory perception of the user, superimposing virtual objects to the real world, thus seeming that these virtual elements belong and coexist in the same space as real objects.

The concept of Augmented Reality may get confused with another term that it is related with, which is Virtual Reality (Gómez-García, Rodríguez-Jiménez & Ramos, 2019). Both terms refer to different levels of user immersion in virtual environments where the real and the virtual coexist (Di Serio, Ibáñez & Delgado, 2013). The main difference that distinguishes both technologies would be that while Augmented Reality combines virtual elements in real environments or contexts, Virtual Reality completely replaces a real environment with a virtual one. Therefore, when researching the subject and implementing it in the educational context, it is important to distinguish between the two concepts.

Today, professors and the educational community benefits from the possibilities offered by technology, reason for which knowing the potential of Augmented Reality applied to education at all levels is necessary. Thus, various authors (Kellems, Cacciatore, & Osborne 2019; Park, Ro, Lee, & Han, 2018; Akçayır & Akçayır, 2017; Cabero & García, 2016) have presented the advantages of Augmented Reality:

- It helps speakers participate in real-world experiences and explorations
- It makes it easier to perceive events or circumstances that are more complicated without Augmented Reality
- It increases the motivation and satisfaction of students
- It helps acquire research skills
- It creates learning environments where the combination of real and virtual elements prevails
- It encourages and develops critical thinking and problem-solving capacity

- It promotes communication through collaborative tasks
- It increases positive attitudes towards the subject being taught (Akçayır, Akçayır, Pektas & Ocak, 2016).

Likewise, the limitations of Augmented Reality (Muñoz-Cristóbal *et al*., 2015) have been specified in the scientific literature:

- Difficulties and technical problems during its use
- A correct and detailed user guide is required so that it is not too complicated for students
- A large amount of pre-reading is essential for its proper use (Muñoz-Cristóbal *et al*., 2015).

It is well known that technologies, in most cases, provide a number of benefits to students for the novelty of introducing them to the classroom. These benefits are not only at the level of development and facilitation of teaching-learning processes, but also at the level of the individual aspects of personal development. In this regard, motivation is placed as an element that all these new trends aim to increase and enhance to the highest levels (Hernández-Horta, Monroy-Reza & Jiménez-García, 2018; Ortiz-Colón, Jordán & Aredal, 2018), because this increase results in other positive consequences, such as higher levels of involvement, greater interest in the subject or topic, etc. (Fuentes, López, & Pozo, 2019; Quintero Jiménez & Area, 2018).

In addition, research carried out such as that of Di Serio *et al.* (2013) demonstrate how the use of Augmented Reality implies an increase in motivation that reverts to higher levels of personal satisfaction of the students and greater attention, as long as the themes are of their interest. Additionally, studies conducted on students of Higher Education affirm that the application of Augmented Reality promotes a motivational improvement, not only to future teachers, but to future professionals from different disciplines, showing the global nature of Augmented Reality (Cabero & Roig, 2019; Tzima, Styliaras, & Bassounas, 2019; Fuchsova, & Korenova, 2019).

On the other hand, it should be noted that in recent times it is necessary to research previous studies on a particular topic before addressing it; thus, the current state of the subject is checked and the different lines of research can be established to be followed or explored. This is what is generally intended for a systematic review, and it is the aim of this study. Currently, there are several documents of the scientific literature that carry out a systematic review and address technology in general and its involvement in education (Cant & Cooper, 2010; Habler, Major & Hennessy, 2016; Rodríguez-García, Raso & Ruiz, 2019), and in a specific way, although to a lesser extent Augmented Reality (Bacca, Baldiris, Fabregat, Graf, & Kinshuk, 2014), as well as other trends involving the use of technological devices (Pimmer, Mateescu & Gröhbiel, 2016). Also, there are systematic studies linked to Augmented Reality: on the one hand, the work of Pellas, Fotaris, Kazanidis and Wells (2019) focused on their presence in the game, stating that its application influences the primary and secondary education students' cognitive skills. In short, there is the study of Quintero, Baldiris and Rubira (2019) in which it was visualized that the use of Augmented Reality favored the inclusion of those students who had visual, motor, cognitive and hearing difficulties, showing an increase in motivation and improved performance.

2. Methodology

Based on the ideas mentioned above, the aim of this paper is to complete the following: a) find documents of impact and prestige that have experienced Augmented Reality in the educational field; b) analyze the transcendence of Augmented Reality in student´s motivation. These are the research questions based on the above:

RQ1: How many studies were published in the last 5 years?

RQ2: Who are the most recognized authors in the field of Augmented Reality?

RQ3: In what areas or disciplines of knowledge are these studies most published?

RQ4: Does the Augmented Reality app significantly influence student´s motivation?

This work has followed the methodological guidelines for systematic literature review to answer these questions (Rubio-Aparicio, Sánchez-Meca, Marín & López, 2018; Okoli & Schabram, 2010). For its elaboration, the quality standards of the PRISMA declaration for systematic reviews were taken into account (Urrutia & Bonfill, 2010), as well as impact works that follow this type of methodology (Hinojo, Aznar, Cáceres, Trujillo, & Romero, 2019).

Figure 1. Synthesis of the steps to be taken in the systematic review with meta-analysis (PRISMA Declaration)

Own elaboration

2.1. Search strategy

To ensure the sensitivity of the search process, the search equation used in the database was applied as follows: "Augmented reality" and "Motivation" and "Education". For not limiting the number of results, no particular educational stage was included as a descriptor.

The data search was set in the Web of Sciences (WOS) and Scopus database in the Eselvier group. These are the most scientifically prestigious database in JCR and SJR impact index, respectively. In the case of the Web of Sciences, the search was carried out on the Social Sciences Citation Index (SSCI), Science Citation Index Expanded (SCIE) and Arts and Humanities Citation Index (AHCI).

2.2. Procedure

The method carried out for obtaining the sample was divided into three phases from the inclusion and exclusion statement criteria which allowed the initial number of documents to be limited (Table 1). Impact journal articles were used for open access, so that they could be investigated in detail. Subsequently, it was specified in that recent productivity with the aim of establishing an updated opinion.

In addition, those studies of quasi-experimental methodology were taken into account, so that, in the subsequent meta-analysis, a comparison of the work favorable to the control or experimental group could be established. Following this idea, those articles were chosen in which the motivation variable was measured, and, in turn, it was avoided to analyze the case studies, so a criterion regarding the minimum sample size was implemented.

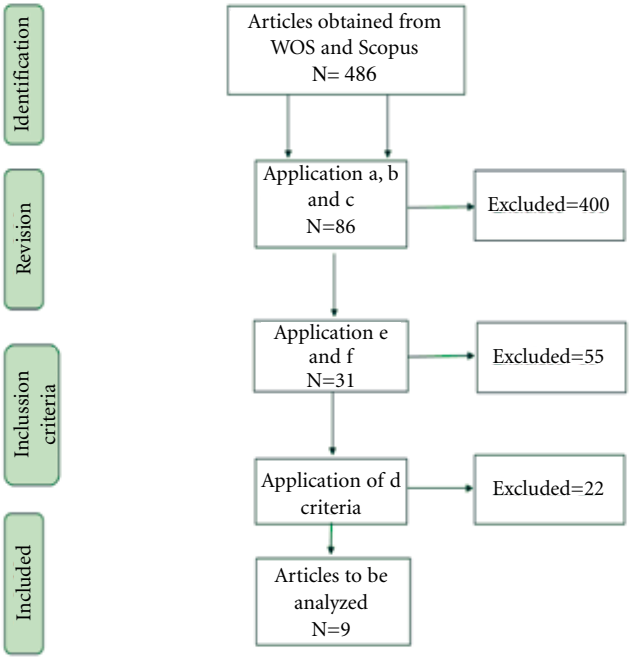
Table 1. Inclusion and exclusion criteria

Criterios de inclusión	Criterios de exclusión
a) Journal Articles b) Publications in the last five years (2014-2019) c) Open-Access d) Studies involving control and experimental group treatment e) The builder to measure is motivation. f) The sample size in the pos-test must be greater than four participants	a) Proceedings of Congresses, Book Chapters, Book or others... b) Restricted Access to the publication c) Motivation is not specified as study construct d) Theoretical studies or revisions e) Duplicate articles

Own elaboration

The flowchart shows the process followed, the scientific articles found, and the formation of the final sample (Figure 2).

Figure 2. Flowchart as stated in the PRISMA statement



Own elaboration

2.3. Data Analysis

Data analysis has been performed through Review Manager v.5.3 software. First, the initial sample that was subjected to a refinement process was formed until the final sample was obtained at the end of phase 3. Each of the documents that constitutes it has been examined through a content analysis (Urrutia & Bonfill, 2010).

3. Results

Once the sample is counted, a total of 9 documents were obtained as the final sample of the systematic review. A forest plot was established, tak-

ing into account measures of a descriptive nature (mean and standard deviation) that allowed to establish a final opinion on the significance of using augmented reality in student´s motivation.

3.1. Systematic review

The studies analyzed were grouped according to the year of publication. It should be noted that most of these have been published in 2019, excepting two works (Gutiérrez & Fernández, 2014; Toledo-Morales, & Sánchez-García, 2017) in 2017 and one in 2014.

On the other hand, most articles are written by various authors (Table 2). The application of augmented reality is independent of any discipline, thus studies are found in different disciplines, such as engineering, computer science, medicine or education.

Table 2. Authors of the studies and their number of publications

Author	Total of studies
Lai, A., Chen, C., Gutiérrez, J.M, Fernández, M.D., Toledo-Morales, P., Sánchez-García, J., Liu, Y., Lu, S., Kao, C., Chung, L., Tan, K., Henssen, J.A., van den Heuvel, L., De Jong, G., Vorstenbosch, A., van Cappellen, V., Van den Hurk, M., Kooloos, G., Bartels, H., Kirikkaya, E., Basgul, M., López- Belmonte, J., Pozo, S., Belmonte, G.L., Ibáñez, M.B., Peláez, J., Kloos, C., Wang, Y.	1

Own elaboration

Taking into account the journals that publish scientific work (table 3), it is observed that the works have been published in different countries, and therefore in different languages. From the nine documents analyzed, it is noted that only more than one of the scientific papers are found in the United Kingdom. As for h-index, there are varied coefficients, especially that of the Journal of Computer Assisted Learning and the British Journal of Educational Technology.

Table 3. Publication countries of the Journals and their h-index

References	Journal	Country	h-Index
Lai *et al.* (2019)	British Journal of Educational Technology	United Kingdom	73
Gutiérrez and Fernández (2014)	International Journal of Engineering Education	Ireland	35
Toledo-Morales and Sánchez (2017)	Revista Latinoamericana De Tecnología Educativa-Relatec	Spain	9
Liu *et al.* (2019)	International Journal of Engineering Business Management	Croatia	13
Henssen *et al.* (2019)	Anatomical sciences education	USA	41
Kirikkaya and Basgul (2019)	Journal of Baltic Science Education	Lithuania	12
López-Belmonte *et al.* (2019)	Pixel-Bit, Revista de Medios y Educación	Spain	6
Ibáñez et al. (2019)	Advances in Intelligent Systems and Computing	Germany	12
Wang (2017)	Journal of Computer Assisted Learning	United Kingdom	74

Own elaboration

In terms of the characteristics of the samples analyzed in the studies collected (Table 4), most studies have applied Augmented Reality in university students (Higher Education), although studies are also found at the Primary and Children's Education.

Table 4. Research and educational stage of the studies

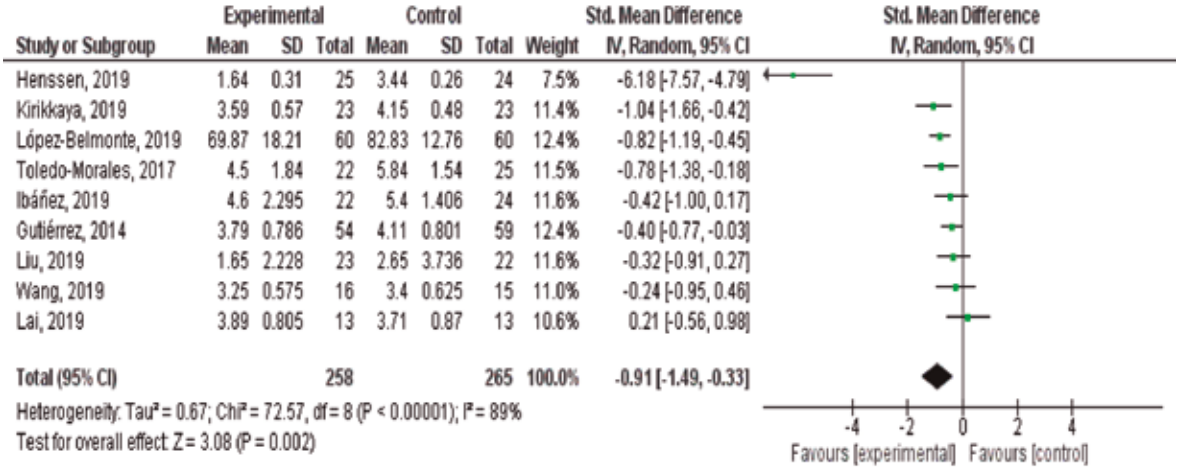
Reference	Educative phase		
	Pre-school	High school	Higher education
Lai *et al.* (2019)			
Gutiérrez y Fernández (2014)			X
Toledo-Morales y Sánchez (2017)		X	
Liu *et al.* (2019)			X
Henssen *et al.* (2019)			X
Kirikkaya y Basgul (2019)		X	
López-Belmonte *et al.* (2019)	X		
Ibáñez *et al.* (2019)			X
Wang (2017)			X

Own elaboration

3.2. Meta-analysis

Meta-analysis was developed through continuous data from the nine scientific papers collected (Henssen *et al.,* 2019; Kirikkaya & Basgul, 2019; López-Belmonte *et al.,* 2019; Ibáñez *et al.,* 2019; Liu *et al.,* 2019; Wang, 2017; Lai *et al.,* 2019; Toledo-Morales *et al.,* 2017; Gutiérrez & Fernández, 2014). First, it is important to note that the statistical weight of each document analyzed is very similar. Based on the elaborate forest plot, it is shown that the results are generally favorable to the experimental group. Specifically, it is noted that a big part of the work has lower means and a lower degree of dispersion, reflecting a higher degree of agreement on the part of the students analyzed stating that the application of Augmented Reality was positive. Among the studies analyzed, the research of López-Belmonte *et al.* (2019) stands out. (2019) in which a considerable improvement is experienced once Augmented Reality was applied in the experience. Only an unfavorable result was found in the improvement of the motivational level following the experimentation of Augmented Reality (Lai, 2018).

Figure 3. Meta-analysis forest plot with continuous data



Own elaboration

Discussion and conclusions

The application of Augmented Reality is a study trend to be considered in education. The results of the systematic review carried out have allowed to observe its application in the different educational stages. First, it is a subject whose experimentation in the classroom is booming as shown by the diachronic production of the articles examined, which mostly belonged to this year 2019. Referring to the authors, this study has determined that there are numerous authors who have published at least one scientific paper on Augmented Reality. This idea indicated that there are no specialized authors in the area.

However, this is a novel theme at a global level as shown by the analysis of the different journals in which the articles on Augmented Reality have been published. From the nine documents, a total of five different countries of origin have been distinguished. They are mostly journals related to Technological Education and teaching innovation, but the provenance of the articles is varied: from the engineering branch to the medical branch and finally, in greater number education.

On the other hand, the results of this work allowed to infer on the idea that the application of Augmented Reality in the classrooms of different educational stages promotes an improvement in student´s motivation. This result becomes the line of other similar studies on the motivational increase through the application of emerging technologies (Rodríguez-García, Raso & Ruiz, 2019; Pimmer, Mateescu & Gröhbiel, 2016). Although the heterogeneity of the model is not complete, the significance of the model is optimal, and has allowed to establish an optimal approach to the idea intended to infer with the approach of this work: the application of Augmented Reality in the classrooms causes a motivational improvement in the student. This results agree with the results expressed in previous researches (Cabero & Roig, 2019; Tzima, Styliaras & Bassounas, 2019). In the same way, the inference obtained from this study also relates to the results of the systematic reviews referred to above, adding consistency to the argument that this work intends to provide (Pellas, Fotaris, Kazanidis & Wells, 2019; Quintero, Baldiris, Rubira, Cerón & Vélez, 2019).

In short, Augmented Reality is an emerging resource that can constitute a motivational improvement in the student. Additionally, it is a current way to be used for the teaching-learning process in the classrooms at any stage (Di Serio *et al*., 2013).

Finally, regarding the limitations of the study, they are mainly directed towards the sample size. As these studies follow a quasi-experimental methodology in different classrooms, the set of subjects analyzed in the nine scientific articles is not numerous. Therefore, as a future line of research, it is proposed to continue applying Augmented Reality at different educational stages, and to continue checking the motivation progress once the resource has been applied, in order to create a set of scientific articles that can corroborate the lines established by the model created in this work.

References

Akçayır, M., & Akçayır, G. (2017). Advantages and challenges associated with augmented reality for education: A systematic review of the literature. *Educational Research Review, 20*, 1-11.

Akçayır, M., Akçayır, G., Pektas¸ H. M., & Ocak, M. A. (2016). Augmented reality in science laboratories: The effects of augmented reality on university students' laboratory skills and attitudes toward science laboratories. *Computers in Human Behavior, 57,* 334-342.

Azuma, R. T. (1997). A survey of augmented reality. *In Presence: Teleoperators and Virtual Environments, 6*, 355-385.

Bacca, J., Baldiris, S., Fabregat, R., Graf, S., & Kinshuk. (2014). Augmented Reality Trends in Education: A Systematic Review of Research and Applications. *Educational Technology & Society, 17*(4), 133-149.

Cabero-Almenara, J., & García, F. (2016). *Realidad Aumentada. Tecnología para la formación*. Madrid: Síntesis.

Cabero-Almenara, J., & Roig-Vila, R. (2019). The Motivation of Technological Scenarios in Augmented Reality (AR): Results of Different Experiments. *Applied Sciences-Basel, 9*(14), 2907.

Cant, R. P., & Cooper, S. J. (2010). Simulation-based learning in nurse education: Systematic review. *Journal of Advanced Nursing, 66*(1), 3-15.

Caudell, T. P., & Mizell, D. W. (1992). Augmented reality: An application of heads-up display technology to manual manufacturing processes. En *Proceedings of the twenty-fifth Hawaii international conference on system sciences*.

Chicchi-Giglioli, I. A., Pallavicini, F., Pedroli, E., Serino, S., & Riva, G. (2015). Augmented reality: A brand new challenge for the assessment and treatment of psychological disorders. *Computational and Mathematical Methods in Medicine,* 1-12.

Cohen, E. E., LaMonte, S. J., Erb, N. L., Beckman, K. L., Sadeghi, N., Hutcheson, K. A., ... & Lyman, G. H. (2016). American Cancer Society head and neck cancer survivorship care guideline. *CA: a cancer journal for clinicians*, *66*(3), 203-239.

De Pablos Pons, J., Bravo, P. C., & Moreno, P. V. (2010). Políticas educativas, buenas prácticas y TIC. *Education in the Knowledge Society (EKS), 11*(1), 180-202.

Di Serio, Á., Ibáñez, M. B., & Delgado, C. (2013). Impact of an augmented reality system on students' motivation for a visual art course. *Computers & Education, 68*, 586-596.

Esteve, F., Adell, J. & Gisbert, M. (2013). *El laberinto de las competencias clave y sus implicaciones en la educación del siglo XXI.* En II Congreso Internacional multidisciplinar de investigación educativa (CIMIE 2013). (http://bit.ly/2PVurrf)

Fuchsova, M., & Korenova, L. (2019). Visualisation in Basic Science and Engineering Education of Future Primary School Teachers in Human Biology Education Using Augmented Reality. *European Journal of Contemporary Education, 8*(1), 92-102.

Fuentes, A., López, J., & Pozo, S. (2019). Análisis de la Competencia Digital Docente: Factor Clave en el Desempeño de Pedagogías Activas con Realidad Aumentada. *REICE. Revista Iberoamericana sobre Calidad, Eficacia y Cambio en Educación, 17*(2).

Gómez-García, G., Rodríguez-Jiménez, C., & Ramos, M. (2019). Virtual Reality in Physical Education area. *Journal of Sport and Health Research, 11,* 177-186.

Gutiérrez, J.M., & Fernández, M.D.M. (2014). Applying augmented reality in engineering education to improve academic performance & student motivation. *International Journal of Engineering Education 30* (3), 625-35.

Habler, B., Major, L., & Hennessy, S. (2016). Tablet use in schools: A critical review of the evidence for learning outcomes. *Journal of Computer Assisted Learning, 32*(2), 139-156.

Hinojo-Lucena, F. J., Aznar-Díaz, I., Cáceres-Reche, M. P., & Romero-Rodríguez, J. M. (2019). Opinión de futuros equipos docentes de educación primaria sobre la implementación del mobile learning en el aula. *Revista Electrónica Educare, 23*(3), 1-17.

Hinojo-Lucena, F. J., Aznar-Díaz, I., Cáceres-Reche, M. P., Trujillo-Torres, J. M., & Romero-Rodríguez, J. M. (2019). Problematic Internet Use as a Predictor of Eating Disorders in Students: A Systematic Review and Meta-Analysis Study. *Nutrients, 11*(9), 2151.

Henssen, D., van den Heuvel, L., De Jong, G., A T M Vorstenbosch, M., van Cappellen van Walsum, A.-M., M Van den Hurk, M., & Bartels, R. (2019). Neuroanatomy Learning: Augmented Reality vs. Cross-Sections. *Anatomical sciences education*, 1-13.

Hernández-Horta, I. A., Monroy-Reza, A., & Jiménez-García, M. (2018). Aprendizaje mediante Juegos basados en Principios de Gamificación en Instituciones de Educación Superior. *Formación universitaria*, *11*(5), 31-40.

Ibáñez, M. B., Peláez, J., & Kloos, C. D. (2019). Using an augmented reality geolocalized quiz game as an incentive to overcome academic procrastination. *Advances in Intelligent Systems and Computing*, 909, 175-184.

Kellems, R. O., Cacciatore, G., & Osborne, K. (2019). Using an Augmented Reality-Based

Teaching Strategy to Teach Mathematics to Secondary Students with Disabilities. *Career Development and Transition for Exceptional Individuals, 42*(4), 253-258.

Kirikkaya, E. B., & Basgul, M. S. (2019). The Effect of the Use of Augmented Reality Applications on the Academic Success and Motivation of 7th Grade Students. *Journal of Baltic Science Education, 18*(3), 362-378.

Lai, Ah-Fur, Chih-Hung Chen, y Gon-Yi, Lee (2019). An Augmented Reality-Based Learning Approach to Enhancing Students' Science Reading Performances from the Perspective of the Cognitive Load Theory. *British Journal of Educational Technology 50*(1), 232-47.

López-Belmonte, J., Pozo, S., & López-Belmonte, G. (2019). The effectiveness of augmented reality in infant education: A BLS and CPR learning study in 5 year-old students. *Pixel-Bit, Revista de Medios y Educación*, (55), 157-178.

Liu, Y.-C., Lu, S.-J., Kao, C.-Y., Chung, L., & Tan, K. H. (2019). Comparison of AR and physical experiential learning environment in supporting product innovation. *International Journal of Engineering Business Management*, *11*, 1-10.

Muñoz-Cristóbal, J. A., Jorrin-Abellán, I. M., Asensio-Pérez, J. I., Martínez-Mones, A., Prieto, L. P., & Dimitriadis, Y. (2015). Supporting teacher orchestration in ubiquitous learning environments: A study in primary education. Learning Technologies, IEEE *Transactions on Learning, 8*(1), 83-97.

Okoli, C., & Schabram, K. (2010). A guide to conducting a systematic literature review of information systems research. *Sprouts: Work Papers Inf. Syst., 10*(26), 1-46.

Ortiz-Colón, A. M., Jordán, J., & Agredal, M. (2018). Gamificación en educación: una panorámica sobre el estado de la cuestión. *Educ. Pesqui., 44.*

Pellas, N., Fotaris, P., Kazanidis, I., & Wells, D. (2019). Augmenting the learning experience in primary and secondary school education: A systematic review of recent trends in augmented reality game-based learning. *Virtual Reality, 23*(4), 329-346.

Park, Y. J., Ro, H., Lee, N. K., & Han, T.-D. (2019). Deep-cARe: Projection-Based Home Care Augmented Reality System with Deep Learning for Elderly. *Applied Sciences-Basel, 9*(18), 3897.

Pimmer, C., Mateescu, M., & Gröhbiel, U. (2016). Mobile and ubiquitous learning in higher education settings. A systematic review of empirical studies. *Computers in Human Behavior*, *63*, 490-501.

Quintero, J., Baldiris, S., Rubira, R., Cerón, J., & Vélez, G. (2019). Augmented Reality in Educational Inclusion. A Systematic Review on the Last Decade. *Frontiers in Psychology*, *10,* 1835.

Quintero, L. E., Jiménez, F. & Area, M. (2018). Más allá del libro de texto. La gamificación mediada con TIC como alternativa de innovación en Educación Física. *Retos: nuevas tendencias en educación física, deporte y recreación*, (34), 343-348.

Rodríguez-García, A. M., Raso, F., & Ruiz, J. (2019). Competencia digital, educación superior y formación del profesorado: Un estudio de meta-análisis en la Web of Science. *Pixel-Bit. Revista de Medios de Comunicación, 54*, 65-81.

Rubio-Aparicio, M., Sánchez-Meca, J., Marín-Martínez, F., & López-López, J. A. (2018). Guidelines for reporting systematic reviews and meta-analyses. *Anales de Psicología, 34*(2), 412-420.

Toledo-Morales, P., & Sánchez-García, J. M. (2017). Augmented Reality in Primary Education: effects on learning. *Revista Latinoamericana de Tecnología Educativa-Relatec, 16*(1), 79-92.

Trujillo, J. M., Aznar, I., & Cáceres, P. (2015). Análisis del uso e integración de redes sociales colaborativas en comunidades de aprendizaje de la Universidad de Granada y John Moores de Liverpool. *Revista complutense de Educación, 26*(1), 289-311.

Tzima, S., Styliaras, G., & Bassounas, A. (2019). Augmented Reality Applications in Education: Teachers Point of View. *Education Sciences, 9*(2), 99.

Urrutia, G., & Bonfill, X. (2010). Declaración PRISMA: una propuesta para mejorar la publicación de revisiones sistemáticas y metaanálisis. *Medicina clínica, 135*(11), 507-511.

Wang, Y.-H. (2017). Using augmented reality to support a software editing course for college students. *Journal of Computer Assisted Learning, 33*(5), 532-546.

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Virtual reality and motivation in the educational context: Bibliometric study of the last twenty years from Scopus

Realidad virtual y motivación en el contexto educativo: Estudio bibliométrico de los últimos veinte años de Scopus

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Abstract

Information and communication technologies have undergone great changes in all sectors of today's society, but especially in the field of education, promoting the development of new methodologies. Among these new teaching methods is Virtual Reality, which in recent years has been of great importance as it has been shown to have a positive influence on the motivation of students and, at the same time, on the improvement of their attention. Hence the interest in carrying out this study, with the aim of analysing the current situation of the existing research in the Scopus database on the use of Virtual Reality in education to improve motivation in teaching-learning processes. The results reveal that in the last twenty years (1998-2018) the scientific production on the subject in question has grown exponentially, going from 0.27% in 1998 to 14.48% in 2018. We conclude the study by proposing to continue researching on this subject in order to continue verifying to what extent it is possible to improve the quality of education thanks to the use of new methodologies such as Virtual Reality.

Keywords: Virtual Reality, education, motivation, active methodologies, bibliometric.

Resumen

Las tecnologías de la información y comunicación han acontecido grandes cambios en todos los sectores de la sociedad actual, pero, especialmente en el ámbito educativo, promoviendo el desarrollo de nuevas metodologías. Dentro de estos nuevos métodos de enseñanza se encuentra la Realidad Virtual que en los últimos años ha tenido una gran transcendencia ya que se ha demostrado que influye de forma positiva en la motivación del alumnado y, a la vez, en la mejora de su atención. De aquí surge el interés por realizar este estudio, con el objetivo de analizar en qué situación actual se encuentran las investigaciones existentes en la base de datos Scopus sobre el uso de la Realidad Virtual en educación para la mejora de la motivación en los procesos de enseñanza-aprendizaje. Los resultados revelan que en los últimos veinte años (1998-2018) la producción científica sobre el tema en cuestión ha crecido de forma exponencial, pasando de publicar un 0.27% en 1998, a un 14,48% en 2018. Terminamos el estudio proponiendo seguir investigando sobre este tema con la finalidad de seguir comprobando hasta qué punto es posible mejorar la calidad educativa gracias al uso de nuevas metodologías como la Realidad Virtual.

Descriptores: Realidad Virtual, educación, motivación, metodologías activas, bibliometría.

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1. Introduction

Society is immersed in an age when information and communication technologies (ICTs), have acquired great importance in all social sectors, especially in the educational field (Rodríguez, Cáceres & Alonso, 2018), promoting the development of new teaching methods (Viñals & Cuenca, 2016). Among the main features that stand out from ICT and which are influenced in the educational field, are ubiquity —since it can be used from anywhere and at any time — and ergonomics —since it adapts to the specificities of the teaching and learning processes — (Fombona & Pascual, 2017).

The entry of ICT into the pedagogical actions developed today in schools, which is present in all educational stages (Larionova, Brown, Bystrova & Sinitsyn, 2018), has promoted new connections in the students, since ICT allow them to be connected with their peers, teachers, the educational content and material resources (Radu, 2014), stimulating their interest in the task (Villalustre & Del Moral, 2017), and allowing them to increase motivation and participation in educational dynamics (Marín & Muñoz, 2018).

Among the innovative practices in the educational field is the use of Virtual Reality (Dyer, Swartzlander & Gugliucci, 2018), which is defined as various multimedia sequences that simulate reality almost reliably, generated by human beings using information and communication technologies, being a requirement for their use of specific hardware (Díaz, Díaz & Arango, 2018; Samaniego, 2016).

Currently, the use of Virtual Reality in the pedagogical field is booming (Dos Santos & Dos Santos, 2019; Sural, 2018), since it is being included in different curricula (Huttar & Brintzenhofeszoc, 2019), being considered as an effective pedagogical resource that supports the learning of students (Jamil *et al.,* 2019), as well as innovative (Slater et al., 2019). Augmented Reality is accessible by various means, including the mobile phone (Degli *et al.,* 2019), which makes it customizable, accessible and interactive (Nijman *et al.,* 2019).

The use of Virtual Reality in education has gained remarkable recognition (Panerai, Catania, Rundo & Ferri, 2018) by being an effective form of training and evaluation (Abi-Rafeh *et al.*, 2019), which generates advantages in students (Klippel *et al.,* 2019), including the understanding of the contents (Hanson, Andersen & Dunn, 2019), improving creativity (Yang *et al.,* 2019) participation (Lorenzo-Álvarez, Rudolphi-Soler, Ruiz-Gómez & Sendra-Portero, 2019) and students' commitment to content and learning (Makransky & Lilleholt, 2018), as well as making education more accessible to everyone (Sood & Singh, 2018), thus increasing the specific competences of the students in their field of knowledge (Wu *et al.*, 2019).

Currently there are several studies that analyze the use of Virtual Reality and its influence on motivation, among which are those of Kim and Hall (2019), which determined that there is a highly significant effect of perceived enjoyment in those using Augmented Reality; Sattar *et al.* (2019), who found that Virtual Reality was best for medical students, both in learning motivation and learning competence; Ho, Sun and Tsai (2019), established that students in the digital media department improve their motivation and interest in learning 3D animation; Rockstroh, Blum and Goritz (2019), determined that when implementing Virtual Reality to teaching and learning processes, it improved motivation and helped users keep their attention.

Due to the transcendence that Virtual Reality has acquired in the field of education, especially from 2017 onwards (Gómez-García, Rodríguez-Jiménez & Navas-Parejo, 2019), and its influence on motivation, the aim of this study is to analyze the existing research in the Scopus database on the use of Virtual Reality in education for the improvement of motivation in teaching-learning processes, which is specified in the following specific objectives:

- To know the diachronic productivity of the last 20 years and if the Price Law is complied
- To analyze if there are authors and sources specialized in this topic and therefore if the Laws of Lotka and Bradford are complied.
- To determine which countries produce the most scientific documents on the subject, which are the main areas of publication, and which types of documents are most commonly used for their dissemination.
- To analyze the connections between the different descriptors related to the Virtual Reality used in education.

2. Methodology

The methodology of the bibliometric studies has been followed (Moreno, 2019), with the intention of quantifying the scientific production of one of the most relevant databases; Scopus, about Virtual Reality used in education and its relationship with motivation in teaching-learning situations over the last 20 years.

Previously, a series of descriptors related to the subject to be studied contained in the ERIC Thesaurus were stablished, resulting in the following keywords with which the search was carried out: "Virtual Reality", "Education " (Education) and "Motivation". All these descriptors address the fundamental concepts of this study.

The search for the data and its analysis took place during the month of September 2019. The premises of other studies of the same type have been followed (Aznar, Romero, Rodríguez & Rodríguez, 2018; Rodríguez, Trujillo & Sánchez, 2015) analyzing the following elements:

- Production indicators: diachronic and personal productivity, which have led to verification of Price's and Lotka's law.
- Scatter indicators: to which Bradford's law has been verified.
- Impact indicators, depending on: the area of publication, typology of the documents, country of publication.

On the other hand, connections have been established between the different descriptors related to virtual reality used in education, configuring a network map from the VOSviewer software.

For the preparation of the final sample (n = 1.112) different inclusion criteria were applied, depending on the different variables and the type of analysis performed (Table 1). The entire population has been analyzed, therefore it is equivalent in number to the sample.

Table 1. Inclusion criteria based on variables

Variables	Inclusion criteria
Year of Publication	Years from 1998 to 2018 (2019 is excluded because it is not completed)
Type of Documents	Only scientific articles were taken into account to make the network map. For the rest of the study, all documents have been used
Publishing Areas	The most relevant six have been included
Country	Those which published from 2% of the total documents
Language	In the analysis of the documents, no exclusion criteria by publication language have been used. Because the keywords used for the search were in English, all articles written in any language are covered, since they have descriptors (keywords) translated into English in addition to those of the publishing language
Bibliometric Map	It has been done with all the articles found in Scopus

Own elaboration

Data collection was organized in Excel. For the analysis of personal production and that of the scattering indicators, the SPSS statistical program has been used in version 22, analyzing percentages of occurrence and linear regression of variables, and Excel, finding the scatter plots for the comparison of values and analysis of trend lines. Different statistics have been used for the data analysis such as: percentages, Pearson correlation coefficient, regression coefficient, and prediction coefficient.

3. Results

After placing the different descriptors in the Scopus search engine, selecting the "Article Title, Abstract and Keywords" option for "Virtual Reality" and "Education" and "All Fields" for "Motivation", and using the "y" connector to increase the rigor of the search, 1,241 results were obtained. Once the search has been refined excluding this year 2019 that has not been completed (123 documents) and those before 1998 (only 6 documents since 1993), the results are reduced to 1112 documents.

3.1. Production Indicators

3.1.1. Diachronic production

Analyzing the 1122 indexed references in the Scopus database, which are obtained with the combination of the selected descriptors, detailing the search to the years between 1998 and 2018 and using as variable "year of publication", it can be observed the increase in the last 20 years of scientific production that deals with virtual reality used in education and is related to motivation.

Figure 1 contains the results per year of the production indexed in Scopus. An exponential production increase can be observed graphically.

In accordance with Price's law, it can be seen that the premise that scientific production is doubled every 10-15 years is fulfilled (Price, 1986). In this case, the proportion is even higher; 3 documents published in 1998 (0.27%), then it goes to 45 in 10 years (4.05%), corresponding to 2008. In the following ten years 2018, production amounted to 161 documents (14.48%).

Figure 1. Diachronic Productivity on Virtual Reality

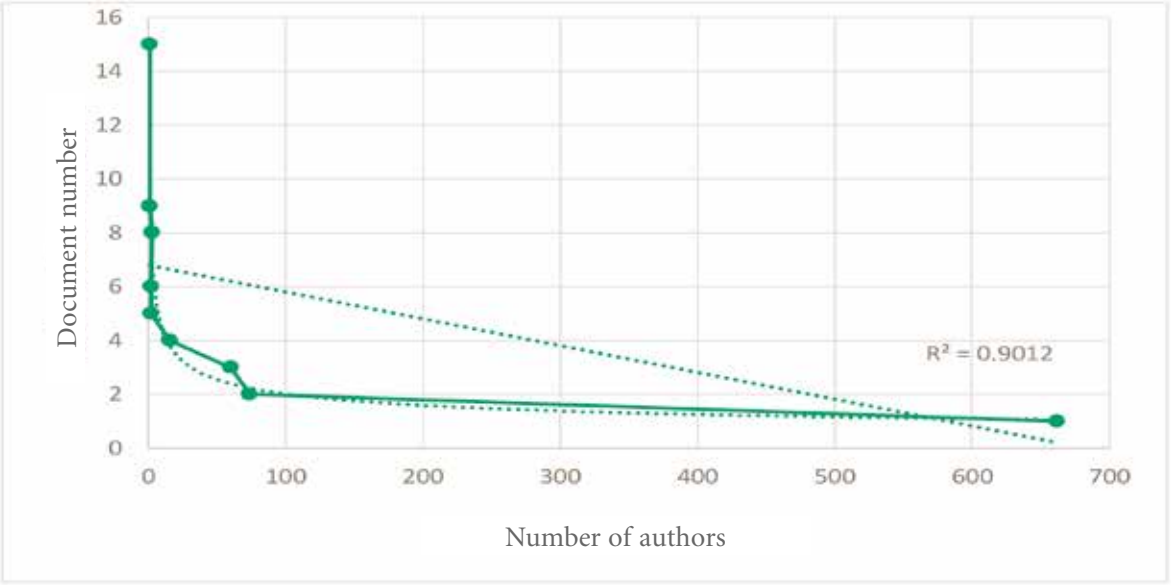
3.1.2. Personal productivity

With regard to personal productivity, it is proven that Lotka's law is complied, which states that biggest amount of the documents published on a given subject agree with a very small number of authors who are specialized in that area of knowledge.

Looking at Figure 2, it can be seen that the correlation between the fewest authors and the highest number of Scopus references is positive. Thus, it is observed at one end that a single author has published 15 documents and at the opposite end 662 authors have published one, showing the specialization of the author in this field.

When examining the linear relationship between the variables, a correlation coefficient of Pearson r = -0.498 is obtained, indicating that there is an average dependency between the variables and that they have a negative correlation, as they are affected inversely proportional. With respect to the coefficient of determination or multiple correlation, the result obtained is R2=0.9012, indicating that it has a very good fit.

Figure 1. Diachronic Productivity on Virtual Reality



Own elaboration

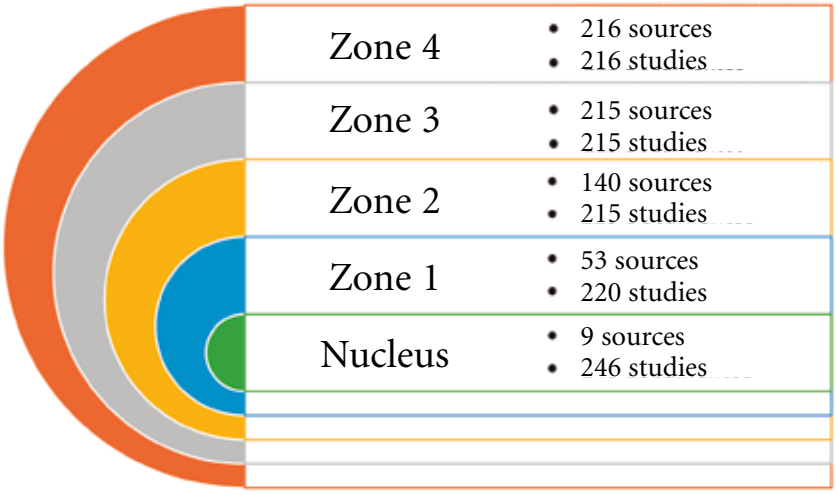
3.2. Scattering Indicators

Bradford's Law or The Law on the Scattering of the scientific literature of Bradford describes the quantitative relationship between journals and scientific articles contained in a literature on a given area, stating that a small number of journals, which make up the nucleus, concentrate a similar number of articles than a large number of journals, grouped into scattered areas (Miranda, 1990).

In this case, the total of the sources where the 1112 documents are indexed were distributed in 5 zones with an average of approximately 220 in each, where it can be observed that the nucleus consists of only 9 sources and it contains a similar number of documents as the other zones that have up to 216 sources in the areas farthest from the core, containing that same number of documents. This means that there are a lot of sources that contain only a reference of those found in Scopus on the subject matter and a considerably

smaller number of sources with a large number of documents, showing the specialization of some journals and books on Virtual Reality in education that refer to motivation (Fig. 3).

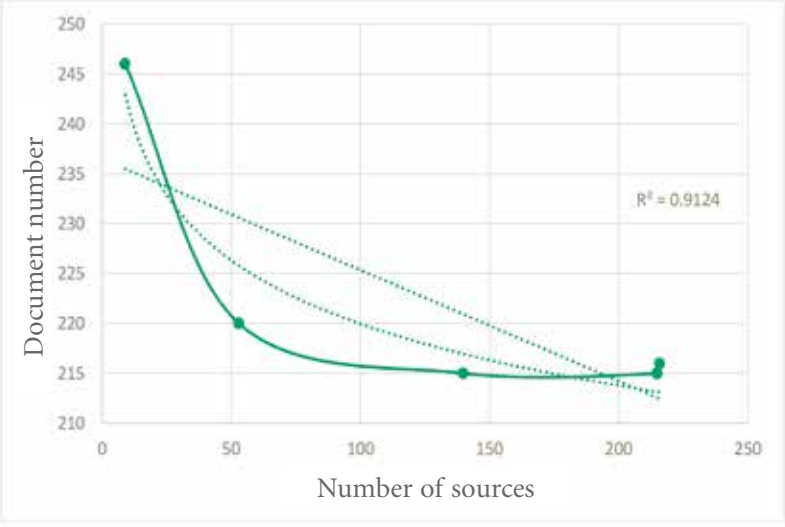
Figure 3. Bradford scattering area of scientific documents dealing with education-related Virtual Reality by mentioning motivation



Own elaboration

The linear regression analysis shows a high negative correlation between the number of sources and the accumulated documents (Fig. 4). It has a correlation coefficient of Pearson r = -0.783. And a multiple determination or correlation coefficient R2= 0.9124, indicating a very good fit.

Figure 4. Linear regression analysis between the number of sources and the number of studies



Own elaboration

3.3. Impact Indicators

Impact indicators have been analyzed according to different variables to know the influence of Virtual Reality studies on the scientific literature: publication area, type of documents and country of publication.

3.3.1. Publishing area

Different references are indexed in different publishing areas, including some that can be found in several categories.

Globally, it can be observed that most of the scientific production in this field is in the area of Computer Science (67.27%) followed by Social Sciences (39.21%). Out of the 26 areas of publication in which the 1,112 references are distributed, the six most representative references are presented in Table 2.

Table 2. Number of documents depending on the area of publication in the Scopus databases

Area of publication	Number of Scopus documents	Total percentage
Computer Sciences	748	67,27%
Social Sciences	436	39,21%
Engineering	274	24,64%
Medicine	142	12,77%
Mathematics	114	10,25%
Psychology	52	4,68%

Note: Percentages have been done on the total documents (1112) in each publication area. Since some documents can fall into several categories, the sum of the percentages does not match 100% of the items.

Own elaboration.

3.3.2. Type of document

Considering this variable that corresponds to the type of document found (Table 3), it is verified that most are session documents (51.80%), followed by articles (37.68%), in a low number there are book chapters and revisions, and with less than 1% the rest of the documents. Therefore, it can be stated that the preferred format for publishing research studies on Virtual Reality associated with motivation in education are the session paper and the scientific dissemination article.

Table 3. Number of documents depending on the type of documents in Scopus and WoS

Type of documents	Scopus Number	Percentage
Session Document	576	51,80%
Article	419	37,68%
Book chapter	69	6,20%
Revision	28	2,52%
Conference Revision	5	0,45%
Editorial	4	0,36%

Type of documents	Scopus Number	Percentage
Note	3	0.27%
Letter	1	0,09%
Retracted	1	0.09%
Indefinite	6	0,54%

Own elaboration

3.3.3. Country of publication

The countries with the highest scientific production on Virtual Reality in motivational education are the United States (27.52%) and Spain (8.63%), as can be seen in Table 4, which represents countries with more than 2% of the documents published on this topic in the last 20 years in Scopus. Thus, it can be observed the international scenario, geographically locating the institutions that investigate the most in this area. Fourteen countries containing 967 documents have been extracted from the 1112 analyzed, equivalent to 86.96% of the total. Spain ranks second with 96 publications, a long distance from the top position, but very close to the third position that is the United Kingdom.

Table 4. Number of documents depending on the country of publication of the Scopus databases

Countries	Documents in Scopus	Percentage
United States	306	27,52%
Spain	96	8,63%
United Kingdom	89	8,00%
Taiwan	61	5,49%
China	60	5,40%
Australia	59	5,31%
Germany	53	4,77%
Greece	51	4,59%
Italy	41	3,69%
Canada	35	3,15%
France	30	2,70%
Brazil	29	2,61%
Portugal	29	2,61%
Netherlands	28	2,52%

Own elaboration

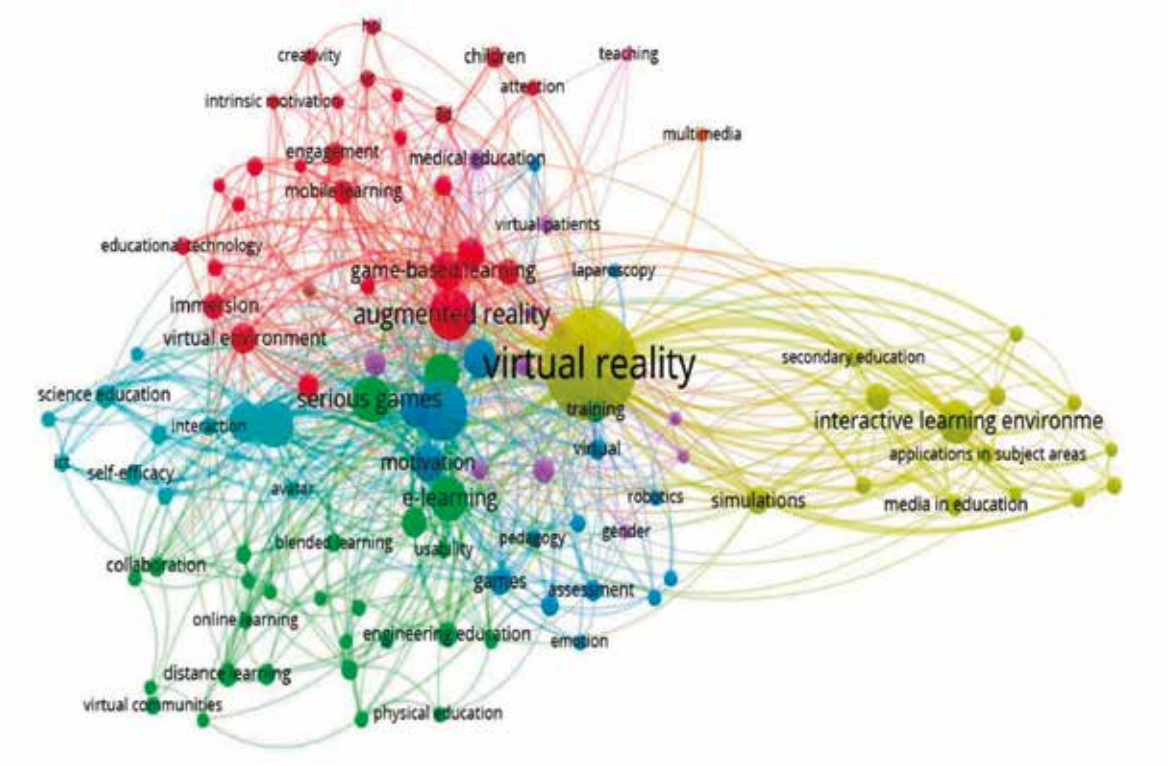
3.4. Bibliometric map

The network map between descriptors shown in Figure 5, presents the relationships that exist between the different keywords used in the analyzed articles that are indexed in Scopus (419).

Looking at the image, 6 groups of descriptors can be distinguished differentiated by different colors: yellow, blue, light blue, red, green and violet. The size of the concepts is directly proportional to the frequency of occurrence and the number of connections to other descriptors.

The largest concepts in the yellow clusters are: "Virtual Reality", "Interactive Learning Environment", "Simulation" and "Secondary Education". These descriptors are related to contextualized and active forms of teaching. The blue cluster features the descriptors "Motivation" and "Serious Games". This cluster relates to emotions and pedagogical games.

Figure 5. Map of networks between the keywords of articles published in Scopus on Virtual Reality in motivational education



Own elaboration

The green group is closely related to education and the different forms of learning with ICT, highlighting concepts such as: "e-learning" (virtual learning space).

On the other hand, the red cluster refers to different educational methodologies with ICT, observing that the most outstanding concepts are: "Augmented reality" and "Game-based learning". Again, the motivation that is referred to in this case is intrinsic.

The light blue cluster includes "Interaction" and "Science Education". These are the most prominent descriptors that have been used in the 419 articles analyzed and that are closely related and connected to each other.

4. Discussion and Conclusions

Referring to the use of ICT in the educational context, Virtual Reality has had great significance in recent years as it has been demonstrated how this methodology influences the motivation of students by promoting the teaching process as mentioned by Marín and Muñoz (2018), Jamil *et al.* (2019), Cagiltay, Ozcelik, Berker and Menekse (2019), Jacobsen *et al.* (2019).

Additionally, the results of diachronic productivity over the past 20 years show that between 1998 and 2018 an increase in exponential scientific production has occurred, fact that agrees with studies carried out by Dos Santos and Dos Santos (2019), who claim that the use of Virtual Reality in the pedagogical field is increasing. In 1998, 3 documents were published, then 45 in 2008 and 161 in 2018, i.e., it goes from a production of 0.27% to 14.48%, which allows to verify that the Price Law is complied, although in this study the percentage has been higher than double. It should be noted that this first number in scientific production came two years after the publication of the Organic Law 2/2006 on Education (LOE), which is committed to the use of technologies to "create an open learning environment, make learning more attractive and promote active citizenship, equal opportunities and social cohesion" (p. 17160). In addition, the largest production occurs in 2018, five years after the entry into force of the Organic Law 8/2013 for the Improvement of Educational Quality (LOMCE), which supports the use of Information and Communication Technologies (ICT) in the educational field to "promote the conditions that allow the timely methodological change, so that students are an active element in the learning process" (p. 97860).

Regarding the personal productivity, it is observed that 662 authors have published only one article, while one author has published 15 on the topic, demonstrating that the Lotka Law is complied by stating that there are authors who specialize in a certain area of knowledge. Also, the Law of Bradford is complied since a large number of sources contain only a reference on the subject and a small number accumulate a high percentage of documents, allowing to understand that there are journals and books that demonstrate how Virtual Reality influences students' motivation. Out of the 1112 documents indexed in Scopus, distributed in 5 zones with an average of 220 each, it can be seen that the nucleus consists of 9 sources with a total of 246 documents.

In relation to the countries that have published more scientific documents on Virtual Reality, the results show that the United States is first, fact that is in agreement with what has been stated by Gómez-García, Rodríguez-Jiménez and Ramos-Navas-Parejo (2019), with 306 publications, followed by Spain (96), United Kingdom (89), Taiwan (61), China (60), Australia (59), Germany (53), Greece (51), Italy (41), Canada (35), France (30), Brazil (29), Portugal (29) and the Netherlands (28). These are based on six areas of publications: Computer Science, Social Sciences, Engineering, Medicine, Mathematics and Psychology.

In view of the type of documents, it is noted that most publications are session documents (576) followed by articles (419), and, in very low number, book chapters (69) and revisions (5), as mentioned by Gómez-García, Rodríguez-Jiménez and Ramos-Navas-Parejo (2019).

In short, and according to the results found, it is important to emphasize that the improvement of educational quality is possible by the use of new methodologies such as Virtual Reality. As can be seen, the scientific literature regarding the use of Virtual Reality as a methodology that encourages motivation in students and which is present in the Scopus database shows an increase in 2018 which allows predicting that it will increase in the coming years; thus, the aim is to investigate such increase with the idea of delving into the subject and continuing to see to what extent it is possible to improve educational quality due to the use of new methodologies such as Virtual Reality.

The limitations found in this research were based on the debugging of the database, since the various documents had to be analyzed one by one to verify that they met the requirements set out in the study. As a future line of research, it is planned to carry out a study with similar characteristics in the Web of Science database or on Google Academic.

References

Abi-Rafeh, J., Zammit, D., Jaberi, M.M., Al-Halabi, B., & Thibaudeau, S. (2019). Nonbiological Microsurgery Simulators in Plastic Surgery Training: A Systematic Review. *Plastic and Reconstructive Surgery, 144*(3), 496-507. https://doi.org/10.1097/PRS.0000000000005990

Aznar, I., Romero, J.M., Rodríguez-García, A.M., & Rodríguez, C. (2018). Descubriendo el entorno desde nuevos enfoques: la Realidad Aumentada como tecnología emergente en educación. En J. Ruiz-Palmero, E. Sánchez-Rivas, y J. Sánchez-Rodríguez (Eds.), *Innovación pedagógica sostenible*. Málaga: UMA Editorial.

Cagiltay, N.E., Ozcelik, E., Berker, E., & Menekse, G.G. (2019). The Underlying Reasons of the Navigation Control Effect on Performance in a Virtual Reality Endoscopic Surgery Training Simulator. *International Journal of Human-Computer Interaction, 35*(15), 1396-1403. https://doi.org/10.1080/10447318.2018.1533151

Degli, E., Geronazzo, M., Vercovi, D., Nordahl, R., Serafin, S., Ludovico, L.A., & Avanzini, F. (2019). Mobile virtual reality for musical genre learning in primary education. *Computers & Education, 139*, 102-117. https://doi.org/10.1016/j.compedu.2019.04.010

Díaz, S., Díaz, J., & Arango, J. (2018). Clases de Historia en mundos virtuales: ¿Cómo podemos mejorarlo? *Campus Virtuales, 7*(2), 81-91.

Dos Santos, M.J., & Dos Santos, C.A. (2019). Virtual reality in the classroom: geography teaching practice. *Geosaberes, 10*(22), 72-80. https://doi.org/10.26895/geosaberes.v10i22.814

Dyer, E., Swartzlander, B.J., & Gugliucci, M.R. (2018). Using virtual reality in medical education to teach empathy. *Journal of the Medical Library Association, 106*(4). https://doi.org/10.5195/jmla.2018.518

Fombona, J., & Pascual, M. Á. (2017). La producción científica sobre Realidad Aumentada, un análisis de la situación educativa desde la perspectiva SCOPUS. *EDMETIC, 6*(1), 39-61.

Gómez-García, G., Rodríguez-Jiménez, C., & Ramos-Navas-Parejo, M. (2019). La realidad virtual en el área de educación física. *Journal of Sport and Health Research, 11*(Supl. 1), 177-186.

Hanson, J., Andersen, P., & Dunn, P.K. (2019). Effectiveness of three-dimensional visualisation on undergraduate nursing and midwifery students' knowledge and achievement in pharmacology: A mixed methods study. *Nurse Education Today, 81*, 19-25. https://doi.org/10.1016/j.nedt.2019.06.008

Ho, L.H., Sun, H., & Tsai, T.H. (2019). Research on 3D Painting in Virtual Reality to Improve Students' Motivation of 3D Animation Learning. *Sustainability, 11*(6), 1-17. https://doi.org/10.3390/su11061605

Huttar, C.M., & Brintzenhofeszoc, K. (2019). Virtual Reality and Computer Simulation in Social Work Education: A Systematic Review. *Journal of Social Work Education*, 1-11. https://doi.org/10.1080/10437797.2019.1648221

Jacobsen, M.F., Konge, L., Bach-Holm, D., La Cour, M., Holm, L., Hofgaard-Olsen, K., Kjaerbo, H., Saleh, G., & Thomser, A.S. (2019). Correlation of virtual reality performance with real-life cataract surgery performance. *Journal of Cataract and refractive surgery, 45*(9), 1246-1251. https://doi.org/10.1016/j.jcrs.2019.04.007

Jamil, Z., Saeed, A.A., Madhani, S., Baig, S., Cheema, Z., & Fatima, S.S. (2019). Three-dimensional Visualization Software Assists Learning in Students with Diverse Spatial Intelligence in Medical Education. *Anatomical Sciences Education, 12*(5), 550-560. https://doi.org/10.1002/ase.1828

Kim, M.J., & Hall, C.M. (2019). A hedonic motivation model in virtual reality tourism: Comparing visitors and non-visitors. *International Journal of Information Management, 46*, 236-249. https://doi.org/10.1016/j.ijinfomgt.2018.11.016

Klippel, A., Zhao, J.Y., Jackson, K.L., La Femina, P., Stubbs, C., Wetzel, R., Blair, J., Wallgrun, J.O., & Oprean, D. (2019). Transforming Earth Science Education Through Immersive Experiences: Delivering on a Long Held Promise. *Journal of Educational Computing Research, 57*(7), 1745-1771. https://doi.org/10.1177/0735633119854025

Larionova, V., Brown, K., Bystrova, T., & Sinitsyn, E. (2018). Russian perspectives of online learning technologies in higher education: An empirical study of a MOOC. *Research in compara-*

tive and international education, 13(1), 70-91. https://doi.org/10.1177/1745499918763420

Ley Orgánica 2/2006, de 3 de mayo, de Educación. BOE 106.

Ley Orgánica 8/2013, de 9 de diciembre, para la mejora de la calidad educativa. BOE 295.

Lorenzo-Álvarez, R., Rudolphi-Solero, T., Ruiz-Gómez, M.J., & Sendra-Portero, F. (2019). Medical Student Education for Abdominal Radiographs in a 3D Virtual Classroom Versus Traditional Classroom: A Randomized Controlled Trial. *American Journal of Roentgenology, 213*(3), 644-650. https://doi.org/10.2214/AJR.19.21131

Marín, V., & Muñoz, V. P. (2018). Trabajar el cuerpo humano con Realidad Aumentada en educación infantil. *Revista Tecnología, Ciencia y Educación, 9*, 148-158.

Makransky, G., & Lilleholt, L. (2018). A structural equation modeling investigation of the emotional value of immersive virtual reality in education. *ETR&D-Educational Technology Research and Develompment, 66*(5), 1141-1164. https://doi.org/10.1007/s11423-018-9581-2

Moreno, A.J. (2019). Estudio bibliométrico de la Producción Científica sobre la Inspección Educativa. *REICE. Revista Iberoamericana sobre Calidad, Eficacia y Cambio en Educación, 17*(3), 23-40. https://doi.org/10.15366/reice2019.17.3.002

Miranda, A. (1990). Bibliometría. *Bibliotecas, 8*(1), 1-11. (http://bit.ly/2DNMUA8).

Nijman, S.A., Veling, W., Greaves-Lord, K., Vermeer, R.R., Vos, M., Zandee, C.E.R., Zandstra, D.C., Geraets, C.N.W., & Pijnenborg, G.H.M. (2019). Dynamic Interactive Social Cognition Training in Virtual Reality (DiSCoVR) for social cognition and social functioning in people with a psychotic disorder: study protocol for a multicenter randomized controlled trial. *BMC Psychiatry, 19*(1), 1-11. https://doi.org/10.1186/s12888-019-2250-0

Panerai, S., Catania, V., Rundo, F., & Ferri, R. (2018). Remote Home-Based Virtual Training of Functional Living Skills for Adolescents and Young Adults with Intellectual Disability: Feasibility and Preliminary Results. *Frontiers in Psychology, 9*, 1-6. https://doi.org/10.3389/fpsyg.2018.01730

Price, D.J.S. (1986). *Little Science, big science and beyond*. Nueva York, NY: Columbia University Press.

Radu, I. (2014). Augmented reality in education: a meta-review and cross-media analysis. *Personal and Ubiquitous Computing, 18*(6), 1533-1543.

Rockstroh, C., Blum, J., & Goritz, A.S. (2019). Virtual reality in the application of heart rate variability biofeedback. *International Journal of Human-Computers Studies, 130*, 209-220. https://doi.org/10.1016/j.ijhcs.2019.06.011

Rodríguez, A., & Gallego, J.L. (2019) Análisis bibliométrico sobre Educación Especial. Profesorado. *Revista de Currículum y Formación del Profesorado*, *23*(1), 307-327. (http://bit.ly/2PytJRL)

Rodríguez, A. M., Cáceres, M. P., & Alonso, S. (2018). La competencia digital del futuro docente: análisis bibliométrico de la productividad científica indexada en Scopus. *International Journal of Educational Research and Innovation. IJERI, 10*, 317-333.

Rodríguez-García, A.M., Trujillo-Torres, J.M., & Sánchez-Rodríguez, J. (2015). Impacto de la productividad científica sobre competencia digital de los futuros docentes: aproximación bibliométrica en Scopus y Web of Science. *Revista Complutense de Educación, 24*(1), 623-646. https://doi.org/10.5209/RCED.58862

Samaniego, J. C. (2016). Realidad Virtual en la Educación el Próximo Desafío. *Journal of Science and Research, 1*, 57-61. https://doi.org/10.26910/issn.2528-8083vol1issCITT2016.2016pp57-61

Sattar, M.U., Palaniappan, S., Lokman, A., Hassan, A., Shah, N., & Riaz, Z. (2019). Effects of Virtual Reality training on medical students' learning motivation and competency. *Pakistan Journal of Medical Science, 35*(3), 852-857. https://doi.org/10.12669/pjms.35.3.44

Slater, P., Hasson, F., Guillen, P., Gallen, A., & Parlour, R. (2019). Virtual simulation training: Imaged experience of dementia. *International Journal of Older People Nursing, 14*(3), 1-11. https://doi.org/10.1111/opn.12243

Sood, S.K., & Singh, K.D. (2018). An Optical-Fog assisted EEG-based virtual reality framework

for enhancing E-learning through educational games. *Computers Applications in Engineering Education, 26*(5), 1565-1576. https://doi.org/10.1002/cae.21965

Sural, I. (2018). Augmented Reality Experience: Initial Perceptions of Higher Education Students. *International Journal of Instruction, 11*(4), 565-576. https://doi.org/10.12973/iji.2018.11435a

Villalustre, L., & del Moral, M. E. (2017). Juegos perceptivos con Realidad Aumentada para trabajar contenido científico. *Educação, Formação & Tecnologias, 10*(1), 36-46.

Viñals, A., & Cuenca, J. (2016). El rol del docente en la era digital. *Revista Interuniversitaria de Formación del Profesorado*, *30*(2), 103-114.

Wu, W., Hartless, J., Tesei, A., Gunji, V., Ayer, S., & London, J. (2019). Design Assessment in Virtual and Mixed Reality Environments: Comparison of Novices and Experts. *Journal of Construction Engineering and Management, 145*(9), 1-14. https://doi.org/10.1061/(ASCE)CO.1943-7862.0001683

Yang, X.Z., Lin, L., Cheng, P.Y., Yang, X., & Ren, Y. (2019). Which EEG feedback works better for creativity performance in immersive virtual reality: The reminder or encouraging feedback? *Computers in human behaviour, 99*, 345-351. https://doi.org/10.1016/j.chb.2019.06.002

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Augmented Reality in Primary Education since students' visions

La Realidad Aumentada en Educación Primaria desde la visión de los estudiantes

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Abstract

Working today with digital resources in the classroom is a reality without the possibility of questioning. In this sense, the incorporation of tools such as Augmented Reality (from now on AR) are reflecting a new way of seeing and understanding the teaching and learning process. Its use for curriculum development is very diverse as well as the different ways of incorporating them, depending on the perspective that teachers have of it. In this sense, this article presents the vision that a group of pre-service teachers have of AR in Primary Education, so that the viability or not of the use of this technology in the learning in this educational level can be clarified. Thus, by using an ex post facto design, by the collection the dates a questionnaire with 30 items has been created, distributed in 6 dimensions, using a Likert type response scale of 5 options. The sample has been composed of N=520 students from the University of Córdoba. The main objective of the research has been: to evaluate the possibilities and potentials offered by different software used for the creation of technological environments under the AR architecture to be used in university formative contexts. The main result achieved reflects the non-existence of differences around the perception that teachers have of the RA in the field of primary education that this is a difficult-to-use tool with students with specific educational support needs and that once dominated would be easy to be incorporated into your teaching action.

Keywords: Augmented reality, primary education, pre-service teaches, learning, classroom methodology, curricular development.

Resumen

Trabajar hoy con recursos digitales en las aulas es una realidad sin posibilidad de cuestionamiento. En este sentido la incorporación de herramientas como la Realidad Aumentada, están reflejando una nueva forma de ver y entender el proceso de enseñanza y de aprendizaje. En este sentido, este artículo presenta la visión que un grupo de profesores en formación tienen de la Realidad Aumentada en la Educación Primaria de modo que se pueda esclarecer la viabilidad o no de la utilización de esta tecnología en el aprendizaje en este nivel educativo. Así, mediante el empleo de un diseño ex post facto, se ha creado un cuestionario conformado por 30 ítems, distribuidos en 6 dimensiones, empleando una escala de respuesta tipo Likert de 5 opciones. La muestra ha estado compuesta por N=520 maestros en formación de la Universidad de Córdoba. El objetivo principal de la investigación ha sido: evaluar las posibilidades y potencialidades que ofrecen diferentes softwares utilizados para la creación de entornos tecnológicos bajo la arquitectura de la Realidad Aumentada para ser utilizados en contextos formativos universitarios. El principal resultado alcanzado refleja la no existencia de diferencias en torno a la percepción que los maestros tienen de la RA en el ámbito de la educación primaria, que esta es una herramienta de difícil uso con alumnado con necesidades específicas de apoyo educativo y, que una vez dominada, sería fácil de ser incorporada a su acción docente.

Descriptores: Realidad Aumentada, educación primaria, maestro en formación, aprendizaje, metodología de aula, desarrollo curricular.

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1. Introduction

Education today implies a 180-degree turn compared to past decades. The methodologies, the curricular designs, the resources and the profile of the student and the teacher have evolved as the society has been growing (Marín-Díaz, 2017a).

In this sense, the development that Information and Communication Technologies (ICT) have experienced as well as their imbrication with educational action, have precipitated their presence in the classroom and in the academic life of students and teachers.

Digital resources have come to stay in the classrooms, reason for which it is necessary to know, as education professionals and those responsible for the educational act, to incorporate them into the teaching practice, if believing that this element can benefit the learning process of the student (Cuevas *et al*., 2019). Therefore, the aim is to present and have a perspective of ICT, and understand that their first advantage is to improve and facilitate the student's learning process. On the other hand, it can be considered that the educational act will be in continuous growth and improvement.

In the last decade the presence of Augmented Reality (AR) has been growing. It has its origins from Virtual Reality (VR), and it has been used in education for more than a decade, although its presence in Primary Education is gradually becoming more evident, it is quite sparse in terms of inclusive education (Marín-Díaz 2020).

On the following pages this article presents the relationship of AR in Primary education. The purpose is to analyze the situation in which today this technology can lead to educational and inclusive scenarios (Marín-Díaz, 2016, 2017a). In short, the aim is to answer the following question: can AR be a viable tool for the learning development in primary school.

1.1. State-of-the-art

The Horizon Reports of recent years, especially those issued in 2012 and 2016 (Durral, Gros, Maina, Johnson & Adams, 2012; Johnson, Adams, Cummins, Estrada, Freeman & Hall, 2016) introduces Augmented Reality as an emerging technology which should be normally present in training centers around 2020.

RA has been defined as a system that merges 3 elements: on the one hand the combination of the virtual world with the real one, the instant or immediate interaction with objects and finally the possibility of increasing the real objects by offering 3-dimensional images (Sommerauer & Müller, 2014). Consequently, if it is understood as an element, as pointed out by Fabregat (2012), then it provides the person who uses it a visual guide which will allow the person to perform a more precise task; thus, it should be considered that its use in the academic sphere contributes more than it restricts, since it does not limit the methodology used in the classroom, but power it when presenting the world to the students—in which they live and interact with others daily outside schools — within the walls of the classroom, all from a natural perspective (Prendes, 2015); in this way, observation capacity will be enhanced (Ak-ayir & Ak-ay, 2017). Hence, RA offers the possibility to insert an image or virtual object in a real scenario, allowing to experience in a more vivid and rich way the practice of learning.

This emergence by the Horizon reports, because of its link to the teaching of subjects, has highlighted the various studies conducted since more than a decade ago. Thus, there are studies in areas such as the teaching of mathematics (Sommerauer & Müller, 2014; Rahman Ling & Yin, 2020), Medicine (Ferrer-Torregrosa, Torralba, Jiménez, García & Barcia, 2015), Physics (Chang, Wu & Hsu, 2016), Anatomy (Citardí, Agdetoba, Bigas & Luang, 2016), Education (Barroso & Gallego, 2017; Cozar, del Moya, Hernández, & Hernández, 2015; Luna, Ibañez & Rivero, 2019; Yilmaz, 2016), Second languages (Cruz, 2018), Museums or architecture (Luna, Ibáñez & Rivero, 2019), to mention a few subjects. All of them have emphasized that learning can be achieved more effectively by bringing back

images and text, hence the Cognitive Theory of Multimedia Learning supports a positive view of the application of AR in education (Sommerauer & Müller, 2014).

There is a work by Yilmaz (2016) with children's education students, which showed a greater interest in the contents shown through a book developed with this technology, supporting the playful and rational approach with which the teaching process takes place at this level of education. Also, the RAFODIUM project, (Augmented Reality to Increase Training. Design, Production and Evaluation of Augmented Reality Programs for University Training [EDU2014-57446-P] (http: ://bit.ly/2LiQXc3), developed at the University of Seville (Spain), whose objective is to evaluate the possibilities and potentials offered by different software for the creation of technological environments with AR to be used in university training contexts, and in which this article is focused.

Of all these experiences, as well as the research carried out on AR (Álvarez, Delgado, Gimeno, Martín, Almaraz & Ruiz, 2017; Barroso & Gallego, 2017; Cozar-Gutiérrez & Sáenz-López, 2017; Fracchia, Alonos & Martíns, 2015; Marín-Díaz, 2016, 2017a, 2017 b) have allowed to elucidate a number of advantages of the educational application of AR. These would be: it increases the motivation and interest of the students for their own learning process; it enhances playful learning; it provides the possibility of interacting in real time with reality; it allows to combine cognition with physical experience; it complements perception and interaction with the real world; it stimulates perception and helps to understand abstract concepts and content; it stimulates abstraction; it boosts the development of cognitive, spatial, temporary abilities; It allows to offer information in an improved way; it propitiates conducive immersion experiences in the content, causing intuitive and interactive learning.

However, it also entails a number of disadvantages or problems related with the lack of economic resources to acquire digital resources; availability of Wi-Fi connection; lack of training for the implementation in the classroom; the decisions made have no consequences; it does not develop manual skills; shortage of learning objects created under this architecture; teachers' attitudes towards their curriculum integration; distraction from students; it requires a lot of time for its mastery; difficult to be employed by students (Álvarez *et al.,* 2017; Cabero & Barroso, 2016; Cubillo, Martín, Castro & Colmenar, 2014; Durrall *et al.,* 2012; Gavish, Gutiérrez, Webel, Rodríguez, Peveri, Bockholt & Franco 2015; Marín-Díaz, 2016, 2017a, 2017b).

Because of the latter, it can be concluded that implementing AR in classrooms today is a challenge which will be determined by the knowledge, beliefs and skills that teachers at all levels of education have towards it, because providing data in a real environment will imply more work for teachers in designing the classroom methodology and in knowing a lot more about technology. However, there are more advantages than disadvantages in using AR in education.

2. Methodology

The quantitatively cut methodology is based on an *ex post facto* design, which will determine the achievement or not of the established objectives, as well as the confirmation or not of the hypotheses raised (Mateo, 2012).

The objective of this research is based on general objective 1 designed for the project RAFODIUM, which was: to evaluate the possibilities and potentials offered by different software used for the creation of technological environments with Augmented Reality to be used in university training contexts, establishing specific objectives:

1. Determine whether undergraduate college students considered Augmented Reality to have educational value.
2. Set the value of Augmented Reality as a curriculum tool for primary education.

3. Set the possible inclusive value of Augmented Reality.

The starting hypothesis established were:

H1: There are gender differences in the educational value in Augmented Reality of Primary Education for men.

H2: Younger students believe that Augmented Reality can be used as a resource that supports the curriculum development in Primary Education.

An ex post facto study method has been used for the achievement of these objectives and scenarios, thus the objective will be obtained *a posteriori* as pointed out by Mateo (2012).

2.1. Instrument design

For the data collection, a questionnaire created by Marín-Díaz was designed in 2016. This was made up of 31 items. The first three were referring to the identification or dependent variables (gender, age and digital devices that the student has —Tablet, laptop, Smartphone, desktop), the remaining 28 corresponded to the independent variables, which tried to answer the hypothesis of this research.

The response scale of the former was nominal in nature and of the second Likert type, where 1 corresponded to totally disagree and 5 to totally agree.

It was subjected to the Cronbach Alpha (Reliability) test and the Barllett's sphericality test (validity) in order to verify that it continued with the same reliability and validity values obtained by Marín-Díaz (2016), since the sample under study was different.

Having performed Alpha of Cronbach test, it was found that the reliability of the instrument was very high (0.829), taking into account the contributions of Mateo (2012) (see table 1). The aim was also to see that the instrument maintained that reliability, so the same test was carried out taking into account the elimination of the questionnaire items, the result presented an alpha that ranged from 0.835 to 0.809, thus, it can be concluded that the instrument meets the reliability conditions for its use.

Table 1. Cronbach Alpha Study

	Alpha
Item 1 Augmented reality allows the development of primary education	0.812
Item 2 Augmented reality allows the development of inclusive education	0.809
Item 3 Augmented reality enhances creativity	0.813
Item 4 Augmented reality allows collaborative work	0.835
Item 5 Augmented reality allows cooperative work	0.810
Item 6 Augmented reality allows group work	0.810
Item 7 Augmented reality facilitates the real learning of the content	0.811
Item 8 Augmented reality enhances the learning process through experimentation	0.812
Item 9 Augmented reality enhances the learning process by free discovery	0.809
Item 10 Augmented reality can be employed by subjects with visual impairments	0.822
Item 11 Augmented reality can be employed by subjects with motor difficulties	0.810
Item 12 Augmented reality can be employed by subjects with psychological difficulties	0.808
Item 13 Augmented reality can be used by subjects with auditory difficulties	0.813

	Alpha
Item 14 Augmented reality can enhance the cross-sectional teaching of the content	0.810
Item 15 Augmented reality enhances intercultural teaching	0.811
Item 16 Augmented reality facilitates the understanding of curriculum contents	0.808
Item 17 Augmented reality complements the curriculum content explained in class	0.809
Item 18 Augmented reality needs great technological support for its use in the classroom	0.823
Item 19 Augmented reality facilitates communication between students and teachers	0.815
Item 20 Augmented reality facilitates communication between students	0.812
Item 21 Computer skills are needed to use augmented reality	0.815
Item 22 Augmented reality is easy to use by students	0.829
Item 23 The use of augmented reality makes it difficult to acquire the contents	0.809
Item 24 Learning to use augmented reality takes a long time	0.810
Item 25 Augmented reality can be used by subjects with high capacities	0.822
Item 26 Augmented reality enhances multicultural teaching	0.819
Item 27 Augmented reality strengthen the digital gap	0.832
Item 28 Augmented reality can be used to prevent bullying situations	0.826

In order to verify the validity of the instrument's construct, a factorial analysis has been performed, carrying out the Barllett sphericity test (approximate Chi-square 2286.439 and values of significance 0.000), and the Kaiser-Meyer index has been calculated –Olkin (KMO=0.805). The result of the test reflects the existence of 5 factors, which explain 84.548% of the total variance, revealing an optimal balance between the components of the instrument which are representative of the theoretical concept. In this way, it was verified that the Cronbach Alpha test performed on the basis of the dimensions or factors extracted still reflects a high internal consistency of the items: dimension 5 of 0.895; 4 of 0.885; the third with 0.807; the second with an alpha of 0.806 and the first dimension of 0.812.

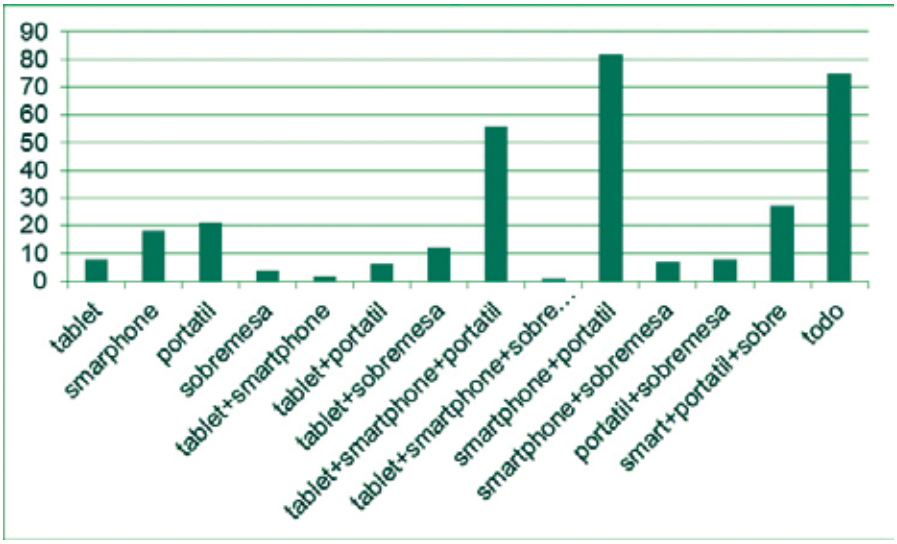
The data achieved have highlighted the validity of the use of this instrument with the sample under study, since they are similar to those obtained by Marín-Díaz (2016).

2.2. Population and sample

The starting population of this study corresponded to the students enrolled in the Degree of Primary Education of the University of Córdoba, taught in the Faculty of Educational Sciences during the academic year 2018-2019, this being 520 students. By incidental sampling, the sample that was finally counted has been 327, taking into account a 5% sample error. From this, 30.9% were men and 69.1% were women. With regard to age, most of the sample is in the age range of 19-20 years, and the lowest in 25-26 years.

Based on the digital devices that the students stated to possess, it was found that 32.51% indicated that they had a smartphone and a desktop computer, and 22.9% had all the indicated digital devices (tablet, smartphone, laptop and desktop), compared to 0.3% that only have tablet, smartphone and desktop computer (see Figure 1).

Figure 1. Student devices



3. Results

3.1. Descriptive study

Participating students fully agree or agree on the educational possibilities that AR has in Primary Education and specifically in the field of inclusive education, highlighting its positive assessment in aspects related to the possibility of enhancing creativity (item 3, 64.2%), the need for computer skills for its use (item 21), and its possibility of being used with the hearing impaired (item 13), 51.4% and 57.7%, respectively.

It is worth mentioning the behavior given to item 4 in which a high percentage of students (16.5%) consider that AR does not allow collaborative work, although 69.1% agree on its possibilities.

However, they disagree or strongly disagree on the assertion that AR can help prevent bullying (item 28, 44.6%) or to strengthen the digital gap (item 27, 42.5%), or that it can be used with visually impaired students (item 10, 29.7%).

3.2. Inferential study

The ANOVA test (n.s.=0.05) based on age has only found significant differences in item 3 (see table 2), referring to the possibility presented by AR to enhance creativity in the student. As can be seen, students aged between 21-22 (M=4.64 DT=.512) and 23-24 years old (M=4.67 DT=.606) consider that AR enhances creativity in Primary Education students versus the other ages (19-20 [M=4.61 DT=0692], 25-26 [M=3.94 DT=1.237] and over 26 years [M=4.29 DT=.736]).

Table 2. ANOVA considering the age

Dependent variable		(I) age	(J) age	Mean difference (I-J)	Typical error	Sig.	95% confidence interval	
							Lower limit	Upper limit
Augmented reality enhances creativity	Bonferroni	19-20	21-22	-.032	.096	1.000	-.30	.24
			23-24	-.067	.117	1.000	-.40	.26
			25-26	.670*	.179	.002	.16	1.18
			Más de 26	.321	.140	.220	-.07	.72

Dependent variable		(I) age	(J) age	Mean difference (I-J)	Typical error	Sig.	95% confidence interval	
							Lower limit	Upper limit
Augmented reality enhances creativity	Bonferroni	21-22	19-20	.032	.096	1.000	-.24	.30
			23-24	-.036	.132	1.000	-.41	.34
			25-26	.701*	.189	.002	.17	1.24
			Más de 26	.353	.152	.211	-.08	.78
		23-24	19-20	.067	.117	1.000	-.26	.40
			21-22	.036	.132	1.000	-.34	.41
			25-26	.737*	.200	.003	.17	1.30
			Más de 26	.389	.166	.199	-.08	.86
		25-26	19-20	-.670*	.179	.002	-1.18	-.16
			21-22	-.701*	.189	.002	-1.24	-.17
			23-24	-.737*	.200	.003	-1.30	-.17
			Más de 26	-.348	.214	1.000	-.95	.26
		Más de 26	19-20	-.321	.140	.220	-.72	.07
			21-22	-.353	.152	.211	-.78	.08
			23-24	-.389	.166	.199	-.86	.08
				.348	.214	1.000	-.26	.95

M=Media
D.T.=Typical deviation

In view of the gender of the students, the Student T test was conducted (n.s.=0.05), which yields significant differences in items 1, 2, 5, 7, 9, 17, 20 and 21, all in favor of women (see table 3).

Tabla 3. T de Student

	Gender	N	M.	D.T.	F.	p	d de cohen
Ítem 1	Man	101	4.27	.747	.539	.005	-0.34
	Woman	226	4.48	.567			
Ítem 2	Man	101	3.99	.755	0.538	.001	-0.41
	Woman	226	4.25	.560			
Ítem 5	Man	101	3.83	.873	.535	.001	-0.39
	Woman	226	4.14	.756			
Ítem 7	Man	101	4.33	.709	.0.284	.003	-1.97
	Woman	226	4.57	.594			
Ítem 9	Man	101	4.01	.900	.050	.000	-0.50
	Woman	226	4.40	.713			
Ítem 17	Man	101	3.92	.783	1.731	.004	-0.34
	Woman	226	4.16	.663			
Ítem 20	Man	101	4.20	.617	1.786	.003	-0.36
	Woman	226	4.41	.576			

	Gender	N	M.	D.T.	F.	p	d de cohen
Ítem 21	Man	101	4.28	.709	12.145	.002	-0.42
	Woman	226	4.53	.543			

M=Media

D.T.= Typical Deviation

3.3. Correlational Study

The results of the correlational study conducted are presented in terms of the dimensions generated by the exploratory factor analysis carried out.

With respect to dimension 1, there is a high correlation between each other in all items, except for item 27, where there is a good correlation between this and the 20.

In dimension 2, item 28 only has a single correlation to 25. It is significant that the rest of the item only has relationships with two items in the dimension; however, these can be considered very high, since they provide bilateral significance level of 0.01.

Based on dimension 3, there is minor significance as there are only three correlations between item 6 and the other items, and two relationships in item 2 (with item 5 and 6).

The correlational study of dimension 4 reflects how the items have a high relationship behavior, except 22 with the others where there is no correlation.

Finally, dimension 5 shows no correlations between item 18 and the rest of the components of the item, while item 21, except for 18, has a high correlation with all others.

4. Discussion and conclusions

The development of the so-called emerging technologies in the educational field is evolving in the way teaching is taught. In the case of the AR several authors (Barroso & Gallego, 2017; Luna, Ibañez & Rivero, 2019; Moreno & Leiva, 2017) have mentioned the great possibilities it offers to the teaching-learning process.

It is believed that its relevance in the educational field lies in the possibilities it offers to provide digital information in real time, enriching the contents and making interactive learning more participatory in terms of the student of any academic level. With regard to future Primary Education teachers, these aspects are valued positively as are the data contained in the work of Moreno and Leiva (2017) and Garay, Tejada and Castano (2017).

The results obtained in this work have shown that AR can be seen as a tool with the possibility of being employed as a resource in classrooms at this educational level (objective 1); it is also seen as an element that allows to complete the development of the contents (Wu, Lee, Chang & Liang, 2013; Joan, 2015; Rahman, Ling & Yin, 2020), fulfilling the objective of this research.

In relation to the second objective set out (*to establish the value of Augmented Reality as a curriculum tool for primary education*), participants believe that AR enhances training through experimentation (Wei, Weng, Liu & Wong, 2015), as in the work carried out on the subject of Anatomy of the medical degree by Ferrer-Torregrosa, Jiménez-Rodríguez, Torralba-Estelles, Garzón-Farinós, Pérez-Bermejo and Fernández-Ehrling in 2016, where it was stated that the learning of muscle movements had been more successful when experiencing these movements by using RA.

In this matter, the students of the Primary Education Degree think that learning through the free discovery typical of this tool, as well as the transversality that it provides to the curriculum development of the contents, is reinforced (Barroso & Gallego, 2017; Moreno & Leiva, 2017).

The most valued element by students has been creativity, as in Wei *et al.* (2015) y Marín-Díaz (2016, 2017a, 2017b). In this sense, the results obtained make it possible to affirm that it enhances the flexible learning (Munnerly, Bacon, Willons, Steele, Hedberg & Fitzgerald, 2014) and the communication between students, as well as the ability to work collaboratively (Martín-Gutiérrez, Fabiani, Benesova, Meneses & Mora, 2015), reinforcing the curriculum development (Joan, 2015).

Nevertheless, it stresses that participants do not consider that this emerging technology can accentuate the digital gap (objective 3), contrary to the results obtained by Marín-Díaz (2017a, 2017b, 2018), as well as to help prevent bullying (Objective 3).

On the other hand, it must be emphasized that elements such as the need to possess computer skills, as well as having time to learn how to use it, are understood as distorting elements in the positive vision that AR can generate for its use in the primary stage; this suggests that this technology can generate displeasure in teachers in addition to provoking some rejection with the training at this educational level.

The results obtained in this research show that the first two objectives set are met, thus it can be concluded that AR is a tool that once it is fully incorporated into working life it will guarantee its use in the academic work.

Finally, with regard to the third objective (*Setting the possible inclusive value of Augmented Reality*) it has been established that, although they consider it to be a tool that allows the development of inclusive education (Cozar *et al.*, 2015; Marín-Díaz, 2018), it has been found that they do not believe that it can be used entirely with individuals who have visual difficulties, fact that agrees with Marín-Díaz (2017a), or with individuals with motor, psychological or with high abilities, information that is opposed to Cozar *et al.* (2015) and Marín-Díaz (2017, 2018), which reflect the great viability of this tool with individuals with autism or any autism spectrum. It is significant that, both in this study and in the study carried out by Marín-Díaz (2017a, 2017b), this resource can hardly be used with students with visual impairment. On the other hand, they believe that it can enhance both intercultural education and multiculturalism (Marín-Díaz, 2017b, 2018), topics that are part of the inclusive perspective.

With regard to the hypotheses raised, it has been demonstrated that there are no gender differences in the educational value of Augmented Reality in Primary Education, given that only one difference has been found in favor of women as regards the creativity potentiality by this tool in the student; therefore, the starting hypothesis can be rejected.

With regard to the second hypothesis referring to the age of the participants, it should also be rejected because young people at a middle age range are those who see the possibility of this tool at this educational stage.

As a final conclusion to this work, it can be determined that even though AR is a technology that helps and facilitates the understanding of the curriculum content, it is necessary to take a number of measures ranging from the provision of digital resources to centers such as training for teachers regarding its use (Garay, Tejada & Castaño, 2017).

Limitations of the study

The development of the research in the field of Social Sciences and education has as the main limitation the availability of sufficiently large samples, which may allow researchers to generalize the conclusions reached.

However, it is precisely there where lies the worth of this type of work, since it proposes new fields of work and/or study that allow to reject or confirm those achieved in the initial research.

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References

Akçayır, M., & Akçay, G. (2017). Advantages and challenges associated with augmented reality for education: A systematic review of the literature. *Educational Research Review, 20*, 1-11. http://dx.doi.org/10.1016/j.edurev.2016.11.002.

Álvarez, S., Delgado, L., Gimeno, M. Á., Martín, T., Almaraz, F. & Ruiz, C. (2017). El Arenero Educativo: La Realidad Aumentada un nuevo recurso para la enseñanza [The Educational Sandbox: Augmented Reality a new resource for teaching]. *EDMETIC, Revista de Educación Mediática y TIC, 6*(1), 105-123. https://doi.org/10.21071/edmetic.v6i1.5810

Barroso, J. M., & Gallego, O. (2017). Producción de recursos de aprendizaje apoyados en Realidad Aumentada por parte de los estudiantes de Magisterio [Learning resource production in Augmented Reality supported by education students]. *EDMETIC, Revista de Educación Mediática y TIC, 6*(1), 23-38. https://doi.org/10.21071/edmetic.v6i1.5806

Cabero, J., & Barroso, J. (2016). Posibilidades educativas de la Realidad Aumentada. En J, Cabero y F. García (coords.), *Realidad Aumentada: tecnología para la formación* (pp. 97-112). Madrid: Síntesis.

Chang, H.-Y., Wu, H.-K., & Hsu, Y.-S. (2016). Integrating a mobile augmented reality activity to contextualize student learning of a socio scientific issue. *British Journal of Educational Technology, 44*(3), E95-E99. https://doi.org/10.1111/j.1467-8535.2012.01379.x

Citardi, M. J., Agbetoba, A., Bigcas, J.-L., & Luong, A. (2016). Augmented reality for endoscopic sinus surgery with surgical navigation: a cadaver study. *International Forum of Allergy & Rhinology*, *6*(5), 523-528. (http://bit.ly/35Dw836)

Cózar, R., del Moya, M., Hernández, J.A., & Hernández, J.R. (2015). Tecnologías emergentes para la enseñanza de las ciencias sociales. Una experiencia con el uso de Realidad Aumentada en la formación inicial de maestros [Emerging Technologies in Social Sciences Teaching. An Experience Using Augmented Reality in Teacher Training]. *Digital Education Review, 27*, 138-153. http://revistes.ub.edu/index.php/der/article/viewFile/11622/pdf

Cózar-Gutiérrez, R., & Sáez-López, J. M. (2017). Realidad Aumentada, proyectos en el aula de primaria: experiencias y casos en Ciencias Sociales [Augmented reality, projects in primary school: experiences and cases in Social Sciences]. *EDMETIC, Revista de Educación Mediática y TIC, 6*(1), 165-180. (http://bit.ly/2PZExXT)

Cruz, M. (2018). Chicos, sacad el móvil de vuestras mochilas porque lo vamos a usar: Empowering Spanish As Foreign Language Students Through Mobile Devices. *The Turkish Online Journal of Educational Technology*, *1*(Special Issue for INTE-ITICAM-IDEC), 1, 282-298. (http://bit.ly/2RoS9hM).

Cubillo, J., Martín, S., Cantro, M., & Colmenar, A. (2014). Recursos digitales autónomos mediante Realidad Aumentada [Autonomous digital resources through Augmented Reality]. *RIED, 17*(2), 241-274. (http://bit.ly/2OSqWT2).

Cuevas, M., Fernández, M., Díaz, F., Gijón, J., Lizarte, E.J., Ibáñez, P., El Homrani, M., Ávalos, I., & Rodríguez, R. (2019). Liderazgo y calidad en la Educación Superior. *EDMETIC, Revista de Educación Mediática y TIC, 8*(2), 52-72. https://doi.org/10.21071/edmetic.v8i2.12120

Durall, E., Gros, B., Maina, M. F., Johnson, L., & Adams, S. (2012). Perspectivas tecnológicas: educación superior en Iberoamérica 2012-2017. (http://bit.ly/2MbtSsc)

Fabregat, R. (2012). Combinando la Realidad Aumentada con las plataformas de e-elearning adaptativas [Combining Augmented Reality and Adaptive E-Elearning Platforms]. *Enl@ce: Revista Venezolana de Información, tecnología y conocimiento*, *9*(2), 69-78.

Ferrer-Torregrosa, J., Jiménez-Rodríguez, M.Á., Torralba-Estelles, J., Garzón-Farinós, F., Pérez-Bermejo, M. & Fernández-Ehrling, N. (2016). Distance learning ECTS and flipped classroom in the anatomy learning: comparative study of the use of augmented reality, video and notes. *BMC Medical Education, 16*,1-9. https://doi.org/10.1186/s12909-016-0757-3.

Ferrer-Torregrosa, J., Torralba, J., Jiménez, M., García, S., & Barcia, J. (2015). ARBOOK: Development and assessment of a tool based on augmented reality for anatomy. *Journal of Science Education and Technology, 24*(1), 119-124. https://doi.org/10.1007/s10956-014-9526-4

Fracchia, C.C., Alonso, A.C., & Martins, A. (2015). Realidad Aumentada aplicada a la enseñanza de Ciencias Naturales. *TE & ET*, *16,* 7-15. (http://bit.ly/362mOpl).

Garay, U., Tejada, E., & Castaño, C. (2017). Percepciones del alumnado hacia el aprendizaje mediante objetos educativos enriquecidos con Realidad Aumentada [Perceptions of the Student to Learning through Enriched Educational Objects with Augmented Reality]. *EDMETIC, Revista de Educación Mediática y TIC, 6*(1), 145-164. https://doi.org/10.21071/edmetic.v6i1.5812

Gavish, N., Gutiérrez, T., Webel, S., Rodríguez, J., Peveri, M., Bockholt, U., & Franco, T. (2015). Evaluating virtual reality and augmented reality training for industrial maintenance and assembly tasks. *Interactive Learning Environments, 23*(6), 778-798. https://doi.org/10.1080/10494820.2013.815221

Hernández, R., Fernández, C., & Baptista, P. (2006). *Metodología de la investigación*. (6ª edición). México: McGraw Hill Interamericana.

Joan, R. (2015). Enhancing education through mobile augmented reality. *Journal of Educational Technology, 11*(4), 8-14.

Johnson, L., Adams, S., Cummins, M., Estrada, V., Freeman, A., & Hall, C. (2016). *NMC Horizon Report: 2016 Higher Education Edition*. Austin, Texas: The New Media Consortium.

Luna, U., Ibáñez, A. & Rivero, M.P. (2019). El patrimonio aumentado. 8 apps de Realidad Aumentada para la enseñanza-aprendizaje del patrimonio [The augmented heritage. 8 apps of Augmented Reality for the heritage teaching-learning]. *Revista Interuniversitaria de Formación del Profesorado, 94*, 43-62. (http://bit.ly/2DPRKwY).

Marín-Díaz, V. (2016). Posibilidades de uso de la Realidad Aumentada en la educación inclusiva. Estudio de caso [Possibilities of use of Augmented Reality in inclusive education. Case study]. *Ensayos, Revista de la Facultad de Educación de Albacete, 31*(2), 57-68.

Marín-Díaz, V. (2017a). The relationships between Augmented Reality and inclusive education in Higher Education. *Bordón*, *69*(3), 125-142. https://doi.org/10.13042/Bordon.2017.51123

Marín-Díaz, V. (2017b). The Augmented Reality in the educational sphere of student of degree in childhood education. Case study. *Pixel Bit, Revista de Medios y educación, 51*, 9-24. http://dx.doi.org/10.12795/pixelbit.2017.i51.01

Marín-Díaz, V. (2018). La Realidad Aumentada al servicio de la Inclusión educativa Estudio de caso [Augmented Reality in the service of educational inclusion. Case study]. *Revista Retos XXI, 2*, 60-72. https://doi.org/10.33412/retoxxi.v2.1.2060

Marín-Díaz, V. (2020). ICT-Based Inclusive Education. En A. Tatnall (eds), *Encyclopedia of Education and Information Technologies* (pp.1-18). Springer, Cham. https://doi.org/10.1007/978-3-319-60013-0

Martín-Gutiérrez, J., Fabiani, P., Benesova, W., Meneses, M.D., & Mora, C. E. (2015). Augmented reality to promote collaborative and autonomous learning in higher education, *Computers in Human Behavior, 51*, 752-761. https://doi.org/10.1016/j.chb.2014.11.093

Mateo, J. (2012). La investigación ex post-facto. En R. Bisquerra (Coord.), *Metodología de investigación educativa*. (pp.195-229). Madrid: La Muralla.

Moreno, N., & Leiva, J. (2017). Experiencias formativas de uso didáctico de la Realidad Aumentada con alumnado del grado de educación primaria en la Universidad de Málaga [Formative experiences in the educational use of augmented reality with students of primary education degree at the University of Malaga]. *EDMETIC, Revista de Educación Mediática y TIC, 6*(1), 81-104. https://doi.org/10.21071/edmetic.v6i1.5809

Munnerley, D., Bacon, M., Fitzgerald, R., Wilson, A., Hedberg, J., Steele, J. & Standley, A. (2014).

Augmented Reality: application in Higher Education. *Office for Learning and Teaching*, *10*(1), 3121-7445.

Prendes, C. (2015). Realidad Aumentada y educación: análisis de experiencias prácticas [Augmented realityand education: analysis of practical experiencies]. *Pixel Bit, Revista de Medios y Educación, 46*, 157-203. (http://bit.ly/2EwTDis)

Rahman M.A, Ling L.S., & Yin OS (2020) Augmented Reality for Learning Calculus: A Research Framework of Interactive Learning System. *Computational Science and Technology. Technology, 603*, 491-499. https://doi.org/10.1007/978-981-15-0058-9_47

Sommerauer, P., & Müller, O. (2014). Augmented reality in informal learning environments: A field experiment in a mathematics exhibition. *Computers & Education, 79*, 59-68. (http://bit.ly/2S73ROq)

Wei, X., Weng, D., Liu, Y., & Wang, Y. (2015). Teaching based on augmented reality for a technical creative design course. *Computers & Education, 81*, 221-234. https://doi.org/10.1016/10.1016/j.compedu.2014.10.017

Wu, H.-K., Lee, S., W.-Y., Chang, H.-Y., & Liang, J.-C. (2013). Current status, opportunities and challenges of augmented reality in education. *Computers & Education, 62*, 41-49. https://doi.org/10.1016/10.1016/j.compedu.2012.10.024

Yilmaz, R. M. (2016). Educational magic toys developed with augmented reality technology for early childhood education. *Computers in Human Behaviour, 54,* 240-248. https://doi.org/10.1016/j.chb.2015.07.040

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Virtual environments for academic writing. A model in Minecraft

Entornos virtuales para la escritura académica. Un modelo en Minecraft

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Abstract

The article analyzes the possibilities a virtual environment through a commercial video game presents for academic writing in university education. At the end of 2017, a mixed investigation was conducted in a single case study with a group of 28 undergraduate students; combined techniques of observation and information gathering (open questions, photographs in the virtual environment, field diary, system records), as well as measurement (Likert scale questionnaire) were used to account for the affinity and adaptability expressed by students in the conduction of the collective writing exercise in Minecraft. After having completed the exercise, the statistical treatment of the questionnaire allowed to establish the presence of the two proposed variables and establish correlations with the rest of the variables of the instrument. For this article, only a selection of the results of the questionnaire is presented —e.g. Affinity (0.522, 0.531) and Adaptability (0.508, 0.688) in the group independently of genre— as well as a selection of the complementary observation records. The findings point towards the relevance of the use of adapted videogames as platforms for academic writing in university training. This allows to think on extended uses of virtual environments for inter and intrainstitutional writing and publishing to develop academic literacy.

Keywords: Adult literacy, information literacy, virtual learning, higher education, writing, videogames.

Resumen

El presente trabajo analiza las posibilidades que un entorno virtual, mediante un videojuego comercial, presenta para la escritura y la publicación académica en el marco de la formación universitaria. A finales del 2017 se realizó una investigación mixta por medio de un estudio de caso único con un grupo de 28 estudiantes de licenciatura; se combinaron técnicas de observación y recolección de información (preguntas abiertas, fotografías dentro del entorno virtual, bitácora del investigador, registros de sistema), así como de medición (escala Likert) para dar cuenta de la Afinidad y la Adaptabilidad expresada por los estudiantes en la realización del ejercicio de escritura colectiva dentro del videojuego. Tras la realización del ejercicio, el tratamiento estadístico permitió establecer la presencia de las dos variables propuestas y establecer correlaciones con el resto de las variables del instrumento. Para este artículo, se presenta una selección de los resultados del cuestionario —e.g. Afinidad (0.522, 0.531) y Adaptabilidad (0.508, 0.688) del grupo independientemente del género— así como una selección de los registros complementarios de indagación. Los hallazgos en su parcialidad apuntan hacia la pertinencia del uso de videojuegos adaptados como plataformas para la escritura académica en el marco de la formación disciplinaria universitaria. Se abre la posibilidad de pensar en usos extendidos de entornos virtuales de escritura y publicación académica inter e intra institucionales para desarrollar la alfabetización académica.

Descriptores: Alfabetización de adultos, alfabetización informacional, aprendizaje virtual, enseñanza superior, escritura, vídeo juego

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1. Introduction and state-of-the-art

Creating the conditions for the access and participation of young people in the written subjects at the university is still a huge challenge for higher education institutions in Latin America. Complications in student´s performance have been attributed to inconsistencies in previous levels, and the problem requires other approaches to broaden the vision and enhance the interventions. The difficulties that students face whilst learning university literacy are not only because of the complexity of the new disciplinary and academic languages and practices (vs. the previous levels), but also due to asynchrony between traditional models of university academic learning in contrast to the many forms that cultural learning has outside these institutions.

It is necessary for universities to incorporate discussions that remark the richness that contemporary models of cultural learning linked to the new media ecology have for their own educational purposes (Gutiérrez & Torrego, 2018; Gil Gonzáles & Pardo, 2018; Alloza, Escribano, Delgado, Coneanu & Escalera, 2017; Ruiz & Díaz, 2016; Evaristo, Navarro, Vega & Nakano, 2016; Agramunt, 2016; Cordón & Jarvio, 2015; Pérez, 2014; Bezanilla, Arranz, Rayóhn, Rubio, Menchaca, Guenaga & Aguilar, 2014; Villegas, 2013), and use them as thoughtful and practical resources to reconstruct educational practice around academic literacy. The variety of digital literacy practices (Gros, 2002) from popular culture can help narrow the gap between students' academic literacy practices and the demands of academic literacy in the university.

The discussion of learning in virtual worlds using commercial video games as educational tools (Lacasa, 2013), based on video games and participation (Squire & Jenkins, 2011) and video games and mediation curriculum learning (Gros & Garrido, 2008), allows to establish the complexity of the challenge of training students and the potential presented by video games as alternatives to educational intervention in academic literacy. Since 2005, Shaffer, Squire, Halverson and Gee anticipated that video games have the potential to change education as it is known, as these can be used to take the education system beyond the traditional management of academic disciplines derived from medieval scholastics and incorporated in schools developed in the industrial revolution, towards a new model of learning through meaningful activities in virtual worlds in preparation for meaningful participation in the post-industrial and technologically rich real world.

For this research, Minecraft was chosen as its use allows the construction of new and relevant scenarios for training and learning in formal education through virtual reality (Karsenti, Bugmann & Gros, 2017; Nebel, Schneider & Rey, 2016; Craft, 2016; Castellanos, Castellanos, Salazar & Casas, 2016; Callaghan, 2016; Sáez-Lopez, Miller, Vázquez-Cano & Domínguez-Garrido, 2015; Cipollone, Schifter & Moffat, 2015; Bebbington & Vellino, 2015).

1.2 Constructivism, affinity and adaptability in virtual environments

For this research, the sociocultural approach of Vygotskyan origin was adopted (Vygotsky, 1986, 1978), which allows to address reading and writing as cultural processes that need to be developed in formal education. The concepts of Affinity Spaces (Gee & Hayes, 2012) and Adaptability (Barr, 2017) are also incorporated and are entrenched with the concept of Zone of Proximal Development as theoretical basis.

The digital age is creating new scenarios and new modes of interaction between the text and its receivers and writers. In this sense, new cultural practices are being generated and contribute to the development of activities that incorporate spaces of affinity (Gee & Hayes,

2012), creating new ways of participation in the digital culture.

Gutiérrez and Torrego (2018) state it as follows: affinity space is a concept that refers to the virtual place from which informal learning environments take place thanks to the interaction with the rest of participants and the content. These environments (Jenkins, 2009), are flexible and experimental, and can change their organization to suit the needs and interests of those who use them, something that does not happen in traditional education systems, where students struggle with a participatory culture based on collective intelligence.

When using video games, people are facing a new multimodal and electronic textuality. The existence of multiple means of communication and the interrelationship established between them have given rise to a type of text that does not begin and end in a single medium, but is diversified and dispersed taking advantage of the characteristics of each medium, giving birth to a intermediate narration (Gil González & Pardo, 2018). In addition, the digitization of the media has allowed new ways of interaction among its users and has fostered the unusual development of a participatory culture like never before.

Despite its age, the validity of Vygotsky's contributions is evident today. For this research, the concept of the Zone of Proximal Development (ZPD) is used, which explains the distance between the level of development of the student (what he/she can do alone) and the level of potential development (what he/she would be able to do with the help of an adult or a more skilled individual). This concept allows to define the potential margin of incidence of the educational action. For this research, it is in the ZPD where new ways of understanding and dealing with tasks and problems by the less competent participant can occur, thanks to the help and resources offered by their most competent peers , in this case, within a virtual environment. From this characterization, it is understood that what the person is able to do with help in the ZPD at any given time, he/she will then be able to do it independently later: which can first be done at the social or the interpersonal level, may later be dominated and performed autonomously by the initially less competent participant (Onrubia, 1999, in Coll *et al.,* 1999).

Constructivist approaches to affinity spaces are related with Barr's findings (2017) on adaptability as an expression of cognitive skills (ability to perceive) and behavior (ability to adapt), using commercial video games as educational tools. Adaptability is a challenge of today's education. According to Ramírez, Herrera and Herrera (2003), adaptability is the intellectual and emotional capacity to respond coherently to the demands of the environment; it is a dynamic process that adjusts and regulates behavior according to the environment. In addition, it encompasses a set of temporarily contextualized attitudes in pursuit of emotional well-being and personal satisfaction by which the student modifies his/her behavior patterns to self-regulate the prevailing conditions of the environment. In this regard, it is agreed that a rapid and effective adaptation of university students is essential to ensure academic success.

2. Methodology

After the methodological and theoretical review for the construction of the strategy and given the unrepeatable conditions of the selected group, an approach was built through a single case study (Yin, 2003) supported by Bisquerra´s Educational Research Methodology (2004), since it allowed to propose a comprehensive yet specific scaffolding to investigate the presence of Affinity and Adaptability in a group of students when performing an academic writing and publishing exercise inside a virtual environment, using a modified commercial video game.

The idea was to observe as well as to measure hence the need to use this mixed approach.

The aim of knowing the presence of Affinity and Adaptability implied the need to build a virtual working environment based on the theoretical positions of constructivist learning, incorporating discussions on vernacular literacies in young college students. The design and implementation of this virtual environment through Minecraft to work on writing and publishing as social practices that accounted for affinity and adaptability also required us to create an instrument that would measure both variables or components and that would also allow to establish some inferences from the correlations between them and the rest of the variables of the instrument.

Therefore, the design of the research in its quantitative part was encompassed by a pre-experiment. Statistically, it was possible to validate the scales of the instrument, first by expert piloting and then by statistical exploration to provide enough reliability and validity on the presence of the two proposed factors, Affinity and Adaptability, and establishing relationships with the rest of the variables. As for the scope of the research, it was exploratory and analytical, because in addition to knowing the group and its characteristics, it was statistically possible to analyze the type of relationships between the proposed variables in order to explain their presence, complementing the analysis with the additional observation and inquiry records collected.

2.1. Subjects of study and brief narrative

The methodological and theoretical definitions described above, in addition to the possibilities of accessing to student groups and their specific conditions of academic literacy, determined the selection criteria and led to the selection of a single group: the 2014 generation of the Bachelor's Degree in Educational Processes of the BUAP School of Philosophy and Letters, which during fall (August-December) 2017, were undergoing the subject of Evaluation, Accreditation and Certification of Higher Education Institutions. A pre-experimental design with a single observation group was used. This group of 35 students was convened by the professor of the subject who told them about the exploration that was going to be conducted. In the first face-to-face meeting with the group, the researcher informed them of the characteristics of the exercise and detailed the mechanics of participation and anonymity. At that same meeting, the researcher required the informed consent of the participants by personally creating their user profiles to enter the virtual environment.

What was the intervention? This research exercise was based on the work that the professor had been doing with the students during that semester. The students had previously read material on the subject, held group discussions, elaborated comparative and analysis tables, and written an essay on the subject. This intervention occurred just after having written that essay. Students had to write an abstract of their essay to share in the group. This is where the exercise was done as students were asked to write and publish their abstract in the Minecraft virtual environment so that it would be virtually presented to everyone else.

After writing and publishing the abstract, they were asked to read at least one of the abstracts and leave a feedback, using a rubric provided to them for such purposes. The rubric was prepared by the researcher and was provided to students inside and outside the environment to ensure its availability even when they were not connected. A modified version of Minecraft was used (to allow the publication of their abstracts) and students had access to it in the faculty's computer lab and on their personal computers outside school hours.

The abstract was prepared using in-game signs, and feedback was made by using books (it is an in-game object that allows writing) that were placed inside chests next to the read abstract. Once students completed the feedback, the exercise was finished. The exercise took place over a week, with three face-to-face meetings in

the computer lab, and multiple encounters in the virtual environment in and out of school hours. It is worth remembering that, although the aim of the students was to publish their abstracts and provide feedback to others, the purpose of the research was not to evaluate the abstracts but to be able to record what was happening with the students during the writing activity. Thus, the research aimed to value the social experience of writing in the virtual environment and not to evaluate the quality of the writings. The rubric provided to students, and the previous work done on the subject, ensured that the writing of the abstracts was indeed subject to an academic standard of publication. Students had to take care of their writing, their style, the use of quotations, and the general organization of ideas so that the abstract had a structure that could be reproducible. At the end of the intervention, only 28 of the initial 35 students completed the exercise in its entirety.

2.2. Identification of variables and validation of the instrument

The working hypothesis raised in the research established a causal relationship between the use of the video game and the presence of Affinity and Adaptability. Through the pre-experimental method we analyzed if the results could be explained exclusively through the relationship between these factors or variables. The available conditions led us to work with this methodological variable to propose a research that could be quantitatively explanatory, while also having other records of data and information obtained through other ways of observation of the single case with the group. Although the lack of a control group normally limits the statistical comparability of the instrument, the validation carried out first by conducting a piloting by experts and then by a statistical exploration to analyze the data, allowed to confirm that two dimensions or components were present and they became indicators for the comparison with the other variables by analyzing their variances (Anova).

The final version of the instrument allowed to achieve an acceptable level of reliability with a Cronbach Alpha of .798, grouping 8 likert scale items into 2 components: the first consisting of 5 items named Affinity, and the second consisting of 3 items named Adaptability. The rest of the items functioned as contrast variables, either categorical or scalar. The instrument yielded consistent parameters for 1) accounting the two proposed components (Affinity and Adaptability) and 2) crossing them and the other variables of the study for describing the group and its characteristics, incorporating the records of other information collection techniques to broaden the spectrum of what was statistically observed.

2.3. Collection techniques and analysis of information

After the intervention, the two parts quantitative instrument was applied: the first regarding the general characteristics of the group and previous experiences of academic and digital literacy; and the second regarding the exercise carried out. The choice to work with a single group involved a limitation: the impossibility of testing alternative hypotheses . However, the statistical validation of the instrument made it possible to account for the changes reported in the dimensions in the observed group, and to complement it with the other observational records to have further elements for understanding the phenomenon.

As part of the single-case study, photographs were taken during the intervention in the virtual environment, server messages were logged by system log, in addition to the observations recorded in the researcher's log; all these observation techniques provided additional information on the Adaptability and Affinity developed during the intervention. In other words, it was possible to record a series of evidence that gave an account of the Affinity and Adaptability of the group, beyond what was

recorded by the questionnaire with the possibility of complementing it.

3. Analysis of the results

The analysis techniques of the instrument were various statistical treatments to which the different variables were tested against, such as Student T, Anova, KMO and Bartlett circumference, Exploratory factor analysis of main components, matrix comparison, variance analysis, Alpha Cronbach. These analyses were performed using the SPSS software in version 22.

An exploratory factor analysis was carried out, using main components and shared variances. Despite the variance of the error, a sufficiently strong association of the variables and variance explanation was achieved.

The instrument was developed under expert piloting and was also statistically validated. This statistical validation was first performed by free extraction of all statistical associations. It was assumed that it was not known whether correlations existed; using perpendicular methods, through a VARIMAX rotation sorted by size small values were supressed. This test allowed us to know how the defined factors were conformed and how exclusive they were from each other. When the measurement scale is above .700 it is assumed to be adequate. The sphericity test tells if the association data does not resemble the identity matrix. In this case, the identity matrix presented a significant difference with the correlation matrix, so it was valid to do a factor analysis since the factors were defined, and because there were factors, specifically two factors in this case. Dimension or factor 1 and dimension or factor 2 explained 61% of the variance, being an acceptable percentage.

The composition of these variables was expressed by the matrix of rotated components. After the refining from the saturation indexes of the variables shared in the components, component 1 was composed by 5 variables and component 2 by 3 variables. Thus, through component validation, the 2 components that were intended to be observed, Affinity and Adaptability were constituted by grouping 8 measurable variables in the two reported components, yielding a reliability (Alpha of Cronbach) of .793.

The two components found after the application were converted to variables. With each component (named Affinity and Adaptability) converted into a variable, it was possible to establish correlations with other nominal and ordinal variables that were retrieved from the instrument. The crosses were made between the characteristics of the group and the Affinity and Adaptability recorded by the instrument. In each case, the values accounted for 1) the homogeneity of the groups using the Variance Homogeneity Test, where values greater than .05 would indicate that the groups are homogeneous; and 2) the Anova between the variances of the variables, where values greater than .05 would indicate that there are no statistically significant differences between the groups; therefore, the presence of the variables will be independent of the factors, in this case the characteristics of the group. After the statistical treatment was carried out, correlations were established between the variables by analyzing their variances (Anova), which were further supplemented by the information recorded through the other research techniques, which allowed establishing the following results.

3.1 Results[1]

After the variance homogeneity test and the Anova, the Affinity variable behaved as follows: it was consistently present in the group, regardless of: age (0.652, 0.149), gender (0.522, 0.531), semester (0.2, 0.095), reason behind career election (0.801, 0.549), and prior knowledge of the Minecraft video game (0.104, 0.168).

1 Due to space limitations in this article, only a selection of quantitative results is presented, as well as a selection of the results obtained from other collection techniques, in this case it is the researcher´s logbook.

After the variance homogeneity test and ANOVA, the Adaptability variable behaved as follows: it was consistently present in the group, regardless of: gender (0.508, 0.688); reason behind career election (0.753, 0.406); difficulty assessment of video games as an activity (0.673, 0.231); difficulty assessment of the exercise (0.626, 0.380); and the opinion on the potential of video games for academic writing (0.762, 0.061).

Based on the above data and from the initial hypothesis stating *the use of a virtual environment from Minecraft impacts the Affinity and Adaptability of university students when performing a collective academic writing and publishing exercise* , it can be said that it is corroborated for the studied group. The limitations and scope of the methodological approach prevent us from corroborating alternative hypotheses, and although it is possible to account for the presence of the proposed variables, it is not possible to assert their generality.

Within its bias, this hypothesis check is important as a thoughtful and methodological benchmark for further research. It suggests the possibility of using various virtual environments through video games to work academic writing at the university. As recorded in this investigation, the affinity and adaptability of the group occurred during the intervention, and its presence can be explained independently of certain group characteristics.

With regard to the objectives of the research, these were met to the extent that it was possible to: 1) Enable a virtual environment using Minecraft and conduct an academic writing exercise with university students to observe, measure and analyze affinity and adaptability; 2) Design an intervention methodology through a virtual environment using Minecraft that allows academic writing to take place; 3) Develop an instrument to measure the application of the virtual environment and its impact on the proposed variables; 4) Account for students' experiences with academic writing and digital literacies during their university education; 5) Describe the characteristics of the group of students with respect to Affinity and 6) Describe the characteristics of the students with respect to Adaptability.

The researcher's logbook allowed the recording of data and events that escaped from the other records but that allow quantitative findings to be robusted. A selection of the findings from this record is presented below.

Some students created their own techniques for writing/migrating their summaries to the virtual environment. Most students had prepared their summaries in word processing in advance, but the task of bringing them into the virtual environment was not so simple. The boards in Minecraft could contain up to 600 characters spread over 15 lines, a total of 40 characters per line. Students reconfigured their abstracts, and in some cases, modified the wording to create their lines of text, and then just insert them directly into the game. One of the advantages of using the PC version of Minecraft is to be able to go from one application to another and take advantage of the copy and paste shortcuts between applications that use writing. Therefore, several students created a kind of text transcription document, i.e., a document in Word that served as a template to segment the lines of their paragraphs to the right size for the game, and then just copy and paste it in the environment. These new uses of the same word processor account for students' adaptability to ingeniously solve new academic and digital literacy challenges.

During the working sessions in the computer lab, the closeness of the computers allowed for two types of interaction between students. One in the virtual environment using the chat (text conversations), and one on the outside, face to face, i.e., students supported at each other in the physical environment, while leaning in the virtual environment.

With the information recorded in the logbook, it is possible to assess processes of Adaptability and Affinity on the part of the stu-

dents: the creation of the transcription documents between Word and Minecraft; the disposition of students to attend virtual and real life sessions outside school hours; and the fellowship and support between each other during the encounters.

4. Conclusions

It was possible to know the effects that a virtual environment tailored for academic writing (through an adapted commercial video game) had on the affinity and adaptability of students who study at the university. In addition, the instrument allowed some comparisons to be made between these two variables and the rest of the variables used.

From an innovation point of view, the research promotes a novel use of digital technologies, known as video games, to work academic writing in the university enhanced by virtual reality, i.e., it provides an idea that given certain conditions of academic literacy, using technologies like Minecraft, can allow processes that in addition to developing affinity and adaptability, allow learning in new, more flexible and relevant modalities. The idea here is to spread the notion of enhancing academic writing by using affinity spaces made possible by videogames and other digital resources from the current media ecology, as aids to develop academic and disciplinary literacy.

The most important results are directly related to the verification of the presence of Affinity and Adaptability in the group of students when performing the writing exercise in the virtual environment, regardless of its general features. This is promising since it allows to imagine new applications of this working format in other groups with other features, assuming that the affinity and adaptability of the participants will continue to be positively impacted.

The multiple positive reactions collected in this research allow having an idea about formalizing and expanding the offer of this type of virtual working environments in other subjects in the bachelor's degree, and even transferring it to all areas of knowledge at the university.

It should be emphasized: the use of digital environments is not meant to replace interactions in the physical world, nor does it imply the non-use of analog tools or local offline processes, on the contrary, it must be assumed that the use of virtual environments works rather as extensions of academic literacy processes already set in motion. To the extent that the practice scenarios of interdisciplinary academic literacy are strengthened, mastery and control will be gained by students over their participation in the development of scientific ideas for humanity.

Being a literate person can only mean to be prepared to participate in the construction of the locations shared with others. Being a digital literate is therefore an imprint on the formation of citizens (Area, 2015). Within universities, the training scenarios of young people must be strengthened so that they can recognize their individuality and undertake a commitment of inclusion with the society they are part of (Villegas, 2013), to make decisions, to reach agreements and to raise questions. Therefore, the university has the challenge and the honor of fostering literate people, i.e., people who can make informed and critical decisions about the processes, contexts and situations that are common to them. The students who participated in the exercise, stated mostly to have moved from confusion and anguish at the unusual virtuality of the task, towards satisfaction and the ability to recognize themselves and act/create collaboratively in the virtual environment. From the Vygotskyan perspective, this transition would correspond to the one that occurs along the Zone of Proximal Development (ZPD).

If the results of this research are any indication, virtual environments can provide new ideas to work university writing, while generating environments that develop the adaptability and affinity of young people. After all, affinity and adaptability are but natural consequences of the learning processes of people.

Through virtuality, it is possible to strengthen the formative processes around aca-

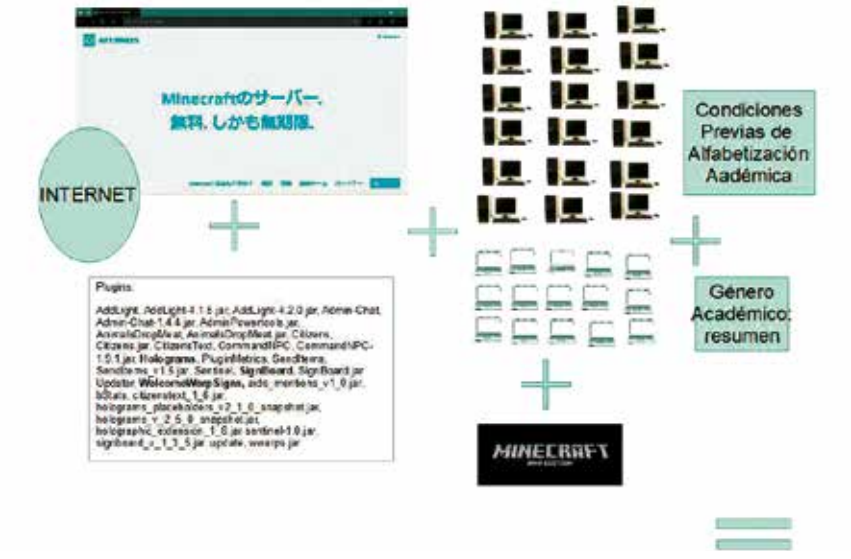
demic writing, and to empower young people to develop their creativity and their critical capacity. As professors of the digital age, we cannot but embrace the possibilities that virtuality presents for our formative pretensions. The idea is not to create individuals who settle without thinking, but to contribute to the personal growth of each person in a group, so that they can own their decisions, and create their interconnected fates.

It is then necessary to carry out new educational processes in Latin America, along with the existing processes, to strengthen the formative scaffolding of young students. The commitment and challenge being faced in the Latin American public university is undeniable. Young students will have the responsibility of continuing the social institutions that guarantee the collective well-being. Thus, taking on virtuality in public university can strengthen processes, channels, and mechanisms for that to happen.

5. Images and figures

Photo of the virtual environment showing a page of one of the 28 abstracts

Resources for constructing the writing virtual scenario



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References

Agramunt, I. (2016). *Videojuegos, la alternativa pedagógica en los procesos de enseñanza/aprendizaje de la Geografía e Historia.* Universitat Jaume I. (https://bit.ly/2ZBTker).

Alloza, S., Escribano, F., Delgado, S., Coneanu, C., & Escalera, S. (2017). *XBadges. Identifying and training soft skills with commercial video games. Improving persistence, risk taking & spatial reasoning with commercial video games and facial and emotional recognition system.* Conference Paper. (https://bit.ly/2NLDpaO).

Area, M. (2015). La alfabetización digital y la formación de la ciudadanía del siglo XXI. *Integra Educativa*, *7*(3), 21-33. (https://bit.ly/2HupbXo).

Barr, M. (2017). Video games can develop graduate skills in higher education students: A randomized trial. *Computers and Education*, *113*, 86-97. https://doi.org/10.1016/j.compedu.2017.05.016

Bebbington, S. & Vellino, A. (2015). Can playing Minecraft improve teenagers' information literacy? *Journal of Information Literacy*, *9*(2), 6-26. https://doi.org/10.11645/9.2.2029

Bezanilla, J.M., Arranz, S., Rayóhn, A., Rubio, I., Menchaca, I. Guenaga, M., Aguilar, E. (2014). *A* proposal for generic competence assessment in a serious game. *New Approaches in Educational Research*, *3*(1), 42-51, january ISSN: 2 254-7399. https://doi.org/10.7821/naer.3.1.42-51

Bisquerra, R. (2004). *Metodología de la investigación educativa.* Madrid: La Muralla.

Callaghan, N. (2016). Investigating the role of Minecraft in educational learning environments. *Educational Media International*, *53*(4), 244-260. https://doi.org/10.1080/09523987.2016.1254877

Carlino, P. (2003). Alfabetización académica: un cambio necesario, algunas alternativas posibles. *Educere*, *6*(20) 409-420. ISSN: 1316-4910.

Carlino, P. (2013). Alfabetización académica diez años después. *RMIE*, *18*(57), 355-381 (ISSN:14056666).

Castellanos, Y., Castellanos, Y., Salazar, J., & Casas, W. (2016). *El videojuego como recurso educativo. Un acercamiento entre percepción docente y el videojuego Minecraft como recurso educativo, para potenciar el trabajo colaborativo en estudiantes de cuarto grado.* (Tesis de Grado de Maestría). Pontificia Universidad Javeriana. (https://bit.ly/2MLEdNg).

Cipollone, M., Schifter, C. C. & Moffat, R. A. (2015). Minecraft as a creative tool: A case study. https://doi.org/10.4018/978-1-4666-8200-9.ch047

Coll, C., Martín, E., Mauri, T., Miras, M., Onrubia, J., Solé, I., & Zabala, A. (1999*). El constructivismo en el aula*. Barcelona: Graó.

Cordón, J. A., & Jarvio, A. O. (2015). ¿Se está transformando la lectura y la escritura en la era digital? *Revista Interamericana de Bibliotecología*, *38*(2), 137-145. https://doi.org/10.17533/udea.rib.v38n2a05. (https://bit.ly/2ZBIHYX).

Craft, J. (2016). Rebuilding an empire with Minecraft: Bringing the classics into the digital space. *The Classical Journal*, *111*(3), 347-364. https://doi.org/10.5184/classicalj.111.3.0347

Evaristo, I., Navarro, R., Vega, V., & Nakano T. (2016). Uso de un videojuego educativo como herramienta para aprender historia del Perú. *RIED. Revista Iberoamericana de Educación a Distancia, 19*(2), 35-52. http://dx.doi.org/10.5944/ried.19.2.15569. ISSN: 1138-2783. E-ISSN: 1390-3306.

Gee, J. P., & Hayes, E. (2012). *Nurturing affinity spaces and game-based learning. Games, Learning, and Society: Learning and Meaning in the Digital Age* (pp. 129-153). Cambridge University Press. https://doi.org/10.1017/CBO9781139031127.015

Gil González, A., Pardo, P. (2018). *Adaptación 2.0. Estudios comparados sobre intermedialidad.* Síntesis de los proyectos de investigación coordinados "Transescritura, transmedialidad, transficcionalidad: Relaciones contemporáneas entre literatura, cine y nuevos

medios, II" e "Intermedialidad, adaptación y transmedialidad en el cómic, el videojuego y los nuevos medios" financiados por el Ministerio de Economía y Competitividad. España. (https://bit.ly/30UpbbL).

Gros, B. (2002). *Videojuegos y alfabetización digital.* Publicado originalmente en Enredando.com el 07/05/2002

Gros, B., & Garrido, J. (2008). Con el dedo en la pantalla": el uso de un videojuego de estrategia en la mediación de aprendizajes curriculares. *Revista Electrónica Teoría de la Educación. Educación y Cultura en la Sociedad de la Información, 9*(3), noviembre. (https://bit.ly/2Hy4tXq).

Gutiérrez, A., & Torrego, A. (2018) Educación mediática "aumentada" para la interacción y participación en entornos virtuales. Análisis de una comunidad de Pokémon Go en YouTube. index.comunicación, [S.l.], *8*(2),129-150, mayo. ISSN 2174-1859. (https://bit.ly/2ZkzRU2).

Jenkins, H. (2009). *Fans, blogueros y videojuegos: la cultura de la colaboración*. Barcelona: Paidós.

Karsenti, T., Bugmann, J., & Gros, P. P. (2017). *Transforming Education with Minecraft? Results of an exploratory study conducted with 118 elementary-school students.* Montreal: CRIFPE. (https://bit.ly/2Hz29z8).

Lacasa, P. (2013). *Learning in real and virtual worlds: Commercial video games as educational tools*. New York: Palgrave Macmillan

Mojang Studios (2009). Minecraft.

Nebel, S., Schneider, S., & Rey, G. D. (2016). Mining Learning and Crafting Scientific Experiments: A Literature Review on the Use of Minecraft in Education and Research. *Educational Technology & Society, 19*(2), 355-366. (https://bit.ly/2LdyRau).

Pérez, Á. (2014). El aprendizaje con videojuegos. Experiencias y buenas prácticas realizadas en las aulas españolas. *Escuela Abierta*, *17*, 135-156. ISSN: 1138-6908. (https://bit.ly/2ZkAaOG).

Ramírez, M. I., Herrera, F., & Herrera, I. (2003). ¿Qué ocurre con la adaptación y el rendimiento académico de los alumnos, en un contexto educativo pluricultural? *Revista Iberoamericana de Educación*, *33*(2), 1-17. (https://bit.ly/30MtWE6).

Ruiz, M., & Díaz, B. (2016). *Aprendiendo con videojuegos. Jugar es pensar dos veces.* Madrid: Narcea.

Sáez-López, J. M., Miller, J., Vázquez-Cano, E., & Domínguez-Garrido, M. C. (2015). Exploring application, attitudes and integration of video games: MinecraftEdu in middle school. *Journal of Educational Technology & Society*, *18*(3), 114-128. (https://bit.ly/2MLFjbQ).

Shaffer, D.; Squire, K.; Halverson, R. and Gee, J.P. (2005). Video Games and the Future of Learning. *Phi Delta Kappan*, *87*(02), 104-111, October. (https://bit.ly/2ZsvN4k).

Squire, K., & Jenkins, H. (2011). *Video games and learning: Teaching and participatory culture in the digital age*. New York: Teachers College Press.

Villegas, E. (2013). *Multiliteracidades en y para la tecnología, rumbo a una sociedad incluyente.* Ponencia en el Virtual educa, XIV Encuentro Internacional Virtual Educa Colombia, 2013. (http://bit.ly/2Q1DPcT)

Vygotsky, L.S. (1986). *Thought and language*. Cambridge, MA: MIT Press.

Vygotsky, L.S. (1978). *Mind in society.* Cambridge: Harvard University Press.

Yin, R. K. (2003). *Case study research: Design and methods*. Thousand Oaks, Calif: Sage Publications.

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From prior knowledge to conceptual elaboration: A case in primary education

Del conocimiento previo a la elaboración conceptual: Un caso en educación primaria

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Abstract

In the Venezuelan Primary Education (MPPE, 2007) the environment was inserted as an integrating axis that connects with the disciplines of the area of mathematics and natural sciences, from this perspective the learning of this concept is fundamental for the understanding of the associated scientific concepts. In order to describe the cognitive dynamics involved in their learning, it was considered necessary to investigate the development of the same in third grade students, from their previous notions to the conceptualization of the environment as a complex system. The study was framed in a Field Investigation, under an action research design. In order to gather the necessary information from 20 selected informants, an open response questionnaire was applied at the beginning and end of the period. For the analysis of the information, the individual and group temporal triangulation was used, identifying the conceptual operators used and the convergent aspects among them. From the analysis made five (5) categories emerged that bring together all the ways of conceptualizing the environment for the moment 1 and Five (5) categories for the moment 2, of these, the latter makes reference to the systemic-complex vision where they were located 11 of the 20 informants. It is concluded that the method used allowed to contrast the advances of the students in the development of their conceptualizations and the cognitive dynamics involved.

Keywords: Knowledge, learning, concepts, teaching, didactics, education.

Resumen

En la Educación Primaria Venezolana (Ministerio del Poder Popular para la Educación -MPPE- 2007) se insertó el *ambiente* como un eje que integra las disciplinas del área de matemática y ciencias naturales, desde esta perspectiva el aprendizaje de este concepto mes fundamental para la comprensión de los conceptos científicos asociados. Con el objetivo de describir la dinámica cognitiva implicada en su aprendizaje se consideró necesario investigar el desarrollo del mismo en estudiantes de tercer grado, desde sus nociones previas hasta la conceptualización del ambiente como sistema complejo. El estudio se enmarcó en una Investigación de Campo, bajo un diseño de investigación-acción. A los fines de recabar la información necesaria de 20 informantes seleccionados, se les aplicó un cuestionario de respuesta abierta al inicio y al final del lapso. Para el análisis de la información se utilizó la triangulación temporal individual y de grupo, identificando así los operadores conceptuales utilizados y los aspectos convergentes entre ellos. Del análisis realizado emergieron cinco (5) categorías que reúnen todas las formas de conceptualizar el ambiente para el momento 1 y Cinco (5) categorías para el momento 2, de éstas, la última hace referencia a la visión sistémica-compleja en dónde se ubicaron 11 de los 20 informantes. Se concluye que la metódica empleada permitió contrastar los avances de los estudiantes en el desarrollo de sus conceptualizaciones y la dinámica cognitiva implicada.

Descriptores: Conocimiento, aprendizaje, conceptos, enseñanza, didáctica, educación.

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1. Introduction

The topic on the environment and its conservation is so important that the United Nations (UN, 2002, 2005) through (UNESCO, 2012, 2015) permanently insists on the mandatory inclusion of Environmental Education programs for the sustainable development at all levels of the education system worldwide, with the aim of training parents, teachers, workers, employers, entrepreneurs and politicians towards the preservation of the environment as a system from the perspective of the complex approach, leading to an inclusive vision of its social and natural components from the relationship and interconnection of the processes that occur in it. In this sense, it is essential to orient the training of students towards a vision of the environment closer to their reality, considering it as another component of their interactions, which intervenes with the students in their community, their health, their diet, their diseases, their employment, among others.

In view of these provisions, the Bolivarian National Curriculum of the Primary School Subsystem (MPPE, 2007) was included as an integrative axis: "Environment and Integral Health" to organize and integrate knowledge (p. 20), which is mainly connected with "Mathematics, Natural Sciences and Society" (p. 57). Among its contents for the third degree, it is considered: "Notion of the environment: observation and interpretation of the environment in my community, region and country. Biosphere research. Establishment of inferences to determine that the biosphere is made up of living beings: humans, animals, plants and microscopic organisms" (p. 59).

There are some questions based on the requirements of the current Venezuelan curriculum: What is the notion of environment that students have when they start the third grade of Primary Education? How to develop this notion of environment according to institutional and curricular requirements? Is it possible for third graders to develop an environment conceptualization as a complex system? To answer these questions, the authors considered necessary to conduct a field study in the National Educational Institution "Meregoto", located at Sucre Municipality of Aragua state, in order to deepen the notion of third graders, based on the application of a Learning Project designed for this purpose.

2. Research objectives

- To specify the notion of environment that third graders have at the beginning of the course, through their answers.
- To design a Learning Project based on the ideas and concerns provided by students in relation to their previous notion about the environment.
- To examine the progress made by students in developing the notion of environment after the implementation of the Learning Project.
- To show the cognitive dynamics involved in the development of the concept of environment achieved by students from their answers.

3. Background

As noted in previous paragraphs, the concept of the environment is included in the Bolivarian National Curriculum of Primary Education (MPPE, 2007), one of the integrative axes of the Learning Area of "Mathematics, Natural Sciences and Society", and in it are found the contents concerning the need to develop a notion of environment that evolves from the first degree as: "Notion of environment, construction of the concept from the identification of environmental components" (p. 34); in the second degree: "Notion of environment, concept, identification and description of the components of the environment, the environment in my community" (p. 46); in the third grade: "Notion of

environment: observation and interpretation of the environment in my community, region and country, research on the biosphere" (p. 59).

In the above description of the contents, it is observed the link of various terms typical of the natural sciences: air, water, soil, human body, animals, plants; it also includes the study of the water cycle, climate, pollution, among others, increasing its range of action and complexity as the degree increases; hence, the construction and apprehension of this concept is essential for understanding the complexity of the environment and its different components. On the other hand, it is important to mention that the new Organic Law on Education (2009) in its article 14 states that "environmental education... is mandatory in official and private institutions and educational institutions" (p. 10), and article 15 numeral 5 reaffirms the purposes of Education: "Encouraging the formation of an ecological awareness to preserve biodiversity and socio-diversity, environmental conditions and the rational use of natural resources" (p. 12), thus legitimizing the importance of education Venezuela.

Additionally, different authors (Meira, 2006; Ochoa García, 2015; Alfonso Martínez, 2016), facing the globalization of development and its impact on the environment have proposed the need to provide the population with a series of notions about how it is and how the environment works, so that people can act responsibly on it. In this sense, the author has carried out studies on how scientific concepts are developed and processed cognitively (Arana & González, 2006; Arana, 2007a and 2012), in relation to the development of the concept of environment in school contexts and situations, the students' previous knowledge as well as the processing and evolution have been monitored from the mental representations they build, and that they externalize through written propositions, drawings, conceptual maps and frameworks, estimating the important mediating role of the teacher in the construction of knowledge.

In this sense, it is considered that one of the main conditions for the achievement of the success of any educational reform is that teachers generate a change in the educational strategies they plan, reason for which this research aims to contribute to the transformation of educational practice in classrooms, developing didactic initiatives for the Natural Sciences Area, and more specifically, to the intention of modeling the previous conceptions of students when they enter school, which according to Meira (2006), are usually colloquial and superfluous, consisting of fragmentary or isolated actions, perceptions and conceptions.

Taking into account the requirements posed during the first three years by the Bolivarian National Curriculum (MPPE, 2007), and also those provided in all the agreements signed on Environmental Education with respect to a notion of the environment as a complex system, it is essential to focus students' training towards a more notion of environment in their vision of complexity (Arana, 2012), closer to reality, analyzing its components and how they relate to it, with its community, with its health, with its food, with the employment and poverty (Unesco, 2015).

4. Methodology

The study was descriptive type, under the qualitative approach of an Action-Participant Research design that according to various authors (Barcedas, 2005; Becerra & Moya, 2010; Colmenares, 2012) is an appropriate methodology when the opinion of program´s participants is critical, or when it is necessary to consider how the protagonists live, feel and express themselves. As a result, it seeks to deepen the learning process of the concept of environment in students of the third grade of Primary Education of the "Meregoto" School from their prior knowledge up to a conception of the environment as a complex system, analyzing its components, how it relates to each other, with itself and with its

context. To this end, a learning project called "Developing my notion of environment" was designed and executed with the purpose of involving participants in activities in and out of the classroom in order to bring them into contact with the environment to which they are part of. In this regard, Colmenares (2012) states that the participation of those involved are also researchers and beneficiaries of the findings and solutions or answers, so that the researchers participated as advisors in all the activities executed, in order to facilitate and guide the learning of students as protagonists.

In addition, Bausela (2004) states that research-action is presented as a research methodology oriented towards educational change configured as a spiral of cycles of planning, action, observation and reflection, i.e., the action procedure according to Corral, Corral and Corral (2016) is developed following a spiral model, in successive cycles that include diagnosis, planning, action, observation and reflection-evaluation. This research process is described with different nuances according to different authors, varying in terms of its complexity. Figure 1 shows the main phases:

Figure 1. Phases and sequences of methodology applied from the action research

This research process is described with various nuances according to different authors, varying in terms of its complexity. Figure 1 shows the main phases:

Source: Buendía et al. (2000, p. 297), adapted by the authors.

5. Key informants

The study was conducted in two sections (C and D) of third grade in the "Meregoto" UEN, where one of the authors works as a third-grade teacher, because children at this level of Primary Education have more developed literacy skills, which allow to apply the techniques and instruments specific to this type of research. Key informants were selected at the end of the course, after having reviewed all the information collected for the students who performed all the evaluation activities, since it was necessary to obtain information consisting of the subject under study. The group of informants was made up of 20 informants (ten in each section), out of a total of 50 students.

6. Techniques and Instruments for the collection of information

Because of the phenomenon studied and according to Martínez (1996 and 1999) in terms of the interests of the research process, non-participating observation was used as a technique for collecting information, through the application of an open question questionnaire submitted to expert evaluation (Hernández, Fernández & Baptista, 2003), for the purpose of knowing more about previous ideas they have about the environment at the beginning and end of the course, in order to compare the progress made by students during the implementation of the learning project. This instrument was structured on the basis of four exercises aimed at obtaining information on: (a) the definition of the concept of environment (propositional representation), b) the actions they take to preserve the environment, c) pictorial representation of the concept and d) graphical representation of it.

7. Design of the Action Plan and Implementation of the project

The concept of the environment to be developed in this project is a complex systemic vision of it, where the knowledge and action applied to biological processes are inextricably linked to social and historical processes, i.e., they include all the complexity of the relationships established between humans and socio-natural elements. By adopting this view, according to Pacheco (2005), a redefinition of this concept can be developed leading to a change in its meaning, which would allow the emergence of new conceptual and methodological tools in the adaptation and intervention of the environment on the part of the human species. One of the keys to this project was based on the questions students ask to themselves about the subject under study. Arana's approaches (2007b and 2010) on the planning of integrative strategies were taken into account for the development and design of the teaching-learning strategies of the educational project. The project was implemented in the last quarter of the 2012/2013 school schedule, in a four-week period, specifically from May 20 to June 26, 2013.

8. Organization and methodical analysis of the information collected

Once all phases of the learning project have been completed and the course was completed, the information collected through the application of the questionnaire was organized:

- At the beginning of the course in order to investigate what the informants know about the concept of environment. Based on these results and considering their concerns, the learning project was designed to promote an advancement of the notion of environment as a complex system, which would allow the development of an integral vision of its components and the inclusion of the human being, as another element of that system.
- Once the learning project was implemented, the same questionnaire was applied in order to contrast the progress made by the informants in relation to the concept studied, and to be able to analyze their progress with respect to the institutional concept of reference (Arana, 2008).

The definitions provided by each informant were ordered, and a continuous comparison analysis was carried out (Glaser & Strauss, 1967; Osses, Sánchez, & Ibañes, 2006), to detect all ways of expressing the concept of environment by informants (individual level temporal triangulation) and conceptual operators were extracted (set of criteria attributes that allow to recognize and express what it is or its meaning) used in the expression of their propositions for each section

(see Table 1). Subsequently, depending on these extracted operators, the definitions provided by both groups (interactive collective-level triangulation) are compared against each other in order to find patterns or similarities between them. According to Pérez (1998), triangulation is an analysis procedure involving the collection of data and methods on the same subject or problem, which are collected from different points of view, in order to make multiple comparisons of a single phenomenon of a group at different times and using different perspectives. In this regard, Barcedas (2005) agrees that triangular is: "to use cross-checking information, seeking to compensate the weakness of the methodology with the complementarity and convergence of different procedures, subjecting the cross-check to the views of different participants on the same subject" (p. 34).

9. Integrated analysis of the results ordered by section

Section C

The results from question No. 1 are provided at the two times programmed as well as the analysis formed by the elaboration of their ideas by the informants of Section C, depending on the conceptual operators used (see Table 1).

At first glance, it is observed that all informants improved their definitions of the environment in the second application of the questionnaire, which was expected after the experiences and learning strategies carried out during the implementation of the project

Table 1. Answers of the informants (Section C) of question No. 1

1. Define in your own words what is environment to you?

Key Informants	Evaluation 1 (M1) Previous Knowledge	Conceptual Operator	Evaluation 2 (M2) Final Evaluation	Conceptual Operator
C1	Love, peace, because it is neat and without garbage, and because there are animals that need the clean environment to live.	Love, clean living room peace to live	It is the interaction between the things of nature, man and society, for example: the child who catches the bus to go to school accompanied by his mother and the pet.	Interaction, Nature, man and society.
C2	It is what gives us life, what surrounds us, and all the elements of this planet, such as water, air, fire and earth.	What gives us life, what surrounds us, all the elements of this planet	It is the interaction of elements such as the hydrosphere, lithosphere and atmosphere so that there are conditions for the life of animals, plants and humans.	Interaction of elements, hydrosphere, lithosphere, conditions for life
C3	Life, air, without it we cannot live, breathe, to me it looks like the jungle.	Life, air, we cannot live without it	It is a set of elements that relate to each other (animals, plants, man and things made by humans).	A set of elements that are related.
C4	They are animals, the forest, the air, pure and clean, the trees, the environment is a source of life for animals and people.	It is a source of life.	It is the animals (my pet, the lucky elephant), the people (my mom, dad, my companions), the technology (houses, cars, the school, my T.V.) that act with each other to keep us alive.	They act on each other to keep us alive.

Key Informants	Evaluation 1 (M1) Previous Knowledge	Conceptual Operator	Evaluation 2 (M2) Final Evaluation	Conceptual Operator
C5	It is for me the best that life has given me and the atmosphere for me is beautiful.	Beautiful	It is the people, the buildings, the animals, the plants, the table, the chairs, the doors, the fan, the school, the church, it is all that surrounds us.	People, buildings, animals, all around us.
C6	The atmosphere is the place where we can live, the atmosphere is big, so big that you can see it, if the atmosphere was not clean we could not live.	A place to live, if it is not clean we would not be able to live.	They are the elements that interact to keep life, but man damages and endangers the planet.	Elements that interact with each other to maintain life.
C7	It is an environmental phenomenon. A natural place where all humans are happy and think it is great for the land, a place to live.	Environmental phenomenon, a place to live.	It is a system that includes all living beings that develop in the biosphere, which must be taken care of to maintain life.	System, Biosphere, care to keep life.
C8	The atmosphere is all around us.	Everything around us.	It is the interaction that happens between human beings, living beings and communities.	Interaction between human beings, living beings and communities
C9	It is all around us.	All that surrounds us	It is the people, the plants, the animals, the things created by man and God.	Things created by man and God.
C10	It is all that surrounds us: the plants, the animals, the air, the river.	Everything around us	The environment is a home for animals, plants, and living things, it is very important for me to keep it clean so that we do not get sick.	Home, important to keep it clean.

Looking in more detail at the answers provided in the first evaluation (M1), it is noted that four of the informants (C2, C8, C9 and C10) express an anthropocentric view of the environment "everything around us", five other informants (C1, C3, C4, C6 and C7) are oriented towards a vision linked to life, place or space to live, some of which (C1 and C6) emphasize that it must be clean. And an informant (C5) expresses an aesthetic vision "The atmosphere is beautiful" locates it into the pre-concept categories.

Generally, none of these definitions approximates the concept of the environment associated with the systemic approach (Institutional Concept of Reference), because they are notions that have structured from their experiences, as pointed out Vigotsky (quoted by Benbenaste, Luzzi & Costa, 2007), the use of these definitions show daily knowledge, these notions are based on the basic, familiar way, so that the individual realizes his/her environment, it is how he/she gives meaning to the world.

A progress of informants towards higher levels of elaboration can be seen in the second evaluation (M2) by using conceptual operators typical of the systemic approach, such as: system, interactions, set of elements related among them, elements that interact with each other, which denote a closer approach to the institutional concept that wants to be developed. This is the case for informants (C1, C2, C3, C6, C7 and C8). From this analysis, six categories emerged, bringing together all the forms and meanings used by these informants in their conceptualization on the environment (see Table 2), for both moments.

Table 2. Comparison of emerging categories in diagnosis (M1) and final assessment (M2) in section C

Categories	Diagnostic		Final evaluation	
	Informant	Frequency	Informant	Frequency
Preconcept	C5	1	----	0
Magical Religious Vision	-----		C9	1
Anthropocentric Vision	C2, C8, C9, C10	4	C5	1
Source of Life Vision	C3, C4	2	-----	0
Life Space Vision	C7	1	-----	0
Conservation Vision	C1, C6	2	C10	1
Systemic Vision - Complex	-------	0	C1, C2, C3, C4, C6, C7, C8	7

The categories were ordered chronologically according to their approach to the most up-to-date institutional concept of reference (Arana, 2008). It can be seen in Table 2, that six of the informants (C1, C2 C3, C6, C7 and C8) advanced towards levels of more complexity in their definitions, expressing a terminology more associated with the concept of environment as a system developed in the learning project, which highlights the conceptual progress experienced by the informants.

It is interesting the case of the informant C4 that has an initial vision of the environment as a source of life, then introduces socio-technological elements as part of the environment and dimension: "that they act with each other to keep us alive", i.e., it is oriented towards the systemic-complex, but it is still incomplete.

Likewise, the case of informant C9 who moves from an anthropocentric view to a magical-religious one, which remains being contradictory, considering that the religious topic was not addressed during the project. Finally, it can be concluded that nine of the ten informants moved towards levels of more complexity in the elaboration of their definitions.

Section D

The following are the results and analysis of the responses provided by the informants in section D.

Table 3. Answers of the informants (Section D) to question No. 1

1. Define in your own words what is the environment to you?

Key Informants	Assessment 1 Previous Knowledge	Conceptual operator	Evaluation 2 Final evaluation	Conceptual operator
D1	Flowers, animals, river, lagoon, grass, birds.	Natural elements	It is where all living beings live in the sphere of life, but we must take care of it or we will all die.	Living beings live, sphere of life.
D2	The atmosphere is all around us.	Everything around us	It is very important, it is not possible to live without it, we have to take care of it to have a better environment.	Life is not possible, take care of it.
D3	The environment is to take care of the trees, animals and flowers.	Caring	It is everything around us like humans, animals, buildings, and we have to take care of it.	Everything around us, take care.
D4	It is everything around us: plants, animals, birds, trees, lights, houses, people.	Everything around us	The environment for me is a home for animals and living things, and it is very important because thanks to it we are alive.	Home, we re alive.
D5	That is all that is around us.	Everything around us	It is the medium where I live, the school, the house, the beach, the zoo, and I have to keep it clean.	Where I work, keep clean.

Key Informants	Assessment 1 Previous Knowledge	Conceptual operator	Evaluation 2 Final evaluation	Conceptual operator
D6	What surrounds us: plants, trees and mountains.	Everything around us	They are the elements of nature (animals, plants) and social (people) that interact with each other, but it is in danger by man.	Elements, interaction with each other, danger by man.
D7	It is all that is around us.	Everything around us	It is the interaction of nature, humans and society, but any imbalance created by human beings can threaten all life.	Interaction of nature, human beings and society, imbalance
D8	It is all around us.	Everything around us	It is the interaction of the elements present in nature, and those created by man, if one disappears it endangers others, example: bears need ice to live, we depend on plants, animals and water to live.	Interaction of the elements, disappears, we depend to live.
D9	The natural environment is all that surrounds us.	Everything around us	Everything we humans interact with and depend on to live.	Everything we interact with, we depend to live.
D10	It is all that is around us.	Everything around us	Elements of the environment, such as water, air, soil, plants, people, society, which relate to each other to live better.	Set that relate to each other, live better.

As in the previous group, all informants improved their definitions of the environment in the second application of the questionnaire, and in fact this is easily evident, since, at the beginning, most (8) of these informants expressed a notion of the anthropocentric environment "everything around us", linked in some cases to a naturalistic vision (D4, D6, D9). On the other hand, the informant D1, only refers to natural elements and the D3 points out that the environment is to take care of the natural elements, in both cases they do not show a conceptual statement, they can be classified as preconceptions.

However, the second moment of evaluation shows more enrichment in the operators used to define the concept. As shown in Table 3, the elaboration of statements in the first five informants is changed towards the consideration of the environment as a living space (D1, D2, D4, D5) and that we must take care of (D2, D3, D5), leaving behind, the anthropocentric vision, except for the case of D3, denoting the inclusion of social elements and itself as parts of the environment.

The conceptualizations of the last five informants were closer to the institutional conception of reference, especially the informants D6, D7, D8; describing it as the interaction between natural, human and social elements or the D10 "set of natural elements, people, society, which relate to each other" (paraphrased) note the progress with respect to their previous notions. The D8 informant stands out, when he adds: "... if one disappears the others are in danger", so informants D6 and D7 argue the threat posed by human beings to the balance of this system, i.e., they are aware of their responsibility in the face of environmental issues.

However, informant D9, even when using the "interaction" operator, still has an anthropocentric view by stating, "It's everything we humans interact with". Table 4 shows the categories that emerged from the previous analysis.

Table 4. Comparison of the categories obtained in the diagnosis and in the final evaluation in section D

Categories	Diagnose (M1)		Final Evaluation (M2)	
	Informant	Frequency	Informant	Frequency
Preconcept	D1, D3	2	------	------
Anthropocentric Vision	D2, D4, D5, D6, D7, D8, D9, D10	8	D3, D9	2
Source of Life Vision	-----	---	D1, D2, D4, D5	4
Systemic Vision - Complex	------	---	D6, D7, D8, D10	4

Note that the elaboration of statements of all informants have moved from very simple notions to more elaborate conceptual answers, richer in terms of the conceptual operators they use and also at a more complex level. The fact that the systemic-complex category emerged at the end evidences the progress by one of the informants from their previous ideas towards concepts associated with the institutionally proposed scientific contributions, so that it can be said that the pedagogical activities carried out throughout the learning project were significant to the achievement of the proposed objectives, especially the inclusion of human beings as another element of this system, thereby fostering comprehensive formation, the vision and holistic thinking in the students that would allow them to interpret their reality from a new perspective.

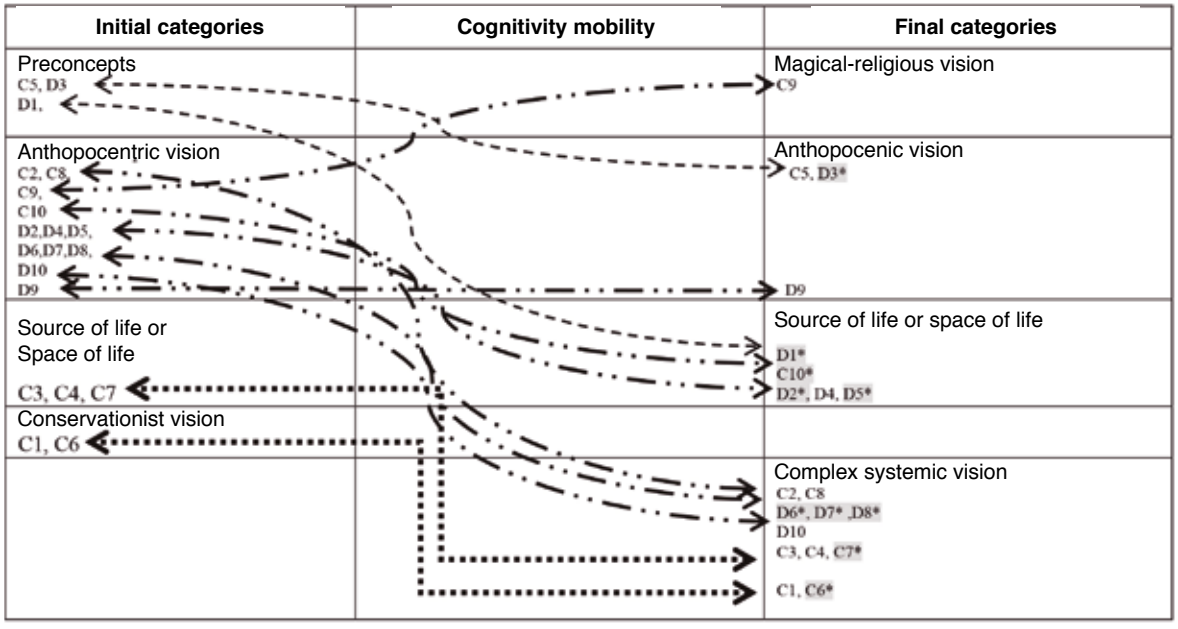
Discussion and conclusions

In summary, various answers emerge from the study that provide interesting conclusions regarding the learning of concepts and these are listed below:

1. The inclusion of the environment as an integrative axis in the Primary Education Curriculum promotes various learning opportunities based on educational projects, this is one of the main strategies for children to understand the functioning of socio-natural systems that enable a broader view of their reality, their problems and better solutions, from an interdisciplinary approach and as required by the Bolivarian National Curriculum (MPPE, 2007).
2. The teaching-learning of scientific concepts guarantees in students inclusive teaching strategies aimed at the activation of mental processes of observation, association, comparison, conceptual elaborations, among others, which can be externalized through definitions, drawings, graphics, information processors such as mind maps, conceptual maps and others, so that the teacher can compare the progressive progress from the beginning of the course.
3. It is confirmed that the prior knowledge expressed by the informants, for the most part (12 out of 20) is related to a notion linked to anthropocentric conception and others (3 of 20) to a conception linked to the possibility of life or space of life. The conservationist attitude was only seen in two (2 out of 20) of the informants, which agrees with other research carried out (Arana & González, 2006), at higher levels of education, and which demonstrates the conception of humans as the central axis of the environment.
4. In examining the progress made by the informants, there was an increase in all groups in the number of conceptual operators used to develop their definitions (M1 and M2), i.e., there is an increase in progressive concepts (Arana, 2007a) that provide greater meaning in the cognitive network of each of the informants, which is evidenced by the coherence in their written expressions, and the examples referred in some cases.

5. The informants moved their concept elaborations to more complex levels, progressively approaching the institutional concept of reference, as noted by different authors (Villegas & González, 2005; Moreno, 2012; Rey-Herrera & Candela, 2013) in relation to the construction of cognitive structures that increase the interpretive capacity of the environment, as well as the development of a conservationist attitude (10 out of 20 informants). See Figure 5, shaded and with (*).
6. Generally, the cognitive dynamics involved in conceptual learning appear to be due to a forward movement whose trajectory is progressive in terms of its complexity (see Table 5). This dynamic is best seen when more than two assessments are carried out, as seen in previous research by the author. A schematic interpretation of the trajectory is presented below:
   6.1. Note that informants in the preconception category (←------→) advance to intermediate categories, anthropocentric vision (C5 and D3) and living space (D1).
   6.2. Informants in the anthropocentric category (←·····→) advance to the space-of-life category (C10* D2*, D4, D5*) and complex systemic vision (C2, C8 C3, C4, C7* C1, C6D6*, D7*,D8* D10).
   6.3. All informants located in the categories source of life and conservationist (←·····→)advance to the systemic-complex vision category (C3, C4, C7* and C1, C6*).

Table 5. Cognitive dynamics



*The informants marked with the asterisk have a conservationist attitude.

7. The methodical analysis applied was appropriate for the purpose of the cognitive dynamics involved in the development of concepts, which is important for educational research and for teachers, since in teaching it is essential to know how to develop the concepts in the students, analyze how previous knowledge is reorganized with the integration of new information and how these new contributions are processed in them.

References

Alfonso Martínez, O. (2016). *Globalización y el impacto ambienta*l. (http://bit.ly/348976S).

Arana, A., & González, F. (2006). Enriquecimiento conceptual progresivo. Una explicación teórica del proceso de desarrollo de los conceptos científicos. *Revista de Pedagogía,* UCV, *XXVII*(79), 193-230. (http://bit.ly/2S5qoep)

Arana, A. (2007a). Representando la complejidad ambiental: dos estudios de caso. *Investigación y postgrado*, *22*(1), 13-58. ISSN 1316-0087. (http://bit.ly/2M8ChNb)

Arana, A. (2007b). Entramados Ambientales: Un modelo didáctico integrador. *Educere: Revista Venezolana de Educación, 11*(39), 727-738. ISSN-e 1316-4910. (http://bit.ly/2rXJ6tO)

Arana, A. (2008). Construcción del saber institucional en torno al concepto de ambiente. *Revista de Investigación*, *32*(63). ISSN 0798-0329 (http://bit.ly/2M54nZl).

Arana, A. (2010). Estrategias de Aprendizaje y desarrollo de conceptos. Una programación didáctica para su mediación en el aula. *Revista Multidisciplinaria Dialógica*, *7*(1-2), 133-156. (http://bit.ly/2M97XBP).

Arana, A. (2012). *Entramados... Una mirada a la complejidad*. Alemania: Editorial Académica Española (http://bit.ly/36pVnpJ).

Barcedas, M. (2005). Eligiendo una estrategia de Investigación. Venezuela: *Cuadernos Monográficos Candidus*, (6), 34-35.

Bausela, E. (2004). La docencia a través de la Investigación-Acción. *Revista Iberoamericana de Educación, 35*(1), 1-9 [Revista en Línea]. (http://bit.ly/2YyLpzu).

Becerra Hernández, R., & Moya Romero, A. (2010). Investigación-acción participativa, crítica y transformadora. Un proceso permanente de construcción. *Integra Educativa, III*(2). (http://bit.ly/2E56kAO)

Benbenaste, N., Luzzi, S., & Costa, G. (2007). *Vigotsky: desde el Materialismo Histórico a la Psicología. Aporte a una Teoría del sujeto del Conocimiento.* [Revista en línea]. ISSN1668-5024 (http://bit.ly/38rCrss).

Buendía, L., Colás, P., & Hernández, F. (2000). *Métodos de Investigación en Psicopedagogía.* Madrid: McGrawHill.

Colmenares, A. (2012). Investigación-acción participativa: una metodología integradora del conocimiento y la acción. *Voces y Silencios: Revista Latinoamericana de Educación*, *3*(1), 102-115 ISSN: 2215-842114 [Revista en Línea]. (http://bit.ly/36pzNlg).

Corral, Y., Corral, I., & Corral, A. (2016). *El proceso de investigación-acción en el aula: modelo de Mckernan.* Ponencia presentada en la Jornada Divulgativa de Producción Intelectual de Profesores e Investigadores de la FaCE-UC 684. Universidad de Carabobo Valencia-Venezuela. (http://bit.ly/2E2LEcu).

Hernández R., Fernández, C., & Baptista, P. (2003). *Metodología de la Investigación.* México: Mc GrawHill-Interamericana.

Glaser, B., & Strauss, A. (1967). *The discovery of grounded theory.* Chicago: Aldine Press.

Ley Orgánica de Educación. (2009). Gaceta oficial de la República Bolivariana de Venezuela. Nº 5.929 Extraordinario, de fecha 15/08/2009. (http://bit.ly/2MnoORN).

Martínez, M. (1996). Cómo hacer buen proyecto de tesis con metodología cualitativa. *Revista Heterotopía. Tejiendo el pensamiento desde el otro lugar, II*(2), enero-abril. Venezuela.

Martínez, M. (1999). *La nueva ciencia (su desafío, lógica y método)*. México: Editorial Trillas.

Meira, P. (2006). *Crisis ambiental y globalización: Una lectura para educadores ambientales en un mundo insostenible*. (http://bit.ly/2M7spmI).

Ministerio del Poder Popular para la Educación. (2007). *Currículo Nacional Bolivariano del subsistema de Educación Primaria*. Caracas: Cenamec.

Moreno, C. (2012). La construcción del conocimiento: un nuevo enfoque de la educación actual. *Sophia, Colección de Filosofía de la Educación,* núm. 13, 2012, pp. 251-267 Universidad Politécnica Salesiana. (http://bit.ly/348FjqF).

Ochoa García, C. (2015). Consecuencias de la globalización en el manejo del medio ambiente. (http://bit.ly/2RH5rX5).

Organización de las Naciones Unidas (ONU) (2004). Resolución 59/237 de la Asamblea General de las Naciones Unidas. (http://bit.ly/36UCNWG).

Organización de las Naciones Unidas. (ONU, 2005). *Documento final de la Cumbre Mundial 2005.* Resultados beneficiosos en relación a la igual-

dad de género, resultados mixtos en relación a pobreza, paz y derechos humanos. (http://bit.ly/2S7FmAz).

Osses, S., Sánchez, I., & Ibáñez, F. (2006). Investigación cualitativa en educación. Hacia la generación de teoría a través del proceso analítico. *Estudios Pedagógicos, XXXII*(1), 119-133. Universidad Austral de Chile Valdivia, Chile. (http://bit.ly/36Otsjj)

Pacheco, M. (2005). *El ambiente, más allá de la Naturaleza*. México: Elementos.

Pérez, G. (1998). *Investigación cualitativa. Retos e interrogantes. II Técnicas y análisis de datos.* Madrid: La Muralla.

Rey Herrera, J., & Candela, A. (2013). La construcción discursiva del conocimiento científico en el aula. *Educ. Educ.,16*(1), 41-65. (http://bit.ly/2PwtWnb).

United Nations Educational Scientific and Cultural Organization –UNESCO- (2012). La educación para el desarrollo sostenible en acción. (http://bit.ly/2r401uj).

United Nations Educational Scientific and Cultural Organization –UNESCO- (2015). La Educación para Todos, 2000-2015: logros y desafíos, informe de seguimiento de la EPT en el mundo.

Villegas, M. & González, F. (2005). La construcción del conocimiento por parte de estudiantes de educación superior. Un caso de futuros docentes. *Perfiles educativos, 27*, 109-110, enero. México. (http://bit.ly/38qnhnn).

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Multidisciplinary education for prevention of obesity on childhood students of Mexico City

Educación multidisciplinaria en la prevención de obesidad en educandos de la Ciudad de México

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Abstract

Obesity is a public health problem, which recently affects to childhood population, impacting the health and psycho-social development of the infant, so early education aimed at promoting healthy habits represents a central axis in its prevention and control. The present work is an exercise of analysis and reflection on the efficiency of multidisciplinary and preventive programs to control obesity, based on education as a central axis. A review and analysis of studies on obesity as a social phenomenon was carried out, and analysis of studies on the application of multidisciplinary programs based on education to influence integral actions for the prevention of obesity. The prevalence of obesity has not decreased despite the strategies implemented by the health authorities. The multidisciplinary intervention programs whose principal purpose is the awareness of the childhood about how nutrition and physical activity contributes to their health care, can be an efficient means to prevent and reduce the obesity, when education is integrated into the school and family environment. "Health is a right and well-being of the infant", which can be ensured through the implementation of multidisciplinary intervention programs, based on primary care with the participation of the family and the school.

Keywords: Obesity, chronic and degenerative diseases, multidisciplinary intervention, education, health.

Resumen

La obesidad es un problema de salud pública, que afecta recientemente a la población de menor edad, impactando en la salud y desarrollo psico-social del infante, por lo que la educación temprana orientada a fomentar los hábitos saludables representa un eje central en su prevención y control. El presente trabajo es un ejercicio de análisis y reflexión sobre la eficiencia de los programas multidisciplinarios y preventivos para controlar la obesidad, basados en la educación como eje central. Se realizó una revisión y análisis de estudios que abordan el problema de la obesidad como fenómeno social, y de estudios que evalúan la aplicación de programas multidisciplinarios basados en la educación para incidir en acciones integrales de prevención de la obesidad. La prevalencia de obesidad no ha disminuido pese a las estrategias implementadas por las instancias de salud. Los programas multidisciplinarios de intervención cuyo tema central es la concientización de los educandos sobre cómo contribuye la nutrición y la actividad física en el cuidado de su salud, pueden ser un medio eficiente para prevenir y disminuir la obesidad infantil, cuando se integra la educación en el ámbito escolar y familiar. "La salud es un derecho y bien tutelar del infante", que puede asegurarse a través de la implementación de programas de intervención multidisciplinar, sustentados en los cuidados primarios con participación de la familia y la escuela.

Descriptores: Sobrepeso, obesidad, enfermedad crónico-degenerativa, intervención multidisciplinaria, educación, salud.

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1. Introduction

The prevalence of overweight and obesity has almost doubled from 1980 to 2014, becoming a problem with epidemiological dimensions. According to the World Health Organization (WHO), more than 1.9 billion of adults over 18 years old are overweight and more than 600 million are obese worldwide (World Health Organization, 2016).

At present, in Mexico, the problem of overweight and obesity in childhood has reached alarming levels. According to the report of the National Health and Nutrition Survey (ENSANUT, 2016), the combined prevalence of overweight and obesity in children from 5 to 11 years old is 33.2%, which is higher in urban regions than in rural areas (34.9% vs. 29.0%). In Mexico City the epidemiological problem is one of the most alarming because there are especially high numbers of overweight and obesity (OWandO) 32.9% (15.9% overweight and 17.0% obesity). The excessive increase of this condition is manifested in its impact on the increase of chronic-degenerative diseases, pathologies associated with obesity such as: metabolic syndrome, hypertension, dyslipidemia and hyperglycemia, which increase the risk of cardiovascular disease and type 2 diabetes, whose complications are currently linked to the main causes of death in the population (Instituto Nacional de Estadística y Geografía, 2015; World Health Organization, 2015 and 2017).

To prevent and reduce the prevalence and incidence of OWandO in order to ensure an adequate state of health in children, there is a need to develop programs that promote healthy environments where multidisciplinary collaboration between different social actors is essential, the jointly participation of various bodies (family, public and health sector, private sector, education sector, society and international bodies), would be intended to influence comprehensive proposals and actions aimed at changing eating habits and patterns that inhibit physical activity in children.

On the other hand, the consequences of the different risk factors in the development of OWandO have been widely described; thus, the evidence suggests that most interventions are oriented towards changing these key lifestyle factors with different approaches and levels (Brown & Summerbell, 2008), whose theoretical foundations are generally based on the planning and implementation of collective and individual intervention programs aimed at achieving social or behavioral learning. The purpose of this study is to analyze the importance of early education in the health area in reducing or preventing OWandO in children, to analyze a series of studies derived from the implementation of multidisciplinary intervention programs based on teaching the healthy habits and health care of children in order to discuss their efficiency and their usefulness to find a solution for this condition.

2. Material and methods

A review and analysis of studies addressing the problem of obesity as a social phenomenon was carried out as well the importance of education in addressing this public health problem, in order to remark the relevance of education-based intervention programs as a strategy to generate multidisciplinary programs that affect comprehensive actions to prevent and/or treat obesity.

3. Analysis of the problema

3.1. Relationship between overweight, obesity and education

In general terms OWandO are defined as "an excessive accumulation of body fat" (World Health Organization, 2016), established as a result of a loss of energy balance between spending and consumption. From the etiological point of view, obesity is considered a multifactorial condition; however, the decrease in physical activity and diet, characterized by high-calorie

diets derived especially from the consumption of fats and carbohydrates, have been the causes that seem to contribute more significantly to obesity (World Health Organization, 2016).

The etiology of OWandO can also be addressed from the evolutionary point of view (Wells, 2012). In this sense, it is clear that living organisms control or regulate their physiological processes according to the stimuli perceived by the environment, which allow them to maintain physical stability, enabling growth and development, reproduction, among other factors. Such response mechanisms make it possible to survive in a stable way, or from the physiological perspective to maintain homeostasis (Wells, 2012; Serlie, La Fleur & Fliers, 2011). In this sense, the environment in which the human is today (obesigenic environment), is decisive for the development of the diseases that affect him/her (Serlie *et al.,* 2011). Currently, the environmental factors that influence the individual and that enhance the development of OWandO have been addressed by different specialists, thus considering the social, cultural, economic, political factors, etc., therefore, overweight and obesity become a complex problem that hinders its prevention and treatment from a single approach. In the social and cultural factors that favor the development of obesity, "education" has a main role that has been based on different population studies (Andrade & López-Ortega, 2017; Hoffmann *et al*., 2017; Ferguson *et al*., 2017; Non, Gravlee & Mulligan, 2012; Singh-Manoux *et al.,* 2009), not only because it gives the individual the ability to develop fully (cognitive and physical development), but because through education the individual acquires the ability to understand, analyze and discern what is appropriate to maintain eating and nutritional habits that ensure a better health. In simplified terms and as an example, history shows how in the old days the transmission of empirical knowledge had great relevance in the early settlers, in the sense that children and young people were educated by adults about the potential environmental risks that could jeopardize the integrity of individuals. Thus, it can be said that education is the correct way. This role is attributed to "education" by involving the pedagogical action that is exercised on someone else, with the purpose of instilling knowledge, beliefs, values, generating experiences, as well as preparing them for life.

In this regard, León (2007) proposes that education seeks the perfection and security of the human being who is guided and transformed by education and by himself/herself, for education is in its civilizing essence, producing benefits. This reasoning on education to which psychology, pedagogy, sociology of education have contributed so much is also useful in this thoughtful work, in which it is argued that 'educating for the health is educating for a full life'.

Hence, the importance of "health education from the earliest stages of life" is emphasized, leading to the acquisition of healthy habits and knowledge of body care. This allows school-aged children to have a broad knowledge of their body and the environment around them, providing tools that make them capable of becoming aware and distinguishing between good or bad things for their health and physical integrity; moreover, it can give the students the ability to pass on learning from generation to generation, especially when taking into account that OWandO "have physical and psychological consequences for the health during childhood, adolescence and adulthood, in addition to the social, economic and health consequences" (World Health Organization, 2016).

At present, some educational intervention programs aim to strengthen individuals by fostering relevant and appropriate learning in the health, in order to "transform the environment and opbesigenic social patterns" (World Health Organization, 2016, p. 11). Individuals are expected to be able to recognize the environment, risk factors and anti-obesigenic, and to be aware of the benefits of acquiring good health habits (food, physical activity, good sleep, etc.), as well as the health risks involved in lacking

them. However, the implementation of appropriate preventive programs has been a major challenge at the national level, because it requires the attention of a multifactorial problem that must be addressed in the same way, i.e., from a multidisciplinary approach, and it must consider the inclusion, interaction and participation of various actors (family, school authorities, advertising, industry, government, health bodies). As the WHO indicates "without a common vision of the problem and shared responsibility, well-meaning and cost-effective interventions have limited impact and light upon" (World Health Organization, 2016, p. 7).

Figure 1. Social and co-responsible agents for the OWandO problem

On the other hand, the Mexican Institute for Competitiveness (IMCO, 2017), indicates the need to have a comprehensive view of the problem and the actions to be undertaken, which requires multisectoral and multi-government support. Figure 1 shows the co-responsible social actors for the reduction and prevention of OWandO.

From a philosophical point of view, when Edgar Morín conceived the human as *Homo complexus*, it allows to understand the different perspectives of the problems presented and the actions provided by the human. According to León (2007), education is a complex human and cultural process, and it is necessary to consider the condition and nature of the man and the culture as a whole, in its entirety, to establish its purpose and definition, so each particularity makes sense for its bonding and interdepend-

ence with others and with the whole. In this sense and according to César Coll in an interview carried out (Rigo-Lemini, Díaz-Barriga-Arce & Hernández Rojas, 2005), it is very clear that the educational processes are very complex — in which there are numerous variables and factors—requiring a multidisciplinary look (Gibbons, 1998; Morin, 1999).

However, some reports that have highlighted the importance of the relationship between poverty, obesity and education attribute a direct relationship to it (Ortiz-Hernández; Pérez-Salgado & Tamez-González, 2015). In other words, the lack of education influences people's poverty level, and it directly influences the prevalence of OWandO; however, it can also be interpreted as a vicious circle, since poverty may be one of the causes of low or no educational level by not having the minimum conditions of existence, resulting in ignorance of risk factors in food, malnutrition, or giving way to beliefs that are part of their value system, such as believing that "the fater the child, the healthier he is". Hence, the lowest social sectors are placed at a higher level of vulnerability, affecting people's quality of life and becoming a problem that reaches alarming levels in many nations, while the OWandO have become a very serious epidemiological and social condition, especially since "... they can nullify many of the health benefits that have contributed to the improvement of life expectancy" (World Health Organization, 2016, p. VI). In this regard, several studies agree with the fact that the population with the lowest economic resources and with low access to education has the highest figures of OWandO; in this sense, WHO emphasizes that "... in absolute numbers, there are more children with OWandO in low- and middle-income countries than in high-income countries" (World Health Organization, 2016, p. VI).

In addition to the above, the latest results reported by the National Institute of Public Health, derived from ENSANUT 2016, reflect the lack of information and knowledge on the factors that enhance the development of OWandO in the need to address this problem by providing information and generating knowledge about the factors that influences opbesigenic patterns, as well as in promoting health education from an early stage. In relation to the above, ENSANUT applied a series of questionnaires to the Mexican population to investigate their perception of obesity, eating behavior and physical activity; the findings of the survey indicate that the population knows that: high consumption of sweet beverages is harmful to the health (92.3%); b) that these cause the development of obesity (92.2%), c) cause tooth decay (93.4%), d) cause high blood pressure (86.2%) and e) cause diabetes (93%). However, f) most of the people like to consume them (81.6%), which may suggest that their knowledge about the consumption of these products is not enough to raise awareness of health harm on at least one time scale, because these conditions are usually established in the long term and can be asymptomatic at an early stage. On the other hand, a high percentage of the population responds that g) lack of knowledge contributes to not buying healthy foods (38.4%) (ENSANUT, 2016).

Other results of the survey show that lack of education leads to ignorance of the analysis derived from the reading and interpretation of food labelling. With regard to this, it was found that h) less than half of the population reads the nutrition labelling of the products it consumes (40.6%), in addition (i) the vast majority of the population reports that it does not fully understand the label information (83.4%), and that, j) only 19% of the population reviews the packaging or information indicating whether or not the food is healthy. Additionally, k) a high percentage of the population does not know how many daily calories they should consume (76.3%).

On the other hand, despite the intervention programs that have been promoted at the national level, such as the campaign "CHECK, MOVE and MEASURE" that involves different health areas, there is a lack of information that

promotes its implementation, and there is little understanding of the objectives of the campaign as they appear to be poorly taken care of. In this sense, only a little more than half of the population (57.4%) and 61.4% in the urban area, knows the campaign and its objective:

> Check = to attend your health clinic.
> Measure = reduce dampening fat, sugar and salt, as well as performing anthropometric assessments that suggest some cardiovascular risk.
> Move = to exercise daily.

It can also be considered as part of the findings of the survey applied by ENSANUT (2016) to the target population, that only 6 out of 10 Mexicans really know the main purpose of the program which is to modify obesigenic habits and promote a healthy lifestyle.

The above data show the urgent need to work comprehensively on this health problem, addressing it from its complexity as a condition that requires multidisciplinary care.

While obesity, a chronic, complex and multifactorial disease, is also likely to be preventable by encouraging transitional changes in eating patterns and physical activity during childhood, it suggests a preventive action based on education to acquire a clear awareness of the benefits to maintain healthy habits as a lifestyle, considering the concept of health in a broader sense, where "... in addition to being an educational co-agent, essential in the evolutionary development of the child, the new conception of health should be considered as a complete state of physical, psychic and social well-being". This entails a new orientation, not only of the treatment of diseases, but of the promotion of healthy environments where collaboration between social agents and multidisciplinary perspectives is vital (Cámara de Diputados LXIII Legislatura, 2017).

In this sense, it is believed that the multidisciplinary conception can contribute to the prevention and primary detection of OWandO in children, through intervention proposals that promote healthy nutritional habits by remarking the importance of having a diet, performing physical activities and having a good health care.

3.2. Types of multidisciplinary interventions

Generating a classification for the different types of multidisciplinary interventions is complicated due to their heterogeneity, either because of the number of components it considers, the predominant learning approach and the inclusion of different actors, or the context in which it develops. In this sense, a first approach to classify multidisciplinary interventions for the prevention of child's OWandO may be given from the level of prevention: a) those aimed at promoting healthy lifestyles in primary health care, b) primary care focused on specific behaviors for the weight management and control or prevention (c) those that go beyond the objective of adequate nutrition and the practice of physical activity at a third level of care (Fitch *et al.*, 2013).

On the other hand, there are interventions oriented to a single factor or multifactor according to the number of elements to consider, guided for specific purposes, which range from educational aspects in nutritional topics, the promotion of physical activity for the reduction of sedentary lifestyles, and the promotion of habits or behaviors aimed at improving an eating behavior.

Table 1. Main topics and purpose in a systematic and multidisciplinary intervention for the prevention of childhood overweight and obesity

Topic	Purpose
Nutritional	• Increase the consumption of fruits and vegetables • Encourage the consumption of water • Limit the consumption of sweet drinks • Promote the consumption of breakfast • Limit the intake of food outside home • Recommend family meals or involving those responsible for the children • Consider the size of portions suitable for children • Promote the consumption of milk and dairy products • Promote a high-fiber diet • Avoid doing other activities while eating • Plan meals in advance • Eat slowly and in set times, do not skip meals
Physical Activity	• Get involved in moderate to vigorous physical activities at least 60 minutes a day • Identify limitations to physical activity • Perform physical activities outside of school hours, according to the individual's age and preference
Sedentarism	• Evaluate the family environment to identify factors that can contribute to obesity • Reduce screen time (TV, video games, tablets, mobile phones, mobile devices) • Avoid long periods of physical inactivity
Behavior	• Identify key behaviors as an opportunity to improve lifestyle • Promote self-efficacy and self-sufficiency skills in children
Psychological	• Identify moods or risky behaviors related to a food overintake

Source: Own elaboration based on (Fitch *et al.*, 2013, Perea-Martínez *et al.*, 2014).

As the recommendations seek to improve food behaviour through public health policies, programs and systematic and multidisciplinary intervention actions, it is important to note that these are difficult to achieve without appropriate support from different stakeholders and social agents (Elizondo & Serrano, 2010) as mentioned above; hence, suggesting another classification according to the levels of action or context of its implementation, there are those that focus on: (i) the modification of the food service or specific outlets, (ii) individual interventions, (iii) interventions aimed at changing school environments and surrounding areas, (iv) those involving the family environment, and finally (v) intervention proposals generated to impact at community level (Ganann *et al.,* 2014). The above means that intervention strategies should be promoted jointly and not isolated to enhance their effects, which means that better results can be achieved through synergy (cooperation), integrality, systematization, since as Pérez-Mendoza stated (2011), a social impact is intended to be achieved. It is about changing perspectives and creating a virtuous circle in the prevention of OWandO in children, as illustrated in Figure 2.

While schools have been the ideal vehicle for implementing educational strategies aimed at promoting healthy lifestyles; it has been generally observed in the nutrition and physical activity binomial that those with a duration longer than one year aimed at promoting physical exercise are moderately effective in preventing OWandO while the intervention lasts (Barrera-Cruz *et al.,* 2013).

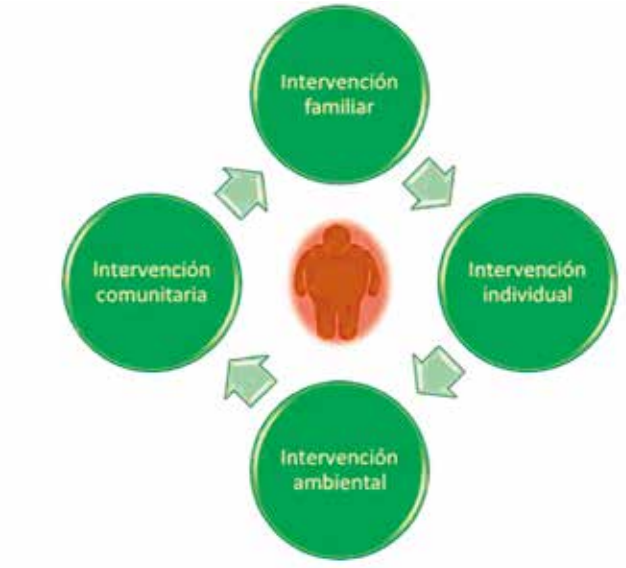
In addition, family interventions seeking to change diet and increase the practice of physical activity are effective in preventing the gain of body fat, at least for the duration of the program; in this regard, the experiences and studies carried out by experts on the subject reveal that a period of 2 to 5 years is key to establishing good nutritional habits, especially when parents actively participate (Barrera-Cruz *et al.,* 2013).

With regard to community interventions, it has been suggested that these represent a promising option to impact a big number of people by encouraging barriers and creating opportunities for the adoption and reaffirmation of healthy lifestyles. These types of programs have been successful once community members recognize and commit to the need for such strategies, as well as providing feedback on identifying barriers and improvements to their implementation. In this sense, education is essential to provide information and tools appropriate to the social context (Registered Nurses's Association of Ontario, 2014).

It has recently been suggested to implement environmental interventions, which rarely change socio-cultural aspects of the community, as they are independent of the environment and include physical, chemical and biological factors external to the person and their behaviour (Prüss-Üstün & Corvalán, 2006), so its effect on the prevention of childhood obesity is unclear.

On the other hand, primary prevention interventions may consider different techniques for the modification of the behavior, highlighting the use of tools that promote family commitment and individual work simultaneously during periods of no less than 6 months, in which useful information regarding the relationship between behaviour and health will be provided, as well as promoting the practice of healthy habits. Some others suggest that the effectiveness of these interventions lies in the basis of social learning or environmental change, which may have differential results among boys and girls, according to their cognitive and psychosocial development (Registered Nurses's Association of Ontario, 2014).

Figure 2. Virtuous circle with intervention programs to prevent and decrease the prevalence of overweight and obesity in childhood



Source: Own elaboration

Conclusions

The problem OWandO is alarming and it negatively affects the population in different aspects, so it has been suggested as a public health priority. The complexity of developing successful programs for the care and prevention stems from multifactorial reasons, so the approach should be integral, taking into account that the success of any strategy lies in the ability to adopt and maintain lifestyle behaviors that contribute at different levels to modify and improve factors at the intrapersonal, community, organizational, governmental and public levels.

When developing strategies for the promotion of healthy lifestyles aimed at the primary and secondary prevention of childhood obesity, it is recommended that these can be universally applied, taking into account certain contexts, as well as focusing on modifying various behaviors through different strategies that allow information, learning and new knowledge to cover a larger extend of population at different educational and socio-economic levels.

Intervention studies for the treatment and/or prevention of OWandO have yielded results with little impact so far, due to the same diversity of factors that need to be addressed. While the programs know the areas require influence, the participation of the educational field becomes a priority, on which an adequate transfer of health care knowledge from an early age of the individual's development depends on education according to the ages and context of each student. In this regard, it is essential to take this transfer of knowledge and inquiries on the subject of OWandO to multidisciplinary practice, with the aim of focusing that research in certain areas of life, such as health, education, public policy, human rights, or whatever with deep implications in the social and pedagogical practices. If this perspective is broaden, there will be many spaces from which pedagogical actions can be carried out for the benefit of children and their future. The planning of multidisciplinary intervention proposals is an opportunity to influence the well-being and good living of children, especially in areas where the preventive level is necessary. On another level, it would be with a solution for those who are already obese, since this tool would induce changes in their lifestyles, beliefs, eating and nutritional habits, becoming aware and reinforcing the premise that "educating for health is educating for life " and it would help improving their quality of life and that of their environment.

References

Andrade, F.C.D., & López-Ortega, M. (2017). Educational Differences in Health Among Middle-Aged and Older Adults in Brazil and Mexico. *J Aging Health,* 1:898264317705781. https://doi.org/10.1177/0898264317705781. [Epub ahead of print].

Barrera-Cruz, A., Ávila-Jiménez, L., Cano-Pérez, E., Molina-Ayala, M.A., Parrilla-Ortiz, J.I., Ramos-Hernández, R.I. … Sosa-Ruiz, M.R. (2013). Gutiérrez-Aguilar J. Guía de práctica clínica Prevención, diagnóstico y tratamiento del sobrepeso y la obesidad exógena. *Rev. Med. Inst. Mex. Seg. Soc., 51*(3), 344-357.

Brown, T., & Summerbell, C. (2008). Systematic review of school-based interventions that focus on changing dietary intake and physical activity levels to prevent childhood obesity: an update to the obesity guidance produced by the National Institute for Health and Clinical Excellence. *Obes. Rev., 10*, 110-141.

Cámara de Diputados LXIII Legislatura (2011). Iniciativa de Ley para la reforma de los artículos 7o. y 42 de la Ley General de Educación. *Gaceta Parlamentaria*, 3187-II. (http://bit.ly/2L0CFwz; http://bit.ly/2OyR98Q).

Elizondo-Montemayor, L.L., & Serrano-González, M. (2010). Obesidad y síndrome metabólico en la infancia y adolescencia: evaluación clínica y manejo integral. *Avances, 7*(20), 26-37.

Ferguson, T.S., Younger-Coleman, N.O.M., Tulloch-Reid, M.K., Hambleton, I.R., Francis, D.K., Bennett, N.R. … Sullivan, L.W. (2017). Educational Health Disparities in Cardiovascular Disease Risk Factors:

Findings from Jamaica Health and Lifestyle Survey 2007-2008. *Front. Cardiovasc. Med., 4*, 28. https://doi.org/10.3389/fcvm.2017.00028.

Fitch, A., Fox, C., Bauerly, K., Gross, A., Heim, C., Judge-Dietz, J., … Webb, B. (2013). *Prevention and Management of Obesity for Children and Adolescents*. Institute for Clinical Systems Improvement. (http://bit.ly/2DrvBVv).

Ganann, R., Fitzpatrick-Lewis, D., Ciliska, D., Peirson, L.J., Warren, R.L., Fieldhouse, P. … Wolfenden L. (2014). Enhancing nutritional environments through access to fruit and vegetables in schools and homes among children and youth: a systematic review. *BMC Res. Notes. 4*(7), 422. (http://bit.ly/2r9mLt4)

Gibbons, M. (1998). *Pertinencia de la educación superior en el siglo XXI.* Unesco-Banco Mundial. (http://bit.ly/2Ouk65X).

Hoffmann, K., De Gelder, R., Hu Y., Bopp, M., Vitrai, J., Lahelma, E., … van Lenthe, F.J. (2017). Trends in educational inequalities in obesity in 15 European countries between 1990 and 2010. *Int. J. Behav. Nutr. Phys. Act., 14*(1), 63. https://doi.org/10.1186/s12966-017-0517-8.

Instituto Nacional de Salud Pública (2016). Encuesta Nacional de Salud y Nutrición de Medio Camino (ENSANUT), 2016. (http://bit.ly/2R4vmaS).

Instituto Nacional de Estadística y Geografía (2015). Defunciones generales totales por principales causas de mortalidad, 2015. (http://bit.ly/37P5mq1).

Instituto Mexicano para la Competitividad (2017). Kilos de más, pesos de menos: los costos de la obesidad en México. (http://bit.ly/2Zbr6sp).

León, A. (2007). Qué es la educación. *Educere, 11*(39), 595-604.

Morin, E. (1999) *Los siete saberes necesarios para la educación del futuro.* París: Unesco. (http://bit.ly/2DrQArd).

Non, A.L., Gravlee, C.C., & Mulligan, C.J. (2012). Education, genetic ancestry, and blood pressure in African Americans and Whites. *Am. J. Public. Health., 102*(8),1559-1565.

Organización Mundial de la Salud (2016). Informe de la Comisión para acabar con la obesidad infantil. Génova, Suiza. (http://bit.ly/34DCL5a).

Ortiz-Hernández, L., Pérez-Salgado, D., & Tamez-González, S. (2015). Socioeconomic inequality and health in Mexico. *Rev. Med. Inst. Mex. Seg. Soc., 53*(3), 336-347.

Perea-Martínez, A., López-Navarrete, G.E., Padrón-Martínez, M., Lara-Campos, A.G., Santamaría-Arza, C., Ynga-Durand, M.A., … (2014). Evaluación, diagnóstico, tratamiento y oportunidades de prevención de la obesidad. *Acta Pediat. Mex., 35*, 316-337.

Pérez-Mendoza, E. (16 de septiembre de 2011) *Intervención educativa.* [artículo en blog]. (http://bit.ly/2L529ZK)

Prüs-Üstün, A., & Corvalán, C. (2006). *Preventing disease through healthy environments. Towards an estimate of the environmental burden of disease.* World Health Organization. (http://bit.ly/2DtQsrb).

Registered Nurses's Association of Ontario (2014). *Primary prevention of childhood obesity.* Toronto, Canada, 2ª Edition. Clinical Best Practice Guidelines. (http://bit.ly/2R03l4a).

Rigo-Lemini, M. A., Díaz-Barriga-Arceo, F., & Hernández-Rojas, G. (2005). La psicología de la educación como disciplina y profesión. Entrevista con César Coll. *REDIE, 7*(1). (http://bit.ly/33qjlPG).

Serlie, M.J., La Fleur, S.E., & Fliers, E. (2011). Obesity: is evolution to blame? *J. Med., 64*(4), 156-158.

Singh-Manoux, A., Gourmelen, J., Lajnef, M., Sabia, S., Sitta, R., Menvielle, G., … Lert, F. (2009). Prevalence of educational inequalities in obesity between 1970 and 2003 in France. *Obes. Rev., 10*(5), 511-518.

Wells, J.C. (2012). The evolution of human adiposity and obesity: where did it all go wrong? *Dis. Model. Mech., 5* (5), 595-607.

World Health Organization (2015). Country statistics and global health estimates by WHO and UN partner. Data Mexico: WHO statistical Profile. (http://bit.ly/2OWLMiT).

World Health Organization (2016). Obesity and overweight. (http://bit.ly/2QYbGWe)

World Health Organization (2017). Obesity and overweight, 10 facts on obesity. (http://bit.ly/2OXbOm1).

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Inclusive education. Analysis and reflections in Ecuadorian Higher Education

La educación inclusiva. Análisis y reflexiones en la educación superior ecuatoriana

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Resumen

El acceso a una educación en igualdad de condiciones y oportunidades de aprendizaje es una aspiración y un compromiso que debe ser asumido por todos los gobiernos e instituciones públicas y privadas. A nivel internacional, y específicamente en Ecuador, se han generado leyes y acuerdos que han apoyado el proceso de educación inclusiva en todas las etapas. El propósito de este artículo es realizar una aportación sobre la situación y los retos que plantea la educación inclusiva en Ecuador, con especial incidencia en el ámbito de la educación superior. Para ello se ha recopilado y seleccionado, con criterios de relevancia, los acuerdos internacionales y la normativa nacional que afecta a la inclusión. A través de este análisis hemos podido constar el avance en el tratamiento de esta a nivel internacional y su reflejo en la normativa nacional. A pesar de ello, transformar las políticas, la cultura y las prácticas de las Universidades para atender a la diversidad sigue constituyendo un reto para todos los actores implicados. Como principales conclusiones de este trabajo se establece la necesidad de avanzar hacia un modelo de universidad basado en los principios de la inclusión educativa ya establecidos, no solo como una cuestión imprescindible para mejorar los procesos de calidad, sino como un elemento clave en orden a construir sociedades más justas, democráticas y equitativas.

Descriptores: Educación, inclusión, diversidad, normativa, universidad, sostenibilidad.

Abstract

Access to education on equal terms and with equal learning opportunities is an aspiration and a commitment that must be assumed by all governments and public and private institutions. At the international level, and specifically in Ecuador, laws and agreements have been generated that have supported the process of inclusive education at all stages. The purpose of this article is to make a contribution on the situation and challenges posed by inclusive education in Ecuador, with special incidence in the field of higher education. To this end, international agreements and national regulations affecting inclusion have been compiled and selected, with relevant criteria. Through this analysis we have been able to note the progress in the treatment of inclusion at the international level and its reflection in national legislation. In spite of this, transforming the policies, culture and practices of Universities in order to attend to diversity continues to be a challenge for all the actors involved. The main conclusions of this work are the need to move towards a university model based on the principles of educational inclusion already established, not only as an essential issue to improve quality processes, but also as a key element in order to build more just, democratic and equitable societies.

Keywords: Education, inclusion, diversity, regulations, university, sustainability.

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1. Introduction

Exclusion occurs in all contexts and situations of daily life, sometimes in a direct and perceptibly way and in others in a subtle way. Sometimes, situations where exclusion occurs are socially accepted in a way that it is difficult to perceive it even by those who suffer it. The truth is that the advancement of democracy and the higher perception of human rights make inclusion a relevant issue in all sectors of our societies and especially in education.

In the field of education, exclusion of fact or law can be used (Parrilla, 2002). Sometimes there may be legislation that mentions those who are entitled to education, but it was not always necessary to establish it. Exclusion can occur in promoting an education for certain elites of society, being the majority excluded from educational processes. But beyond economic reasons, exclusion has its origin in the non-valuable difference. What is different is rejected, someone who does not fit into the canons of "normality" do not have any possibility in society.

Inclusion in education entails attitudes of deep respect for differences and a responsibility to make them an opportunity for the development, participation and learning. The design of educational processes that place inclusion as a vital axis requires the participation of many social actors. UNESCO (2006) conceives education as a cohesion factor as long as it considers the diversity of people and human groups, avoiding being a factor of social exclusion (Calvo & Verdugo, 2012). Inclusive education is based on a system of determined values that are welcomed to enable the process of teaching and learning to be initiated (Colmenero, 2015). It is therefore a change of approach to accommodate the flexibility that the difference requires.

The right to education is an unquestionable human right in any modern society. It was established in Article 26 of the Universal Declaration of Human Rights and developed in a multitude of subsequent documents, such as the United Nations International Covenant on Economic, Social and Cultural Rights in 1976, the Convention on the Rights of the United Nations 1990, the Millennium Development Goals in 2000 or the 2014 Sustainable Development Goals, among many others. The Declaration of Human Rights states that "education shall aim at the full development of the human personality and the strengthening of respect for human rights and fundamental freedoms; understanding, tolerance and friendship between all nations and all ethnic or religious groups" (United Nations, 1999) will be fostered and four basic characteristics are defined for this purpose: availability, accessibility, acceptability and adaptability.

It is not possible to delimit the right to education under these premises taking as criteria a disability or diversity. Inclusion involves removing, reducing all barriers to learning (Booth, 2000) and consequently moving towards a fairer, more inclusive society for all. Taking into account the diversity present in societies, the school and educational institutions should be a positive reflection of this diversity by supporting the work of parents, teachers, managers, new professionals and social agents who have the same ideal (Corral, Villafuerte, & Bravo, 2015), but it should be noted that the student's unique physical presence does not represent that the institution becomes an inclusive space, this is just the beginning of the inclusive education process.

In Ecuador, in the 60s and 70s although education was characterized by a high appreciation of the public school (Isch, 2011) it can be said that it was an exclusionary model. The school accepted only children considered "normal" while the "different" found neither the necessary access nor itineraries according to their needs. Educational exclusion will be reduced over the years as well as the design of reforms implemented by social and educational policies, whose main objective was to transform educational institutions in the country.

Policies generated at the international level by organizations such as: Regional

Office for Education for Latin America and the Caribbean (OREALC), United Nations Educational, Scientific and Cultural Organization (UNESCO), Organization of States (OEI), as well as at the national level: National Secretariat for Planning and Development (SENPLADES), National Council for Equality of Disabilities (CONADIS), National Secretariat for Higher Education, Science, Technology and Innovation (SENESCYT), Council for Higher Education (CES) among others, aim to promote respect for diversity as a fundamental value of society; all this considering that the only way to transform the education system is with the participation of teachers, students, authorities and families. For Booth (2000) an education with warmth involves significant transformations to the education system, "in its cultures, policies and practices" (Booth, 2000, p. 11).

International recommendations and related public policies with education have made progress in generating mechanisms to advance in inclusion, looking at diversity from a more comprehensive framework, highlighting the traits of student badges: differences in race, ethnicity, gender, language, religion, learning styles, personal status, artistic ability, manual and intellectual abilities (Muñoz, 2009; Herdoíza, 2015; Gallegos, 2015). From this point of view, the aim is to determine the impact of the regulations around educational inclusion, regulations that guarantee an education focused on respect for individualities and diversity.

2. On inclusive education

Booth states that "all human beings are different, no two identical beings. These individual differences should be recognized in educational processes" (Booth, 2000 p. 9).

An extensive path has been taken from the denial of the right of various human groups to education, women, individuals with disabilities, people from different cultures, girls and children, children of displaced people or migrants, until the current situation of partial or full admission at different levels of the education system. "The journey has not been unique (in fact, there are different paths and routes to inclusion) nor linear (it has developed at different rhythms and times according to people and countries)" (Parrilla, 2002, p. 11).

Inclusion has not had a one-on-one conception in its references, rather it has evolved with different senses and theoretical frameworks. In principle, it emerges by a new social conscience, which UNESCO initiates and promotes, on inequalities in the human rights treaty, paying special attention to differences in respect for education as a right. In this sense, inclusive education is understood as a dynamic, open and flexible process that recognizes and appreciates diversity in children and adults without making distinctions of any kind. To include means implementing an education system based on diversity, equity and participation in an ordinary environment (Calvo & Verdugo, 2012; Echeita & Navarro, 2014; Colmenero, 2015; Fernández & Pérez, 2016). For UNESCO (2004) educational inclusion means developing schools that serve all, whatever their characteristics or difficulties; for their part Booth and Ainscow (2002) conceive it as a set of processes that aim to remove or reduce barriers that do not allow everyone to participate.

In the educational field all citizens must be guaranteed a quality education. Educational institutions are responsible for making real the right to an education that deploys the full potential of each person, considering diversity from a more comprehensive approach, and emphasizing that the student is part of an agglomeration composed of differences (Booth, 2000; Muñoz, 2009; Echeita & Navarro, 2014). In this context, public policies linked to education have progressed in the mechanisms that promote educational inclusion, on the basis that the future of society is the result of its education, so that society and educational institutions have to bet on offering a quality education (Colmenero, 2015; Herdoíza, 2015).

2.1. International Agreements

Humans have created international agreements and commitments that drive educational inclusion, recognizing the right to educate oneself in diversity with equity and quality. These are:

- The right to education is noted in Article 26 of the Universal Declaration of Human Rights (1948), which recognizes the human value of education, based on solid foundations not only moral but also legal. Education is an undoubted tool for defending and sponsoring other human rights. The exercise of freedom, enjoyment of safety and an adequate environment are strengthened by a quality education. The recognition of the intrinsic human value of education has been consolidated into major conventions that emphasize the importance of the full inclusion of people with diversity (Valenciano, 2009).
- In 1975, the UN General Assembly's Declaration of the Rights of Disabled People established rules on equal opportunities for people with disabilities. Recognition of rights to all is consolidated, urging the community not to exercise distinction based on race, sex, language, color, religion, creeds, origin, socioeconomic status, birth or any other characteristic (Parra, 2010). For Muñoz (2009), this statement promotes policy changes to assist the integrated education of students with disabilities in regular schools. This statement seeks to offer basic rights to people with disabilities, and its greatest interest lies in preventing disabilities and stimulating rehabilitation (Parra, 2010).
- The Warnock report, prepared by Mary Warnock, for England, Scotland and Wales published in 1978, indicates that education is a good, and it must be recognized as a right of all, and that educational needs (SEN) are common for all students who require different specific attention and resources (Warnock, 1990).
- The Universal Declaration of the Rights of the Child 1959: Establishes equal rights for all children, recognized as a person, without exception, with their interests and needs (United Nations, 1959).
- Jomtien Conference, World Declaration of Education for All, 1990, set out the objective of "education for all", with the aim of motivating equality and universal access to education, taking attention to diversity as a value and as a potential for the advancement of society (UNESCO, 1990).
- World Conference on Special Educational Needs: Access and Quality. Salamanca, 1994: It states that schools should welcome all children, without observing their personal, cultural or social conditions, and it is essential to teach all students within the regular education system, and it states that classrooms are the most powerful measure to combat segregationist attitudes, this allows the creation of host communities, which enables the construction of a society with education for all (United Nations, 1994).
- International Consultative Forum on Education for All 2000, held in Dakar, this space reaffirms the need to pay attention to access to education and the inclusion of historically marginalized and disadvantaged students. To achieve this goal, education systems must be comprehensive, mainly considering basic learning needs and promoting equity among all humans (OEI, 2000).
- In December 2006, the General Assembly, in its resolution 61/106, adopted the Convention on the Rights of People with Disabilities and its Optional Protocol. This protocol constitutes an international treaty recognizing the rights and obligations of States parties to promote, protect and ensure compliance. Likewise, the equality of all human rights and fundamental freedoms that must be guaranteed to all people are

recognized through an inclusive education system at all levels (United Nations, 2008).

- More recently and although in general, the 2030 Agenda places education as the engine of all the Sustainable Development Goals (SDGs) and sets out a target, number 4, which focuses specifically on education "Ensuring inclusive education, quality and promoting lifelong learning opportunities for all" (United Nations, 2015). This objective is developed in concrete targets that must be achieved by all countries and where inclusion is an essential vector.

These conferences and international agreements enable education to be shaped as an ongoing effort to respond to diversity. Thus, education has gone from being a privilege of few people to being a right of all (Clavijo, López, Mora, Ortiz & Cedillo, 2016).

In the case of Latin America and the Caribbean, a number of "structural gaps" must be overcome, such as gender, race, ethnicity and population inequality, , the near-zero effectiveness of public social inclusion policies, the poor quality of health and education services, (...) (United Nations, 2015), inequality that provides an additional effort to make inclusive education a reality at all levels of the education system, especially in higher education as a mechanism for correcting social inequalities (De la Cruz, 2012; Herdoíza, 2015; Vessuri, 2016; Fernández & Pérez, 2016).

2.2. Inclusive education in the country. Legal basis

While inclusive education in other Latin American countries such as Mexico, Brazil, Chile already has a path on inclusion, Ecuador has addressed this topic at the beginning of this century. The term inclusive education is relatively recently used and is still in the process of interpretative and practical consolidation (Clavijo et al., 2016). It started in the 40s and was characterized by the care, in which a medical approach prevailed. Responsibility for educational care to students who had no place in the school system remained in parents and individual organizations who, on their own initiative, set up educational care for children with disabilities. This care was based on charitable criteria (Vicepresidencia de la República, 2011).

In the 70s started the period of institutionalization. Several public and private bodies assumed responsibilities in the areas of education, health and social welfare to meet and correct the needs of the population with disabilities. A rehabilitative approach determined by curriculum adaptation for each of the disabilities is subsequently adopted. These curricula are formalized through ministerial agreements and are parallel to those of regular education, although educational institutions work in an isolated way and differently from regular education (Vicepresidencia de la República, 2011).

Important actions were developed in the 60s to 80s such as the publication of ministerial regulations (Organic Education Law, Education and Culture Act of 77, Special Education Law and Regulation) and regulatory agreements regulating Special Education. All this legal basis presents an inclusive orientation and for the first time "the term of inclusive education appears, but mixed with that of integration" (Rosano, 2008, p. 60); despite this mixture that in principle makes education appear to be embedded in educational integration, allows inclusion in the country to make solid steps towards inclusive education.

Global events in the 90s (World Declaration of Education for All, Declaration of the Disabled, World Education Forum, among others) also push Ecuador to direct education from an inclusive perspective. Measures are generated to help students be cared with the same opportunities. The generally accepted idea that only students with special needs need support is left behind, recognizing that any educator may need support to access the official curriculum.

In 2003 the Code of Children and Adolescents came into force, which argues that,

before the law, all girls, boys and adolescents are equal regardless their status (Congreso Nacional, 2003). The willingness of the Ecuadorian State to promote inclusion in educational institutions by adopting diversity as a positive element is evident. Later, with the political situation of the time, the ten-year plan for education was approved in 2006 through national popular consultation with more than 66% of the votes. The eight policies in this plan have an inclusive approach and seek to ensure the education of all people, regardless the personal, cultural, ethnic, social and disability situations. The lines present to universalize initial education and basic general education, improve infrastructure, quality and equity, revalue the teaching profession (SENPLADES, 2012), among others, constitute policies that assist in the promotion of inclusive education.

The Constitution of the Republic of Ecuador adopted by plebiscite in 2008 sets objectives linked to progressively improving educational quality, based on rights, gender, intercultural and inclusive approach, seeking to strengthen the unity in diversity, and above all ensuring the permanence and completion of studies, as well as examining other forms of diversity by analyzing the capacity of each of them in their contribution to build relationships of coexistence, equity, dialogue and creativity (Constitución, 2008). Education is embodied as a right of people throughout their lives and as a duty that the Ecuadorian state cannot do without. It is a priority area of public policy.

> Education will focus on human beings and will ensure its holistic development in the context of respect for the human rights, the sustainable environment and democracy; it will be participatory, obligatory, intercultural, democratic, inclusive and diverse, of quality and warmth; it will drive gender equity, justice, solidarity and peace (Constitución, 2008, p.16)

Additionally, with the enactment of the Intercultural Education Act (LOEI, 2011), the constitutional rights held by people with disabilities are effective, ensuring inclusion in educational institutions and removing barriers for learning. It is recognized as holders of the right to quality, secular, and free education at elementary and high school, as well as to a lifelong education to all the inhabitants of Ecuador (...). To receive comprehensive and scientific training, which assists in the full development of their personality, capacities and potentials, considering their rights, fundamental freedoms through the promotion of gender equality, non-discrimination, recognition of diversity, participation, freedom and cooperation. This law promotes each being "treated with justice, dignity, without discrimination, with respect for their individual, cultural, sexual and linguistic diversity, their ideological, political and religious convictions, (...)" (Legislación, 2011, p.18).

LOEI promotes equity and inclusion, it guarantees all people access, permanence and culmination in the education system. It promotes inclusive policies through the creation of affirmative measures and an inclusive school culture, motivating equal opportunities for communities, people, nationalities and groups (Legislación, 2011).

Later, the Disability Act (2012) was approved; with this, the Ministry of Education must assume some responsibilities by allowing children and young people with disabilities to integrate into regular education. A key aspect of this law is the recognition of the right to education, establishing that the State manages and ensures that those with disabilities have access and complete the National Education System and the Higher Education System (CONADIS, 2012).

At the same time, the National Plan of Good Living (PNBV) is created, which includes suggestions from public policy to develop components of inclusion, social protection, integration and territory. This plan strengthens the idea that the educational system identifies and values all people, especially priority care groups, and recognizes the plurality of communities, people and nationalities (SENPLADES, 2012).

The PNBV includes knowledge, through the recognition of equal opportunities, the signs of behavior for social interaction, as well as their relationship with the nature, fundamental rights, intercultural dialogue, among others (SENPLADES, 2012). In the face of this new philosophy, it is a policy of state to legitimize and respect sociocultural diversity by eliminating all forms of discrimination, basic actions that must be promoted from all educational institutions and above all strengthened from the Institutions of Higher Education (IES) (Herdoíza, 2015).

In the "A whole life plan" (2017-2013), which specifies the public policy of the Ecuadorian territory, it is established as the responsibility of the State to provide a public, free and universal education; as well as to restate higher education as a public good and creator of development. Higher education is a space for the integral and inclusive training of all; hence, the challenge is to improve the quality, as well as the access and the significant increase of coverage (SENPLADES, 2017).

3. Inclusive education in Higher Education

With regard to Higher Education, the Higher Education Act (LOES) is enacted in 2010. The aim of the law is to define its principles and guarantee the right to quality higher education that points to excellence, through universal access, permanence, mobility and egress without any difference. It is based on the principle of equal opportunities seeking to guarantee to all equal possibilities, without differences in gender, sexual orientation, beliefs, ethnicity, culture, political conviction, socioeconomic status or disability (Asamblea Nacional, 2010).

In this context, overcoming inequalities and exclusion are perhaps the most pressing challenges of these times for Latin American countries and the world. It is precisely Higher Education institutions the ones with the challenge to contribute to the transformation of society, through the training of professionals with knowledge and skills that allow them to provide answers to the needs of social development and help build a citizenship prepared for the human coexistence and well-being (Asamblea Nacional, 2010; Fernández & Pérez, 2016).

Placing inclusion as a main axis of education, especially in the university system means promoting more equitable and fair societies. As UNDP notes on its website: "The goal of achieving inclusive and quality education for all is based on the belief that education is one of the most powerful and proven drivers for ensuring sustainable development". Training in any professional activity seeks to contribute to the knowledge and promotion of human rights, as well as to know the democratic and equality principles between women and men, solidarity, environmental protection, universal access, thus fostering a culture of peace (United Nations, 2015).

While inclusive education must be taken on an individual basis, Ecuadorian institutions of Higher Education will implement actions that will be translated into the society (Asamblea Nacional, 2010; Herdoíza, 2015); all careers must guarantee that their new professionals are not left out of social action to ensure the good living stated in the Constitution. Professors will help in the training of competencies which would allow to find solutions to specific problems of their career, assuming lifestyles that recognize and respect diversity. There are some studies such as Rodríguez (2004), Espinosa, Gómez, and Cañedo (2012) or Fajardo (2017), which point to Ecuadorian universities as responsible institutions in the formation of personal and social behaviors which safeguard the dignity and equality of all students, claiming inalienable rights from the recognition and respect of their diversity, working with values such as non-violence, health promotion, which are inescapable values for inclusive educational development.

The University of Cuenca, aligned with the Constitution of the Republic, the OBV and

the All-Life Plan, has institutional policies of affirmative action such as policies and practices aimed at eliminating all kinds of discrimination by ensuring equal opportunities for all human groups, all this through the Department of the University Welfare, with the "format that regulates the process of educational inclusion at the University of Cuenca" (2017), seeking to ensure higher education as a right of all.

The work in attention to diversity and the format are intended to sensitize and involve all members of the university community to recognize diversity, removing barriers that limit learning and guarantee entry, permanence and completion of their studies to all students entering the University (Universidad de Cuenca, 2017).

Hence, inclusive education is a basic reference in the regulatory order of the country's education system, linking to the recognition of the dignity and equality of people as part of their inalienable rights. Inclusive education is oriented in compromising the university action in overcoming differences by compensating the different inequalities (SENPLADES, 2017), these aspects stated in the Whole Life Plan seek to contribute to forming a twinned society, based on the recognition and respect of human diversity, through a regular framework of rights and shared duties, a society that strives to equate the opportunities of all, especially for those who are in a more vulnerable position for different reasons (Herdoíza, 2015).

4. Challenges and Opportunities in Inclusive Education

The rules on inclusion in the country aim to promote the true meaning of inclusive education, understood as a fundamental right and as an element that determines educational quality. The path has already begun, the countries of Latin America and the Caribbean in recent years have made significant progress in the development of education, extending the durability of elementary (compulsory) education; expanding coverage at different levels; designing curriculums that respond to diversity; improving the provision of materials and infrastructure and, above all, executing different actions that contribute to the teacher´s training (Vessuri, 2016). Beyond the government action, the responsibility of institutions of Higher Education entails to respond with appropriate new approaches and responses that can address the challenges of diversity, expanding coverage at different levels; designing curriculums that respond to diversity; improving the equipment and the actions of institutions as well as their professionals (Parrilla, 2002). Facilitating access to an institution of Higher Education means that teachers, students, authorities and other staff of the institution implement institutional actions to serve the whole population with quality and responsibility (Blanco & Duck, 2010). Beyond administrative issues, inclusive education must struggle with certain attitudes of people involved in the educational process. It is a question of applying the postulates of the culture of diversity in the public university (Juárez, Comboni & Garnique, 2010).

Taking into account the above, and in line with international contributions and the Ecuadorian legislation, a series of actions to be carried out in the institutions of Higher Education are considered, mainly:

- Institutional: Create physical, material and structural conditions to guarantee access and permanence of students regardless their characteristics. This involves establishing and maintaining accessible infrastructures that remove physical barriers that would restrict participation in the learning processes.
- In addition, it is desirable to provide financial support for students with diversity in order to ensure the completion of their university studies. Additionally, implement human resources to support the Department of University Welfare and the generation of an inclusive culture.

- Training: With regard to teachers, the idea is to establish specific training and the necessary support to improve the educational practice. The aim is to look for the individual awareness and also to provide teachers with tools to work on quality inclusive education.
- Specifically, it is important to design and implement Inclusive Education Master programs to promote the respect and appreciation of diversity in the university community through the training on inclusive education.
- Research: implement and promote research lines on Inclusive Education: inclusive policies, cultures and practices that make it possible to improve the teaching practice; thus, providing a response to the diversity of students.

The responsibility for enabling a truly inclusive education must be committed to all and not only by educational institutions. Providing resources is a responsibility that no government should avoid doing.

Conclusions

In recent years, the regulations have recognized the need to train in inclusive education in university contexts. In the face of social diversity, the challenge is to achieve an inclusive, quality education; therefore, the university must respond to this social demand by incorporating it into its structures and curricula.

Effective inclusion first happens when access to knowledge is democratized, where equal opportunities that allow the development of the skills required to act in society are also provided; inclusion is much more than access to education, it implies the real possibility of concluding it, there can be no inclusive education if people and society do not begin to comply, at least, with the current legislation.

A quality university education will observe effectiveness and efficiency as main aspects of training policies and will try to ensure the right to education. The idea is to have institutions of Higher Education that will accept and value the difference, recognizing fairness and equal opportunities. In practice, all people involved in higher education must defend this true sense of quality education by working from university classrooms with the training of professionals with a curriculum in which knowledge about diversity is taught in all careers and academic programs.

Education is a main human right, and it is essential for the progress. It allows all human beings to live a healthy, creative and meaningful existence. It is a catalyst that seeks to consolidate inclusive societies from university spaces, not only declaring it valuable in institutional documents, but training professionals with the capacity to make decisions and face the complex life in this 21st century.

References

Asamblea Nacional (2010). Ley Orgánica de Educación Superior LOES. Registro Oficial Suplemento 298. Quito. 1-69.

Blanco, R., & Duck, C. (2010). Educación inclusiva en América Latina y el Caribe. *Ediciones Universidad de Salamanca. 17*, 37-55.

Booth, T., & Ainscow, M. (2002). Índice de Inclusión. *Promoviendo el aprendizaje y la participación en las escuelas*. UNESCO: CSIE.

Booth, T. (2000). Guía para la evaluación y mejora de la educación inclusiva. *Consorcio Universitario para la Educación Inclusiva*, 1-13.

Calvo, M., & Verdugo, M. (2012). Educación inclusiva, ¿una realidad o un ideal? *Edetania, 41*, 17-30, ISSN:0214-8560

Clavijo, R., López, C., Mora, C., Ortiz, W., & Cedillo, C. (2016). *Educación Inclusiva en Cuenca: actitudes, prácticas y conocimientos docentes.* Cuenca: Universidad de Cuenca.

Colmenero, M. (2015). Caminando hacia una educación inclusiva. Caminando hacia una sociedad inclusiva. *Iniciación a la investigación, 6*(4) ,1-18.

CONADIS (2012). *Ley Orgánica de Discapacidades.* Quito: CONADIS.

Congreso Nacional (2003). *Código de la niñez y adolescencia*. Quito: Registro Oficial.

Constitución (2008). Constitución de la República del Ecuador. 2008. Quito: Corporación de Estudios y publicaciones.

Corral, K., Villafuerte, J., & Bravo, S. (2015). Realidad y perspectiva de la Educación Inclusiva de Ecuador. *Investigação Qualitativa em Educação,* (2), 582-587.

De la Cruz, G. (2012). Inclusión en educación superior: de la atención a la diversidad al facultamiento del estudiantado. *Revista científica electrónica de Educación y Comunicación en la Sociedad del Conocimiento, 12*(2), 216-230. Publicación en línea (Semestral) Granada (España). ISSN: 1695324X.

Echeita, G., & Navarro D. (2014). Educación inclusiva y desarrollo sostenible. Una llamada urgente a pensarlas juntas. *Edetania, 46*, 141-161. ISSN: 0214-8560.

Espinosa, C., Gómez, V., & Cañedo, C. (2012). ¿Integración o inclusión? La educación superior ecuatoriana y el pleno acceso de estudiantes con discapacidad. *Revista Ciencia y Sociedad*, *37*(3), 1-19.

Fajardo, S. (2017). La Educación Superior Inclusiva en algunos países de Latinoamérica: avances, obstáculos y retos. *Revista Latinoamericana de Educación Inclusiva, 11*(1)*,* 171-197. ISSN: 0718 7378.

Fernández, N., & Pérez, C. (2016). La educación superior latinoamericana en el inicio del nuevo siglo. Situación, principales problemas y perspectivas futuras. *Revista Española de Educación Comparada, 27,* 123-148. https://doi.org/10.5944/reec.27.2016.15044

Gallegos, M. (2011). La inclusión educativa en la Universidad Politécnica Salesiana. *Alteridad, Revista de Educación, 6*(2), 118-126.

Herdoíza, M. (2015). *Construyendo igualdad en la Educación Superior. Fundamentación y lineamientos para transversalizar los ejes de igualdad y ambiente*. SENESCYT. UNESCO.

Isch, E. (2011). Las actuales propuestas y desafíos en educación: el caso ecuatoriano. *Educación Social Campiñas, 32*(115), 373-391.

Juárez, J., Comboni, S., & Garnique, F. (2010). De la educación especial a la educación inclusiva. *Argumentos UAM-X. 62*, 41-83.

Legislación (2011). Ley Orgánica de educación intercultural (LOEI). Quito: Corporación de estudios y Publicaciones.

Muñoz, X. (2009). *Educación inclusiva: ¿Mito o realidad?* Fondo de Investigación y Desarrollo en educación. Proyecto FONIDE, 1-70.

Naciones Unidas (1959). Declaración de los derechos del Niño. Asamblea General de las Naciones Unidas. Resolución 1386.

Naciones Unidas (1999). Comentario General núm. 13 al art. 13 (sobre el derecho a la educación) del Convenio internacional sobre derechos económicos, sociales y culturales (ICESCR), adoptado por el Comité de Derechos Económicos, Sociales y Culturales (CESCR). (https://goo.gl/xSq2TJ).

Naciones Unidas (1994). Declaración de Salamanca y Marco de Acción para las Necesidades Educativas Especiales. Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura. Salamanca. 1-49.

Naciones Unidas (2008). Convención sobre los derechos de las personas con discapacidad y su protocolo Facultativo. Oficina del Alto Comisionado para los Derechos Humanos. 1-64.

Naciones Unidas (2015). Transformar nuestro mundo: la Agenda 2030 para el Desarrollo Sostenible. Asamblea General. 1-40.

Organización de Estados Iberoamericanos (2000). Foro consultivo internacional sobre educación para todos. Declaración Mundial sobre educación para todos "Satisfacción de las necesidades básicas de aprendizaje" Organización para la Educación la Ciencia y la Cultura. 1-9.

Parra, C. (2010). Convención sobre los Derechos de las Personas con Discapacidad: antecedentes y sus nuevos enfoques, 16 International Law. *Revista Colombiana de Derecho Internacional*, 347-380.

Parrilla, Á. (2002). A cerca del origen y sentido de la Educación Inclusiva. *Revista de educación, (327),*11-29. Universidad de Sevilla,

Rodríguez, N. (2004). Integración de las personas con discapacidad en la educación superior en Ecuador. (http://goo.gl/vaGjEm).

Rosano, S. (2008). *El camino de la inclusión educativa en punta hacienda*. (Tesis maestría). Cuenca: Universidad de Andalucía.

SENPLADES (2012). Plan Nacional de Desarrollo Plan Nacional para el Buen Vivir 2009-2013: Construyendo un Estado Plurinacional e Intercultural ISBN: 978-9978-92-794-6 Secretaría Nacional de Planificación y Desarrollo-SENPLADES. República del Ecuador. Quito, Ecuador.

SENPLADES (2017). Plan Nacional de desarrollo 2017-2021. "Toda una vida". Secretaría Nacional de Planificación y desarrollo. Quito Ecuador.

UNESCO (1990). Declaración mundial sobre educación para todos y Marco de acción para satisfacer las necesidades básicas de aprendizaje. Secretaría del Foro Consultivo Internacional sobre educación para Todos.1-42.

UNESCO (2015). El desarrollo sostenible comienza por la educación. Cómo contribuir la educación a los objetivos propuestos para después de 2015. Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura. 1-20.

UNESCO (2016). Educación 2030. Declaración de Incheon y Marco de Acción. Hacia una educación inclusiva y equitativa de calidad y un aprendizaje a lo largo de la vida para todos. Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura. 1-60.

Universidad de Cuenca (2017). Instructivo que regula el proceso de Inclusión en la Universidad de Cuenca. Unidad de Bienestar Universitario. 1-4.

Valenciano, G. (2009). *Construyendo un concepto de educación inclusiva: Una experiencia compartida.* Colección Investigación Salamanca. 13-24.

Vessuri, H. (2016). *La ciencia para el desarrollo sostenible* (Agenda 2030). Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura. UNESCO 1-19.

Vicepresidencia de la República (2011). Módulo I. Educación inclusiva y especial. Quito: Ecuador.

Warnock, M. (1990). *Informe sobre NEE*. Siglo Cero, 130, Madrid. 12-24.

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Environmental education in the television media. Case study: Oromar TV

La educación ambiental en los medios televisivos. Estudio de caso: Oromar TV

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Abstract

The current research article has the purpose of analyzing environmental education in television media in the province of Manabí. For which, it was decided to take the Oromar TV channel as a case study. This with the objective of measuring the social impact caused by the mass media in regard to the awareness and care of the environment in this province. In addition to examining the production of training content focused on environmental education within the programming of this channel. The methodology that was applied for the investigation is of qualitative type, so that the technique of documentary analysis was used for the revision of the programming of the Oromar TV channel, this was carried out in a sample period of two months. The results obtained show that there are shortcomings in the programming of the Oromar TV channel, due to the scarce productions of educational content. Therefore, it is concluded that, in the absence of an increase in training television programs, and total absence of specialized productions in the area of environmental education in the Oromar TV channel, that could cause a lack of knowledge in the television audience in regard to in matters of prevention and care of the environment in the province of Manabí.

Keywords: Environmental education, educommunication, mass media, media research, journalism, TV.

Resumen

El actual artículo de investigación tiene el propósito de analizar la educación ambiental en los medios televisivos de la provincia de Manabí. Para lo cual, se decidió tomar como estudio de caso el canal Oromar TV. Esto con el objetivo de medir el impacto social que provocan los medios masivos en lo que concierne a la concientización y cuidado del medio ambiente en esta provincia. Además de examinar las producciones de contenidos formativos enfocados hacia la educación ambiental dentro de la programación de este canal. La metodología que se aplicó para la indagación es de tipo cualitativa, de modo que se utilizó la técnica del análisis documental para la revisión de la programación del canal Oromar TV, esto se llevó a cabo en un periodo de muestra de dos meses. Los resultados obtenidos demuestran que existen falencias dentro de la programación del canal Oromar TV, debido a las escasas producciones de contenido educativo. Por lo tanto, se concluye que, al no existir un incremento de programas televisivos formativos, y ausencia total de producciones especializadas en el área de educación ambiental en el canal Oromar TV, eso podría ocasionar un desconocimiento en la audiencia televisiva en lo que se refiere a materia de prevención y cuidado del medio ambiente en la provincia de Manabí.

Descriptores: Educación ambiental, educomunicación, medios de comunicación, investigación de medios, periodismo, televisión.

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1. Introduction

Environmental education throughout history has been the mechanism to promote environmental care in the population, however, pollution problems have still persisted in many places around the world. This is largely due to the lack of knowledge and disinterest that exists about values and environmental ethics, which results in few ecological habits in a changing society.

Pollution has become a problem for humanity today, and the best way to control it is by teaching environmental values and practices. Chagollán *et al.* (2006) states: "The objectives of Environmental Education include changing attitudes and values; i.e., to assist society and the individuals to acquire environmental values" (p. 150).

However, environmental education faces challenges that limit its total development in the communication field, this is due to the public agenda managed by the mass media. Meyer (2009) notes: "the media decides which topics to exclude or include in the agenda to eliminate or incentivize their public debate" (p. 18). The public agenda of the media is shaped on the basis of its own interests, which can become economic, political and ideological. Sometimes information related to environmental issues is removed from the public agenda, as it may affect the interests of the environment. León (2014) states: "The media pays little attention to the environment in general and to climate change. Coverage varies greatly depending on current issues".

As for the work of environmental awareness in Manabí, the picture is not very different from other places in the world, the interests of the media are reflected in the programming they broadcast to their audience, which somehow could be affecting the production of educational content dedicated to it.

Educational programs in the media have the role of transforming society through the dissemination of knowledge. According to The United Nations Children's Fund of Argentina (UNICEF, 2013):

> In a world where new generations are born in a media culture, media education from a social and educational perspective appears as a critical point in thinking about the relationship between socialization and training of children and young people and the appropriation of different languages and forms of transmission and appropriation of knowledge (p. 19)

Therefore, this article considers the case of Oromar TV media, with the intention of measuring the social impact generated by mass media in terms of environmental awareness and care in the province of Manabí, as well as examining the existence or lack of productions of educational content in the programming of the Oromar TV channel.

2. Methodology

In this research, a qualitative methodology was carried out, which allowed to thoroughly analyze environmental education in Oromar TV, located in Manta, province of Manabí. It was necessary to use methods such as: Abstraction, which allowed to discover the different conceptual elements linked between environmental education and the media on a theoretical level. On the other hand, the method of concreteness was important in synthesizing the different concepts that originated a theory of its own and that was used to argue the case study.

The technique used during the inquiry was the documentary analysis. For this reason, magnetic-type documentary sources (Recordings of the Oromar TV channel) were used. For this study, it was considered to observe only the contents classified as educational and cultural. Also, a sample review period was chosen, which began from November 1 to December 31, 2016, this because the channel changes constantly programs. After this process, the data was analyzed for display in the form of graphs that led to the evidence of conclusive results of the case.

3. Results and discussion

3.1. The importance of environmental education

Environmental protection at the educational level has been present since the United Nations promoted the International Conference on the Human Environment in 1971, which gave rise to the publication of the 1972 general report entitled: *One Earth. The care and conservation of a small planet*. This would be the main aspect for countries to start promoting environmental education in education institutes.

Currently environmental education is in the subjects of study of educational institutions, since its relevance in the academic training of students is essential so that they can know and progressively transform the environment. Leandro (2012) states:

> Environmental education is an educational process during which the individual and general and/or specific communities assimilate concepts and create a system of values through which capacities and behaviors are developed in their relationship with the world, organisms, ecosystems, and social groups as a whole, which allow them to prosecute the interactions between the human environment (...) and the biophysical environment. (p. 38)

At the social level, the success of environmental education is reflected in the most common acts of the human being, which is paramount when determining the behavior of a civilization that is in search of responsible sustainability for the environment. Toro and Lowy (2005) say:

> The perception of the environment is, in short, the reference that guides actions in all areas of human culture, and of course, in education; it is there where the obstacle to environmental education in certain scenarios may be at issue, which has achieved very little and does not achieve the expected end. (p. 31).

In the context of Manabí, environmental education appears to have failed to achieve the essential goals to maintain reasonable responsibility for the environment, as in several previous studies it has been demonstrated the existence of certain inconveniences of pollution in different areas of Manabí. Starting from the pollution of the beaches and rivers of the parishes such as Manta, Jaramijó and Puerto López, which are seriously affected due to the mouths of wastewater and waste that end directly in the ocean. This is evident in an investigation conducted in Tarqui Beach, located in the canton of Manta.

> The results show that the beach is contaminated in both its chemical and microbiological characteristics. This beach should not be considered suitable for recreational purposes, as it exceeds the maximum pollution limits permissible in the Ecuadorian environmental legislation (González & González, 2016, p. 52).

On the other hand, the jaramijó parish demonstrates the problem of river pollution because of the limited ecological culture on the care of water sources. "The lack of awareness of the inhabitants is the main polluting factor when throwing solid waste, in addition to the clandestine home connections that exist and that discharge directly to the Jaramijó River" (Tarco & Menéndez, 2014, p. 95). However, in Puerto López the need for increased training in beach maintenance becomes crucial to solve the problem of marine waste. "There was interest of the inhabitants in learning how the beaches in Salagon parish should be kept clean" (Suárez, 2008, p. 9).

As far as air pollution is concerned, Montecristi parish is often constantly affected by factory settlements in the peripheral areas of the cantonal head. Briones and Morán (2010) indicate:

> The environment surrounding the Schools 'Filomena Chávez de Duque' and 'Father Gabriel León', is different because the former has problems of air pollution, as a result of the bad smells emanating the factories, (...). In contrast, the second has very few pollution problems to be located in the downtown of Manta. (p. 96)

Even the management of computer waste is becoming an environmental problem that is detrimental to the health of the inhabitants of Chone parish. Alcívar and Zambrano (2015) determine: "There is little awareness within public institutions and even the general public of the damage that computer waste can cause within the environment and the human health" (p. 101).

It is also important to emphasize the impact that is occurring on the natural ecosystem of the sectors surrounding Portoviejo parish. Intriago (2012) states: "In Colón parish, the main cause of the extinction of native species is due to environmental pollution that has become worse in recent years as a result of human activities" (p. 49).

Finally, the lack of awareness about the prevention and care of the environment of the cities is becoming a decisive factor in the economy of cities like Manta, as the problem of pollution is affecting the tourism activity. Franco and Vélez (2004) say: "The state of environmental pollution is clearly noticeable to those who visit the city causing an unattractive image, which negatively influences the economic growth of tourist activity" (p. 227).

On the other hand, it should be added that the proliferation of stray animals is a somewhat isolated element to the issue, but that in turn it is an incident factor in the pollution of the cities. A research conducted in 2016 on an analysis surrounding campaigns to reduce the overpopulation of stray animals in the city of Manta shows that there is a connection between pollution of cities and stray animals.

> It is clear that this problem will become dangerous for all inhabitants over time, which will end up causing traffic accidents, diseases, pollution of the cities, cruelty and death of living beings. (Cumba, 2016, p. 79)

All these investigations reach similar conclusions, which show the lack of awareness of the environment care. In addition, the consequences of environmental damage by the inhabitants and rulers of each of the parishes are observed. The low interest given to ecology issues in certain governmental institutions can become a decisive factor, which can affect citizens' behavior in terms of environmental responsibility. Loor (2012) states:

> In Portoviejo, the lack of dissemination and little interest in environmental education issues prevents an authentic commitment for people to feel committed to caring for the environment around them, resulting in polluting behavior by accelerating levels of pollution in the environment of the Pro Improvement Committee 22. (p. 48)

3.2. Environmental education in the media

The media throughout history has had the important function of informing, training, generating opinion and entertaining. Today, this fundamental role played by the media in society is becoming a decisive factor in environmental education, as education is the basis for building the foundations of a progressive society. According to Alcántara, the function of education is to obtain personal achievements involved in it, while seeking improvement and social transformation through greater commitment of people to their environment (Alcántara, 2009).

Journalists and communicators in general have the complex task of informing and training the public who see and listen to them daily with information from reliable sources that are useful for finding solutions and answers to the various problems arisen in the society. Gómez and Patiño (2015) claim:

> The media not only generates harmful and perverse effects, but it has invaluable value applied to the field of education, not only on the instrumental aspect but beyond: the axiom that generating active emitters contributes to creating critical receivers would be fulfilled. (p. 128)

It is for this reason that journalists must have a multidisciplinary training, which allows them to disseminate information to the public.

When it comes to environmental education, journalists and communicators have developed a new type of journalism over the years, which is known as environmental journalism, in which journalists seek to focus on environmental issues such as climate change, pollution, environmental protection and the dissemination of ecology news. It is important to mention that this type of journalism not only seeks to inform environmental issues, but also it trains the public with positive behaviors in the care of the environment, in a simple language that can be understood by the different people according to their local contexts. Reyes and Chávez (2013) point out: "Environmental journalism helps to form environmental or planetary citizens, often without being too aware of it" (p. 136).

Environmental journalism may be the new way of implementing environmental education in the media, but there is one drawback that is preventing environmental education from reaching media agendas, which is known as "silencing uncomfortable truths." This is largely due to the factual powers affecting the global media and the political world, since most of those that contribute to pollution and generate climate change are the big corporations that are linked to fossil fuels, and which hope of mastering the media agenda of the different massive media when coverage of global climate change summits is made. Lemos (1991) states: "Although the media tends to correspond to collective interests, they seek to structure reality without affecting the interests of the dominant groups" (p. 17).

The configuration of the media public agenda has become an obstacle to environmental education being an integrated part of the communication processes. Rodríguez (2004) argues: "Agenda-setting function, one of the most representative current theories of the media. It explores how the media influences audiences through topics considered to be of greater relevance" (p.15). This means that any news event related to an environmental conflict with any of the corporations that the media maintains trade deals, vanishes within the public agenda of the medium so as not to affect their economic interests. Berger and Luckmann (1997) say:

> It is clear that mass media are explicitly used by moral entrepreneurs of different categories for their own purposes, as well as by the State, the church, charitable associations, as representatives of community's opinion. (p. 123)

The power that the agenda has to set in public opinion is able to shape the thoughts of a society, over the years the public agenda has evolved into a more complex concept known as news frames, where the different news begins to have an order in order to modify and direct the audience to a perspective created by the media.

The media has demonstrated the use of the public agenda in the various news events surrounding the problem of climate change. De Rueda (2014) states:

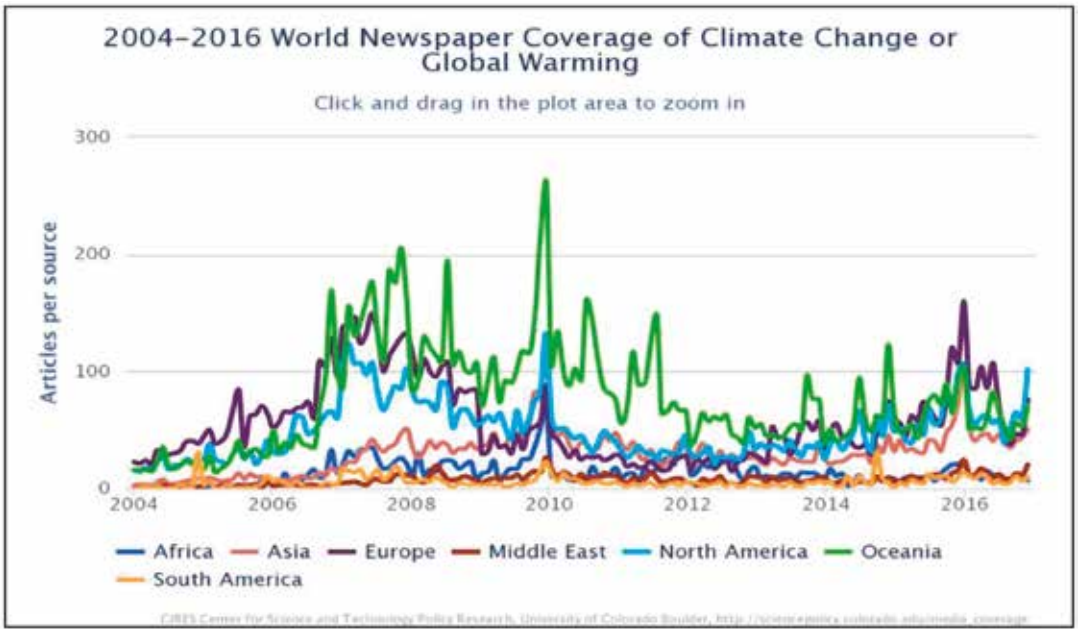
> In an environmental issue at first it activates, and subsequently it interests the public, for certain seasons it remains dormant, but it remains dormant until that action or decision appears —almost always political — and it exercises a triggering reaction that ignites the 'informative boom'. (p.151)

Depending on the configuration of the public media agenda, each media outlet may or may not play a key role in raising public awareness of certain environmental problems. In the case of global warming, mass media has covered news events only seasonally, which is contrary to educational environmental care programs that seek a constant flow of information to raise long-term awareness. Montero (2013) say:

> It is heartbreaking to see how the amount of information on climate change has barely evolved (saving those specific peaks) in the last decade, even though the problem, and its consequences, has continued to grow. (p. 147)

The downside of climate change over the years has become an issue that remains latent in the media agenda of some of the global media, the coverage they have provided over time varies according to each region of the world. Figure 1 shows the peaks of coverage that the global written press has made from 2004 to 2016 on the climate change or global warming.

Figure 1. 2004-2016 Global newspaper coverage on climate change or global warming



Apparently in South America the peaks of coverage are low, being almost similar to the Middle East and Africa, this compared to other regions of the world where they are consistently high. It appears that the media written in South America proves to have some carefreeness about environmental issues, which means that the public has no greater interest in learning about news related to climate change or global warming.

It is clear that the media in South America carry a dissolved media public agenda of environmental issues, resulting in a poor audience of environmental awareness. "The problems of the environment in the region cannot be addressed if there is no awareness of their impact on humanity" (Lemos, 1991, p. 21).

3.3. Environmental education in the Manabí media

The background in Ecuador regarding the media performance in training content programs demonstrates a daunting picture, either in the general educational field or in a specific subject. The Superintendency of Information and Communication (2015) states:

> Unfortunately, there is no significant increase in any of the 4 surveys of information regarding the training content (...). They occupy, on average, 5% of the total content broadcasted on the television. This percentage is a long way from what should ideally be occupied by the training content, in a properly balanced programming, if considering that the constitutional and legal priorities for dissemination are:

> information content, opinion content, formative content; and to which the market priority, which is the dissemination of entertainment content, is added. (p. 163)

In Manabí, the situation of environmental education in the media has a highly worrying outlook, due to the inconvenience of the low production of educational, educational and cultural content programs. Arrobo and Suing (2015) say:

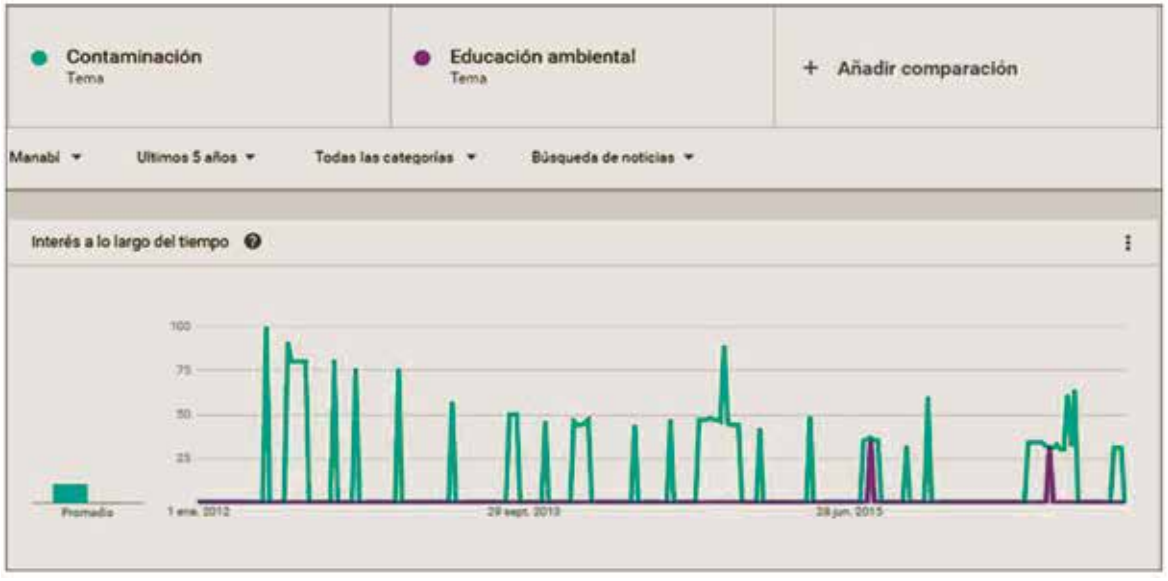
> In January 2015, 40 training/educational/cultural programs were broadcasted on open-signal television stations in the mainland of Ecuador; 8 in ECTV; 5 in Ecuavisa; TC, RTS, UNO and ETV broadcast 4 each; Teleamazonas, GAMA and UCSG 3 each; and, Oromar and RTU one each. (p. 3)

It is worth noting that Oromar is a television channel that has been transmitting for 6 years in the entire Ecuadorian territory, making it the communication media with greater scope and coverage in Manabí, since there are also other channels that have been transmitting for years, but only cover certain sectors of the province.

The low production of training content programs in Manabí affects environmental education by not having a space to create productions of educational content specialized in the prevention and care of the environment. On the other hand, there is the pollution factor that sticks out in the province, in which the media emphasizes sometimes and then it becomes silent again.

This silent mode that the media maintains on the environmental topic can be seen in the public interest in the comparative trend between pollution and environmental education, this in the span of the last 5 years in the province of Manabí, as shown in Figure 2. The data was managed by the Google Trends web application, based on the search analysis of Google News headlines who have trended in public opinion on the network. The Google Trends tool is recognized from the field of research, as a solid and valid indicator for tracking the occurrence frequencies of certain terms that could hypothetically function as catalysts of interest in the public opinion (Reyes *et al.,* 2015).

Figure 2. Comparative trend analysis between pollution and environmental education, 2012-2016.



Made with the Google Trends 2016 tool.

The results show that pollution in Manabí shows peaks in the public opinion over time; however, environmental education remains in a constant low, only rising in mid-2015 and early 2016, being a clear indicator that the configuration of the public agenda of the media in Manabí is limited to temporarily covering the news events related to controversial pollution cases in the public opinion, but there is very little interest when it comes to environmental education on the part of the media in disseminating training content that prevents the problem, this could trigger a lack of knowledge in the audience in a long time about how to prevent and care for the environment. Perales and García (1999) argue:

> The news and information generated is due to the same limitations as most journalism practiced in the media, such as giving priority to the most striking events, as a side of (...), to educational journalism. (p. 151)

3.3.1. Analysis of the television programming of Oromar TV Channel

Oromar TV channel started to ibroadcast on November 1, 2010 in Manta, and it has covered the entire national territory, it is also the first channel of Ecuador to broadcast in High Definition, trait that has allowed the channel to gain viewers. For the current research article, the contents of the channel schedule were classified as shown in Table 1.

Table 1. Oromar TV programming

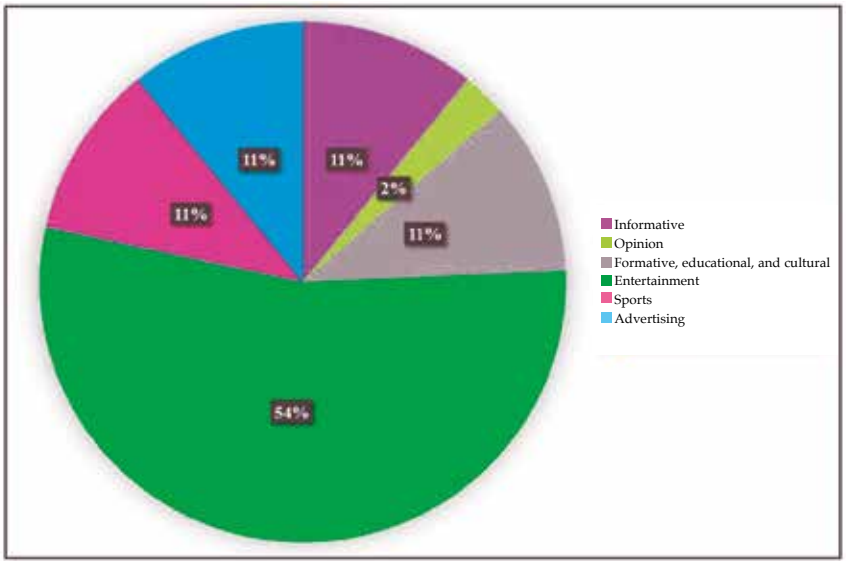
Content Rating					
Information	**Opinion**	**Educational and Cultural**	**Entertainment**	**Sports**	**Advertising**
NTI News (Morning Broadcast)	Between Lines	Student SOS	International Video Control	Sports Stop	What's TV News
NTI News (Night Broadcast)		Ecuador Multicolor (Channel Association)	Records	Ecuadorian Serie A Football Championship	MWW
Together by Manabí		Educa Tv (Government program)	The Flintstones	Ecuaedorian Football Championship Series B	Telemark
Portoviejo Is Born of You		Express (Government Chain)	Looney Tunes	Zero Latitude	Mother Jungle
			The Looney Tunes Show		
			The Coyote and the Road Runner		
			Tom and Jerry		
			Bonanza		
			The Chaparral		
			Walker, Texas Ranger		
			Sea of Laughter		
			Men prefer stupid women		

Content Rating					
Information	Opinion	Educational and Cultural	Entertainment	Sports	Advertising
			Young wife		
			Everyone wants with Marilyn		
			Abigail		
			The Flying nun		
			Zorro		
			The Three Stogees		
			The Wild, Wild West		
			Dr Quinn		

Own elaboration. Based on the information obtained from the official website of Oromar TV channel. Available at: http://oromartv.com/ (visited on December 30, 2016).

Within the review of the programming the first thing observed is that Oromar TV complies with Article 60 of the Organic Communication Law [1], by putting in each of its programs the identification of the content and its classification. But there is an unbalance in terms of the number of productions of the same type, which were broadcasted in the sample period of observation as explained in Figure 3, this imbalance can be counterproductive to the channel's television broadcast.

Figure 3. Balance of Oromar TV programming



Own elaboration.

It can be seen that 54% of the channel's programming is entertainment content type, followed by 11% of formative, educational and cultural programs. Another 11% corresponds to advertising ads, with equal percentage of the informative and sports, finally a remaining 2% of opinion. It is worth mentioning that were taken into account the productions of the government network and associations of television channels for the analysis of the programming balance, which are broadcasted by legal provisions. Since the channel's only own-initiative educational production is SOS Student, which broadcasts twice a week, where each episode addresses a given pedagogical topic in approximately 20 minutes.

This type of programming is contrary to what is established by the Organic Law on Communication (LOC) in Article 8, referring to the prevalence in the dissemination of content of an informative, educational and cultural nature, in a predominant way [2]. Since Oromar TV channel has few informative productions (11%), educational and cultural (11%), making a total of 22%, it does not accomplish to what the law indicates. In this sense, the LOC is clear in mentioning that informational, educational and cultural content has to predominate on the media, i.e., in order to carry out compliance with Article 8, it is necessary that more than 50% of the programming is contained in this type of classification.

The imbalance of programming and non-compliance with Article 8 of the Organic Law of Communication is not an exclusive situation presented only in Oromar TV channel, but also in many other Ecuadorian channels. Reinoso (2014) states:

> The reality is that national television channels tend to offer entertainment programs almost all the time, in which show business and sensationalism have proliferated, discouraging the exercise of thinking. (p. 88)

On the other hand, poor information on environmental care is generating a disinterest in the public opinion in environmental education at the local level. A clear example is the pollution on the beaches of Manta, due to the little media linkage in providing messages for the protection of tourist resorts of this area. In an undergraduate research paper published in 2015 can be observed the lack of awareness messages on the care of El Murciélago de Manta beach by the local media. "Most people believe that the media should be more linked in the dissemination of messages of protection and care of el Murciélago beach" (Cumba, 2015, p. 76).

It is clear that the media plays a key role in the public opinion in shaping and educating a community on environmental issues, so television programs of educational content play the role of strengthening the different areas of knowledge. Article 9 of the Technical Parameter Regulations of the Communication Act provides that programs of formative, educational and cultural content need to be those that strengthen the learning of art, science and technology [3]. Based on this, Oromar TV would not be contributing enough to improve education in the context of Manabí within its television programming, and mainly, in linking productions dedicated to environmental education.

Conclusions

The results show that the interest of the public in environmental education in Manabí's media is low in relation to news events that generate environmental scandals or complaints. This is because the mass media seeks to be trendy in the public opinion using the problem of pollution in Manabi, while awareness and education about environmental prevention and care remains in the background, causing there very little attention from people regarding campaigns and educational programs dedicated to green practices.

In relation to Oromar TV channel, the medium only has 22% of informative, educational and cultural content, which would not be complying with what the LOC dictates in its Art. 8 on placing this type of content in the programming.

In addition to that, the lack of dissemination of educational content in Oromar TV channel can become a determining factor when introducing environmental education into the television environment, since, in the absence of a further increase in educational content, it is quite possible that this will become a kind of limitation not to allow productions dedicated to environmental education in the traditional media.

Finally, the problem of the total absence of environmental education programs in a television medium with great coverage at the regional and national level such as Oromar TV could lead to a lack of knowledge over time in the television audience on topics of environmental prevention and care, which may end up indirectly triggering as one more contributing factor to the environmental pollution problem in Manabí.

Notes

1. Organic Law of Communication. Article 60.- Identification and classification of content types. - For the purposes of this Act, sound broadcasting, television, local subscription channels of audio and video systems, and print media are identified and classified in: 1. Informative -I; 2. Opinion -O; 3. Training/educational/cultural -F; 4. Entertainment -E; 5. Sports -D; and 6. Advertisements -P. The media is obliged to classify all the contents of its publication or programming with legal and technical criteria and parameters.
1. Organic Law on Communication. Art. 8.- Prevalence in the dissemination of contents. - The media, in general, will disseminate content of an informative, educational and cultural nature. These contents should support quality and be transmitter of the main values and rights contained in the Constitution and international human rights instruments.
1. Regulation laying down the technical parameters for the definition of audience, time, classification of the programming, classification of the content, including advertising that are broadcasted on the social media. Article 9.- Informational, educational and cultural content. - The following contents may be transmitted in all time zones, with a prevalence in promoting education and culture for the construction of the Good Living. a. Educational, Cultural Content: 1. Content that strengthens learning from art, science and technology.

References

Alcántara Garrido, M. C. (2009). La importancia de la educación. *Innovación y Experiencia Educativa*, (16), 201-209. (http://bit.ly/2EcPGzr).

Alcívar, C., & Zambrano, C. (2015). *Tratamiento de los desechos informáticos en la contaminación electromagnética del cantón Chone*. (Tesis de pregrado). Universidad Laica Eloy Alfaro de Manabí, Ecuador.

Arrobo, J., & Suing, A. (2015). *Redes sociales de los programas de cultura en la televisión de Ecuador*. (http://bit.ly/36fVKTB).

Berger, P., & Luckmann. T. (1997). *La construcción social de la realidad*. Buenos Aires, Argentina: Amorrortu.

Briones, C., & Morán, A. (2010). *La contaminación del aire y su influencia en el normal desarrollo del proceso de enseñanza-aprendizaje de los niños y niñas de las escuelas particulares "Filomena Chávez de Duque" y "Padre Gabriel León", de la lotización Arroyo Azul del cantón Montecristi y barrio la Dolorosa del cantón Manta.* (Tesis de pregrado). Universidad Laica Eloy Alfaro de Manabí, Ecuador.

CIRES Center for Science and Technology Policy Research, Cooperative Institute for Research in Environmental Sciences & University of Colorado Boulder (2016). *2004-2016 World Newspaper Coverage of Climate Change or Global Warming* [Gráfico]. (http://bit.ly/2Rvovrk).

Cumba, E. (2015). *Campaña comunicacional para la prevención de contaminación ambiental en las playas de la ciudad de Manta. Caso de estudio: playa El Murciélago, periodo 2013-2014.*

(Tesis de pregrado). Universidad Laica Eloy Alfaro de Manabí, Ecuador.

Cumba, E. (2016). *Estudio y análisis de las campañas comunicacionales diseñadas para reducir la proliferación de animales desamparados en las zonas urbanas de la ciudad de Manta*. (http://bit.ly/34xQvgR)

Chagollán, F. *et al.* (2006). *Educación Ambiental*. Zapopan: Ediciones Umbral.

De Rueda, Á. (2014). *El discurso político y el tratamiento periodístico del cambio climático en la prensa española durante las conferencias de las partes de Naciones Unidas: de Copenhague (2009) a Varsovia (2013).* (Tesis doctoral). España: Universidad Cardenal Herrera-CEU.

Fondo de las Naciones Unidas para la Infancia Argentina (2013). *Televisión, Internet y educación básica*. Buenos Aires: UNICEF.

Franco, I., & Vélez, Y. (2004). *La protección del medio ambiente, parte integral del desarrollo turístico sostenible de Manta* (Tesis de pregrado). Universidad Laica Eloy Alfaro de Manabí, Ecuador.

Gómez, M., & Patiño, S. (2015). Educando con los medios, una revisión desde los clásicos. Dos siglos de educación: de Freinet a Wikipedia. *Hachetetepé,* (11), 119-130. (http://bit.ly/2LEBC5A).

González, C., & González, H. (2016). Evaluación química y microbiológica de la playa de 'Los Esteros' en la ciudad de Manta. *Revista de Ciencias de la Vida La Granja*, *23*(1), 47-52. (http://bit.ly/2P3casO).

Intriago, F. (2012). *La desaparición de especies nativas y su incidencia en los ecosistemas* (Tesis de pregrado). Universidad Tecnológica Equinoccial, Ecuador.

Leandro, S. (2012). *Educar para otro mundo posible*. Córdoba: Bubok Publishing S.L.

León, B. (2014). *El periodismo ante el cambio climático*. Barcelona: Editorial UOC.

Lemos, L. (1991). Periodismo ambiental. *Chasqui*, (37), 17-21. (http://bit.ly/2EusnRN).

Loor, F. (2012). *La educación ambiental y su incidencia en la salud del Comité Pro Mejoras 22 de Junio.* (Tesis de pregrado). Universidad Tecnológica Equinoccial, Ecuador.

Meyer Rodríguez, J. A. (2009). Establecimiento de agendas en medios de comunicación: Repercusiones del escándalo mediático Marín-Nacif-Cacho. *Revista Latina de Comunicación Social*, (64), 15-28. (http://bit.ly/353RKVX).

Montero Sandoval, J. M. (2013). El cambio global y la crisis del periodismo. En R. F. Reyes (Dir.), R. M. Chávez (Coord.), *Medios de comunicación y cambio climático* (pp.147-154). Sevilla, España: Fénix Editora.

Perales, F. J., y García Ramírez, N. (1999). Educación ambiental y medios de comunicación. *Comunicar, 6*(12), 149-155. (http://bit.ly/2Ryfpdm).

Reinoso, M. (2014). *La televisión educativa en el ecuador: análisis de los programas del proyecto "educa, televisión para aprender" auspiciado por el ministerio de educación*. (Tesis de pregrado). Pontificia Universidad Católica del Ecuador.

Reyes, F., & Chávez, M. (2013). *Medios de comunicación y cambio climático*. Sevilla: Fénix Editora.

Reyes, F., Raigada, P., & Mariño, V. (2015). La cobertura periodística del cambio climático y del calentamiento global en El País, El Mundo y La Vanguardia. *Revista Latina de Comunicación Social, (70)*, 122-140. (http://bit.ly/2E3jheg).

Rodríguez Díaz, R. (2004). *Teoría de la Agenda-Setting aplicación a la enseñanza universitaria*. (http://bit.ly/2Ytztiy).

Suárez, B. (2008). *La contaminación en las playas del Salango.* (Tesis de pregrado). Universidad Laica Eloy Alfaro de Manabí, Ecuador.

Superintendencia de la Información y Comunicación (2015). *Informe Final Sobre la Línea Base del Cumplimiento de la Ley Orgánica de Comunicación*. (http://bit.ly/2LBpFOj).

Tarco, C., & Menéndez, M. (2014). *Análisis de los factores que provocan la contaminación a lo largo del encauzamiento del río Jaramijó hasta su desembocadura al océano Pacífico y las medidas para contrarrestar su impacto ambiental.* (Tesis de pregrado). Universidad Laica Eloy Alfaro de Manabí, Ecuador.

Toro, J., & Lowy, P. (2005). *Educación Ambiental: Una cuestión de valores*. Bogotá: Universidad Nacional de Colombia, sede Caribe.

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1. General information

«Alteridad» is a bilingual scientific publication of the Salesian Polytechnic University of Ecuador (UPS), published since January 2006 uninterruptedly, on a semi-annual basis (January-July).

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«Alteridad» is indexed in the Web of Science's Emerging Sources Citation Index (ESCI), at the Scientific Electronic Library Online (SciELO), in the REDALYC Scientific Information System, in the directory and selective catalog of the Regional Online Information System for Scientific Journals of Latin America, the Caribbean, Spain and Portugal (Latindex), in the Directory of Open Access Journals (DOAJ), in the European Reference Index for the Humanities and Social Sciences (ERIHPLUS), in the Ibero-American Network of Innovation and Scientific Knowledge (REDIB), on the Dialnet Portal; it is evaluated in the Information Matrix for Journal Analysis (MIAR), the Integrated Classification of Scientific Journals (CIRC), and the Qualis review system for CAPES journals. In addition, it is in repositories, libraries and specialized catalogs around the world.

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2. Scope and policies

2.1. Topics

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2.2. Sections

The journal has a semi-annual periodicity (20 articles per year), published in January and July and has two sections of five articles each by number; the first referring to a **Monographic** topic

prepared in advance and with thematic topic and the second, a section of **Miscellaneous**, composed of varied contributions within the theme of the publication.

2.3. Contributions

All manuscripts must be original, and must not have been published in any other journal or must not be in the arbitration or publication process in another journal. Empirical research results are published in Spanish, Portuguese or English, and studies and state-of-the-art are also admissible:

- **Researches:** 5000 to 6500 text words, including title, abstracts, descriptors, tables and references. Particular assessment will be made of research results, methodological rigor, the relevance of the subject, the quality of scientific discussion, the variety, timeliness and richness of bibliographic references (preferably publications indexed in JCR and Scopus). At least 35 references are expected.
- **Literature studies and reviews:** 6000 to 7000 text words, including tables and references. The debate generated, the relevance of the subject, the originality, current and selective contributions and references of around 70 works (preferably from publications indexed in JCR and Scopus) will be particularly valued.

3. Editorial process

3.1. Submission of manuscripts

Manuscripts must be submitted only and exclusively through the Open Journal System (OJS), in which all authors must register in advance, although only one will be responsible for the correspondence. No author may submit or review two manuscripts simultaneously, estimating a time of four consecutive numbers (2 years). An article may have a maximum of 3 authors, although if justified depending on the size of the study, there may be up to 5.

«Alteridad» informs the reception of the manuscript submitted by the authors; the information related to the acceptance or rejection of the manuscript is sent by email and the platform; and in the case of acceptance, the author is also informed of the editing process.

In the website of the journal, in the Guidelines section, are presented the Guidelines for the Authors, the format of the structure of the articles, the cover page and cover letter, the pre-submission list, the evaluation forms by the external reviewers and a guide for the submission of the article through OJS. Before the submission, it is strongly recommended that the manuscript be checked with the Pre-Check Protocol. Two documents should be sent simultaneously:

a) Cover page and cover letter (use the official model), on which will appear

- Cover page (Title, Abstract and key words provided in the Manuscript).
- Full name of each of the authors, organized in priority order; followed by the professional category, institution, email of each author and ORCID number. It is mandatory to indicate if the authors have a PhD academic degree (include Dr. before the name).

- A **Cover letter** will also be included indicating that the manuscript is an original contribution, has not been sent or evaluated in another journal, with the signature of the authors, and acceptance (if applicable) of formal changes to the manuscript compliant with the rules and partial transfer of rights to the publisher.

b) Fully anonymized **manuscrip**t, in accordance with the rules referred to in section 4.

3.2. Revission process

Upon having received the document and in a maximum period of 30 days, the correspondence author shall receive a notification, indicating whether the manuscript is estimated or dismissed for the arbitration process by the scientific reviewers. In the case that the article has formal problems, or does not address the educational subject, or has a high similarity percentage to another document(s), the editorial board shall dismiss the work without the option to return it. Conversely, if it has superficial problems, it will be returned to the author for the corrections before starting the evaluation process. The submission date of the article will be considered based on the final submission when the article is presented with the corrections.

The articles will be scientifically evaluated by an average of three experts of the topic. Reports will indicate the following recommendations: Accept the Submission, Publishable with Modifications, Sent the manuscript back for its Review, Not Publishable. The acceptance or rejection of the manuscript for its publication will be decided from the analysis of external reports. In the case of dissenting results, it shall be forwarded to a new opinion, which shall be final. The protocol used by reviewers is public (researches; studies and state-of-the-art).

In general, once the external scientific reviews are taken into view, the criteria justifying the decision on the acceptance/rejection of the manuscript by the Editorial board are:

- Current and novelty.
- Relevance and significance: advancement of scientific knowledge.
- Originality.
- Reliability and scientific validity: proven methodological quality.
- Organization (logical coherence and formal presentation).
- External support and public/private funding.
- Co-authoring and internationalization degree of the proposal and the team.
- Presentation: good writing.

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3.3. Editing and publishing of the manuscript

The edition and layout processes of the accepted articles is performed by the Technical Board of the journal in coordination with the Abya-Yala Editorial. «Alteridad» reserves the right to make

style corrections and editorial changes if necessary to improve the manuscript. A proof of printing in PDF format will be sent to the authors for the correction of typography and spelling in a maximum of three days.

Abya-Yala Editorial will carry out, free of charge for the authors, the professional translation of the final version of the manuscript into the English language (or Spanish, according to the original version), which will guarantee the consultation and international dissemination of the manuscript. The articles will be published on the journal's platform in a timely manner. All articles, in their two language versions (Spanish and English), are published in PDF, HTML, EPUB and XML-Jats format.

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The authors are committed to give maximum diffusion to their article published in «Alteridad». In this sense, they are encouraged to promote their published article on academic networks (Academia.edu, ResearchGate, Mendeley, Kudos), social (Twitter, Facebook, LinkedIn, also publishing the DOI), institutional repositories, web or blog staff, among others. Authors are also encouraged to share the published article through email lists, research groups and personal contacts.

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The manuscripts shall be submitted in typeface Arial 10, simple spacing, fully justified and without tabs or white space between paragraphs. Only large blocks (title, authors, abstracts, key words, credits, and captions) will be separated with white space. The page must be 2 centimeters in all its margins. Manuscripts must be submitted in Microsoft Word document (.doc or .docx), requiring the file to be anonymized in File Properties to avoid the information related to the identification of the author/s.

4.1. Cover page

Title (Spanish and English): Concise but informative, in Spanish on the first line and in English in the second, consisting of as many significant terms as possible. The title is not only the responsibility of the authors, and changes can be proposed by the Editorial Board. A maximum of 80 characters with space are accepted.

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Key words (Spanish and English): 6 keywords must be presented for each language version directly related to the topic of the manuscript. The use of the keywords presented in UNESCO's Thesaurus will be positively valued (http://bit.ly/2kIgn8I) or the controlled vocabulary of IRESIE (http://bit.ly/2mgg4m8).

4.2. IMRDC Structure

For those works involving empirical research, the manuscripts will strictly respect the IMRDC structure, with the headings of Economic Supports and Notes being optional. The works involving Literature Studies and Revisions may be more flexible under their headings, especially in Methodology, Results and Discussion. In all types of works, bibliographic references are mandatory.

1. **Introduction and state of the play:** It should include the theoretical foundations and purpose of the study, using bibliographic citations, as well as the review of the most significant literature of the topic at the national and international level. The use of high-impact references (JCR and Scopus) will be positively valued.
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- **Manuscript from a journal (up to six authors):** Espada Chavarría, R. M., Gallego Condoy, M., & González-Montesino, R.H. (2019). Diseño Universal del Aprendizaje e inclusión en la Educación Básica. [Universal Design of Learning and inclusion in Basic Education]. *Alteridad, 14*(2), 207-218. https://doi.org/10.17163/alt.v14n2.2019.05
- **Manuscript from a journal (more than six authors):** Guarderas, P., Larrea, M., Cuvi, J., Vega, C., Reyes, C., Bichara, T., Ramírez, G., Paula, Ch., ... Arteaga, E. (2018). Acoso sexual en las universidades ecuatorianas: validez de contenido de un instrumento de medición. [Sexual harassment in Ecuadorian universities: content validation for instrument development]. *Alteridad, 13*(2), 214-226. https://doi.org/10.17163/alt.v13n2.2018.05
- **Manuscript from a journal (without DOI):** López Hernáez, L., y Ramírez-García, A. (2014). Medidas disciplinarias en los centros educativos: ¿suficientes contra el acoso escolar?. *Perfiles Educativos, 36*(145), 32-50.

b) Books and chapters of books

- **Complete books:** Cuéllar, J.C., & Moncada-Paredes, M.C. (2014). *El peso de la deuda externa ecuatoriana*. Quito: Abya-Yala.
- **Chapter of books:** Padilla-Verdugo, J. (2014). La Historia de la Educación desde los enfoques del conocimiento. In E. Loyola (Ed.), *Ciencia, Tecnología y Sociedad (CTS). Miradas desde la Educación Superior en Ecuador* (pp. 107-128). Quito: Abya-Yala.

c) Electronic means

- Aunión, J. (2011, marzo 12). La pérdida de autoridad es un problema de toda la sociedad, no es específico del aula. *El País*. https://goo.gl/YzRBYT

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