ISSN 2523-2479

Volume 5, Issue 13 – January – June – 2021

Journal of Critical Pedagogy

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Journal of Critical Pedagogy, Volume 5, Issue 13, June - 2021, is a journal published every six months by ECORFAN-Peru. La Raza Av. 1047 No.- Santa Ana, Cusco-Peru. Postcode: 11500. WEB: www.ecorfan.org/republicofperu, revista@ecorfan.org. Editor in Chief: OLIVES-MALDONADO, Carlos. MsC. ISSN: 2523-2479. Responsible for the last update of this issue of the ECORFAN Informatics Unit. ESCAMILLA-BOUCHÁN, Imelda, LUNA-SOTO, Vladimir, updated June 30, 2021.

Journal of Critical Pedagogy

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Support the international scientific community in its written production Science, Technology and Innovation in the Field of Social Sciences, in Subdisciplines of psychology of the education of the sociology, conditions of the educational act from the physiology, conditions of the educational act from the sciences of the communication, pedagogical techniques and the science of the methods, the sciences of the evaluation, the didactics and the theory of the programs.

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Content Presentation

In the first article we present *Use of a techno-pedagogical model in the teaching of Physics*, by MONROY-CARREÑO, Mireya & MONROY-CARREÑO, Patricia, with assignment at the Escuela Nacional Colegio de Ciencias y Humanidades plantel Vallejo-UNAM, as a second article we present *A didactic sequence design for the use of augmented reality in the teaching process of the human body in elementary education*, by GORDILLO-ESPINOZA, Emmanuel, DOMINGUEZ-GUTU, Jesús, TREJO-TREJO, Gilberto Abelino and CONSTANTINO-GONZÁLEZ, Fernando Exiquio, with assignment at the Universidad Tecnológica de la Selva, as third article we present *Design and construction of an educational software that can be used as a teachin resource to improvereading learning in 1st and 2nd grade children*, by SANTOS-HERNÁNDEZ, Enriqueta, PÉREZ-ESPINOZA, Emma and MARTÍNEZ-HERNÁNDEZ, Mariela Lizeth, with affiliation at the Instituto Tecnológico Superior de Tamazunchale, as a fourth article we present *Educational program aimed at the population of Chuquisaca, on the importance of complementary dental examinations*, by S RAYA, María, CUETO, Mariana, GARNICA, Tatiana, MOLINA, Yusara and QUIROGA, Dayana, with adscription at the Universidad Mayor, Real y Pontificia de San Francisco Xavier de Chuquisaca.

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Use of a techno-pedagogical model in the teaching of Physics

Uso de un modelo tecno-pedagógico en la enseñanza de la Física

MONROY-CARREÑO, Mireya†* & MONROY-CARREÑO, Patricia

Escuela Nacional Colegio de Ciencias y Humanidades plantel Vallejo-UNAM, Mexico.

ID 1st Author: *Mireya, Monroy-Carreño* / **ORC ID:** 0000-0002-3611-8532, **CVU CONACYT ID:** 743139

ID 1st Co-author: *Patricia, Monroy-Carreño* / **ORC ID:** 0000-0002-2735-7208, **CVU CONACYT ID:** 424764

DOI: 10.35429/JCP.2021.13.5.1.9 Received January 10, 2021; Accepted June 30, 2021

Abstract

The challenges of education in the XXI century are diverse and multifactorial; now if we add that due to the new normality caused by the Covid-19, the importance of the use of technologies as an indispensable tool to continue with the educational process is retaken. However, different investigations have shown that if these are not correctly based, the results may not be the best, hence the importance of the use of techno-pedagogical models, therefore the objective of this study was to implement the TPACK Model in the teaching-learning of the subject of Physics III in the National School College of Sciences and Humanities (ENCCH) in order to promote meaningful and scientific learning, For this purpose, a non- probabilistic sample of 42 students from the Vallejo campus was used, with the purpose of promoting significant and scientific learning, in which approaches such as the flipped classroom, Bloom's taxonomy and the learning cone were integrated, obtaining that a significant number of young people achieved higher order learning levels, therefore it is deduced that this model is a feasible alternative to consolidate knowledge in a non-face-to-face modality.

Learning, Fluids, Bloom's taxonomy

Resumen

Los desafíos de la educación en el siglo XXI son diversos y multifactoriales; ahora si le sumamos que debido a la nueva normalidad ocasionada por el Covid-19, se retoma la importancia del uso de las tecnologías como una herramienta indispensable para proseguir con el proceso educativo. Sin embargo, distintas investigaciones han demostrado que si estas no estan fundamentadas de manera correcta posiblemente los resultados no son los mejores, de ahí la importancia del uso de modelos tecno pedagógicos, por ello el objetivo de este estudio fue implementar el Modelo TPACK en la enseñanza-aprendizaje de la asignatura de Física III en la Escuela Nacional Colegio de Ciencias y Humanidades (ENCCH) con la finalidad de promover aprendizajes significativos y científicos, para ello se empleó una muestra no probabilística de 42 alumnos del plantel Vallejo, con la finalidad de promover aprendizajes significativos y científicos, en el que se integraron enfoques como el aula invertida, la taxonomía de Bloom y el cono de aprendizaje, obteniendo que un número significativo de los jóvenes lograron niveles de aprendizajes de orden superior, por ello se deduce que este modelo es una alternativa factible para consolidar conocimientos en una modalidad no presencial.

Aprendizaje, Fluidos, Taxonomía de Bloom

Citation: MONROY-CARREÑO, Mireya & MONROY-CARREÑO, Patricia. Use of a techno-pedagogical model in the teaching of Physics. Journal of Critical Pedagogy. 2021. 5-13:1-9.

* Correspondence to Author (E-mail: m.monroy449@gmail.com).
† Researcher contributing as first author.

Introduction

In Mexico at the beginning of the year 2020 education faced different changes, among them and the most radical was that classes took place entirely in virtual scenarios that challenge our ability to adapt (Ruíz, 2020), which forced teachers to develop activities through different technological platforms, some of them were Google Classroom, Meet, Facebook, Zoom and internal platforms of each institution, among others (Hernández, 2020).

Based on the above, it was necessary to face, in a few weeks, the transformation of education towards the adoption of Information and Communication Technologies (ICT) (Said, Marcano & Garzón, 2021). However, virtual education not only requires the use of technological tools, but also the use of methodologies that improve the interaction between the student and the teacher, thus reducing the distance gap (Medina, 2021, p.1).

From the above perspective, it is necessary that teachers are updated in networked training environments, in tools to communicate, in the design of interactive and collaborative content, which is accessible from any device, and thus take advantage of the multiple advantages that these instruments have in education (Castellanos, Sanchez & Calderero, 2017), due to the fact that they have multiple advantages, among which stand out that of promoting autonomy, increasing motivation, since they depend less on their teachers and at the same time encourages cooperative work (Flores, 2017).

However, despite the multiple technological tools that exist and their benefits, there are still a considerable number of teachers who do not use them or do not do it properly, perhaps one of the reasons is due to the lack of knowledge to incorporate them in the classroom or the little or the little or no pedagogical training to implement these technologies (Monsiváis, McAnally & Lavigne, 2014), therefore, teachers face the need for techno-pedagogical training, with the purpose of developing skills that allow them to adapt to an online modality (Garduño & Salgado, 2020).

It is evident then, that technological knowledge acquires a fundamental role for the creation of educational virtual spaces and the development of skills in students (Salas, 2019), hence, models are required to help teachers not only to employ ICT in their practice, but also to know when and how to use these resources to ensure that students achieve meaningful learning.

This research focused on the subject of Physics, considered by a large part of the students difficult to understand possibly, due to its relationship with mathematics and its abstract concepts, which makes it difficult to achieve meaningful learning. In addition, if the words of Calderón, et al. (2016) that alludes to the fact that the subject of Physics shows the lowest percentage of use of ICT and in which, the explanations are made through the blackboard as the only tool and in turn in most cases the use of the internet is limits in the search for information, computers to project some presentations and videos; turning it into a tedious and boring subject for the students, for not finding any relationship with its context.

Based on the above, it is essential that teachers who teach the subject of Physics are updated not only in the use of ICT, but also in aspects that allow them to integrate these instruments in the didactic process, since it must be understood that current educational environments must face the challenges posed by the globalized society. Therefore, it involves betting on a modernized and dynamic teaching process, which provides learning tools and trains young people, in order to live in a highly changing and technified society (Ayón & Víctores, 2020, p.7).

General objective

Implement the TPACK Model in the teaching-learning process of the Physics III subject, at the Escuela Nacional Colegio de Ciencias y Humanidades (ENCCH), in order to promote meaningful and scientific learning in students.

Specific objectives

- Identify the appropriate activities to achieve the learning proposed in the Physics III study program.

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- Choose the technological tools that adjust to the disciplinary and pedagogical approach that contribute to the achievement of meaningful learning.

TPACK Model

From the above perspective, teachers can update school activities and educational practices through techno-pedagogical models, since they integrate technological, pedagogical and disciplinary knowledge that facilitate the creation of innovative and creative spaces for learning and teaching.

Among them, the TPACK (Technological Pedagogical Content Knowledge) model created by Mishra in 2006 stands out, which was developed from the PCK (Pedagogical Content Knowledge) model formulated by Shulman in 1986, since this archetype has somehow modified the way of doing things and of course, the teaching-learning process has not been the exception (Leiva, Ugalde & Llorente, 2018), which is presented in Figure 1.

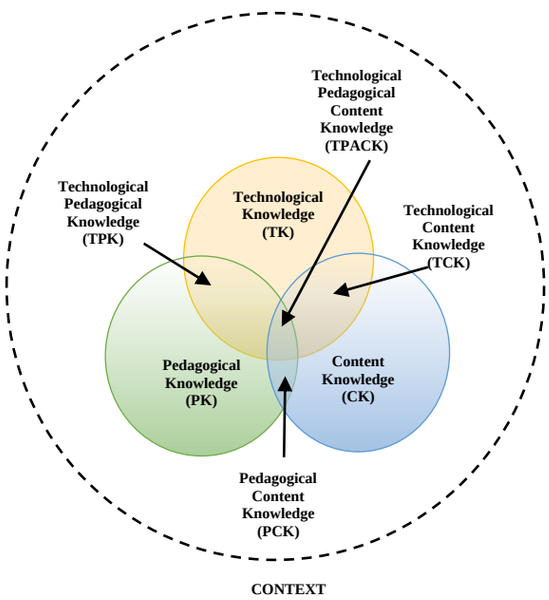

Figure 1 TPACK model
Source: García, Domínguez & Stipcich (2014, p. 84).

Based on García, Domínguez & Stipcich, (2014) and Salas, (2019) allude that the TPACK model studies three types of knowledge and their interrelationships, as stated below:

1. **Disciplinary Knowledge:** It is composed of the models, theories, laws, principles and concepts of the discipline.

2. **Pedagogical Knowledge:** It refers to the knowledge of the processes, methodologies and practices that constitute the teaching- learning process.

3. **Technological Knowledge:** This item focuses on two aspects, the first one to the traditional technology that is constituted by books, blackboards, markers, among other resources and the second ones are the advanced technologies that refer to applications, the internet and technological devices.

4. **Disciplinary Pedagogical Knowledge:** This item refers to how the student constructs his/her knowledge, including planning, organization, sequencing and evaluation, which contemplate learning difficulties and promote the construction of knowledge.

5. **Technological Disciplinary Knowledge:** in this phase, we study which technology is the most appropriate to teach a certain disciplinary knowledge and how to use it effectively to achieve it.

6. **Technological Pedagogical Knowledge:** this stage is constituted by the components of the technology that allow to enhance the teaching and learning process, which are reflected in solid and significant knowledge.

The TPACK model is oriented towards the design and evaluation of the teacher's knowledge, which is focused on effective student learning, in other words, this model is useful for integrating technology into teaching and at the same time studying how it could help in the construction of knowledge (Barajas & Cuevas, 2017).

In addition, the TPACK model is a viable alternative, given that it includes technology as part of the teaching-learning process, to fulfill the educational purpose (Alcívar, 2021, p.6).

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Description of the method

This research was cross-sectional, since it seeks to identify the efficiency of the TPACK model, from a pedagogical approach based on the flipped classroom methodology, since it leaves aside traditional pedagogy, in other words, it no longer only focuses on content exposition, but rather in the analysis and incorporation of collaborative work among colleagues, while the teacher guides them in the development of activities (Cedeño & Vigueros, 2020).

Another reason why the flipped classroom was implemented was because it conforms to Bloom's taxonomy, since it is the classification given to study programs in the ENCCH, in which it refers to the fact that the first two stages that make up this taxonomy are knowing and understanding; that belong to lower cognitive processes. Likewise, according to Zainuddin & Halili (2016, p.315) alludes that the stages of Bloom's taxonomy consist of:

- Remember: in this case, the student must recognize and remember the information, concepts and basic principles of the contents learned.

- Comprehension: at this stage the students interpret the information and summarize what they have learned.

- Application: students practice what they have learned or use their knowledge in a real situation. Analyze: Students use their critical thinking to solve problems, compare their answers with those of their peers, and write summaries.

- Evaluate: in this phase the evaluation of the set of learning concepts is carried out, at the same time a judgment is made on the degree of success of the students' learning achievements.

- Create: students can design, build and produce something new based on what they have learned.

Likewise, the inverted classroom methodology, as its name indicates, inverts the traditional pedagogy, in which the teacher's role is to be a guide, where young people study and learn at home, to finally reinforce their knowledge during the development of the session (Pillajo, 2021), therefore the first two levels of Bloom's taxonomy (Remember and Understand) are worked in asynchronous sessions, since they are lower order cognitive processes, that is, the student can develop them. On the other hand, the last four levels (apply, analyze, evaluate and create) it is necessary that there is an accompaniment by the teacher, in such a way that these must be worked in a synchronous mode as presented in Figure 2.

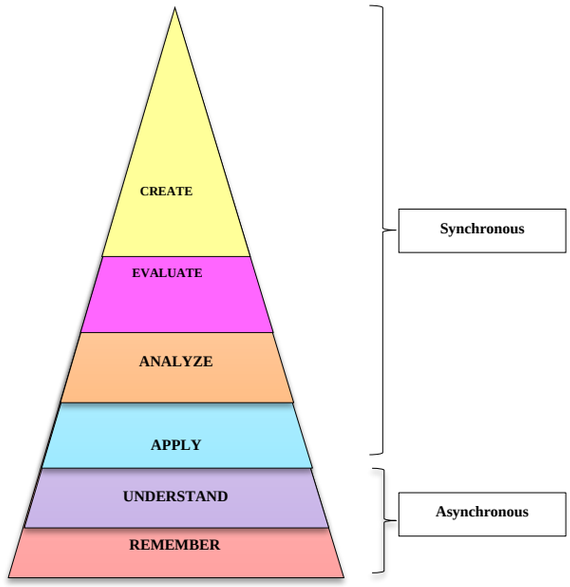

Figure 2 Bloom's Taxonomy in the flipped classroom
Source: Adapted Zainuddin & Halili (2016)

It is necessary to specify that this study was developed for high school in such a way that it only approached the third level that corresponds to "application" according to Bloom's taxonomy, given that the levels of analysis, evaluation and creation by the type of Activities and processes to be carried out are more suitable to build at the university level, since they belong to a higher degree of cognitive difficulty.

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It should be noted that the decision as to whether the sessions were carried out asynchronously or synchronously was based on the cognitive level to be reached according to Bloom's taxonomy, which is why they were structured in six sessions (three asynchronous and three synchronous) with a duration of 120 Minutes each, conducted through the Microsoft Teams and Zoom platforms, in which the topics that belong to the Physics III study program were reviewed, specifically for unit II entitled Fluid systems (Table 1).

Session no.	Modality	Cognitive level according to Bloom's taxonomy	Thematic
1	Asynchronous	Knowledge and understanding	Static fluids Density Pressure
2	Synchronous	Application	Measuring the pressure of a fluid
3	Asynchronous	Knowledge and understanding	Absolute pressure Gauge pressure Atmospheric pressure
4	Synchronous	Application	Pascal's Principle
5	Asynchronous	Knowledge and understanding	Thrust force Apparent weight
6	Synchronous	Application	Archimedes Principle

Table 1 Distribution of the sessions, by modality, cognitive level and topics developed

It should be noted that the activities developed were decided from the cognitive level and the learning or experience cone that consist "a pyramid in which the methods that are more and less effective for learning to take place" (De la Fuente, 2018, p. 309) as presented in Figure 3.

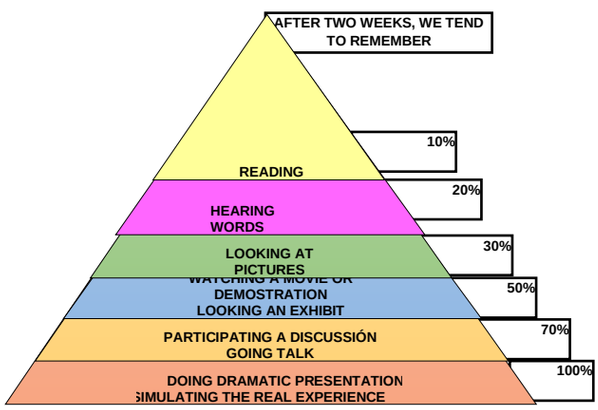

Figure 3 Cone of experience
.Source: Dale, (1932)

Based on the above, Table 2 shows the activities developed according to the cognitive level to be achieved.

Cognitive level	Activities and modality	Nature of the activity
Knowledge	Recognize concepts and definitions and recall information. (Asynchronous)	**VERBAL AND VISUAL ACTIVITY** Readings Pre-recorded conference
Comprehension	Understand information, interpret, compare and contrast facts. (Asynchronous)	**VISUAL ACTIVITY** Videos of some applications
Application	Use information and solve problems. (Synchronous)	**PARTICIPATORY AND RECEPTIVE ACTIVITY** Participate in a conversation and a debate. **PURE ACTIVITY** Use of simulators and virtual laboratories. Solving exercises and carrying out projects.

Table 2 Activities carried out during the sessions depending on the cognitive level

From the previous perspective, educational platforms, videos, web pages, simulators and virtual laboratories were used to carry out the aforementioned activities (Table 3).

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Tool	Type of activity	Activities
FísicaNET It is a site that you can consult notes and exercises of different disciplines for the high school.	Verbal	The notes corresponding to hydrostatics were shared, since they addressed all the issues to be reviewed. https://n9.cl/8d5ro
YouTube It is a social network in which a large number of videos are hosted.	Visual	Videos of fluid statics and troubleshooting examples were shared; its application with experiential environments for the themes of Pascal and Archimedes principle.
Tu prep@ en vídeos de la SEP It is a platform that gives students access to educational videos of different disciplines for the high school	Visual	On this page we worked on block I: entitled, it explains the behavior of fluids. http://www.tuprepaenvideos.sep.gob.mx/en/tuprepaenvideos/principio_de_pascal_fisii_bqi
Khan Academy It is a web platform where you can access educational resources from different areas of knowledge.	Visual	Videos corresponding to pressure and Pascal's principle were reviewed, among which included the pressure at a certain depth in a fluid, finding the height of the fluid with a barometer, the buoyant force, and Archimedes' principle.
Microsoft Teams It is a platform in which collaborative work is promoted.	Verbal y visual	In this platform the notepad section was opened in order to share the materials and the links, the instructions to perform the tasks requested in the asynchronous sessions. Likewise, the evaluations corresponding to the tasks and the questionnaires carried out in Microsoft forms were carried out.
Zoom It is a tool that promotes collaborative work through the virtual sessions section and at the same time promotes two-way communication between the teacher and the students.	Participative and responsive	Synchronous sessions were held on this platform in which debates, guided discussions or feedback on the activities carried out asynchronously took place.
Walter Fendt Site with different Physics content simulators.	Pure	Hydrostatic pressure and thrust force simulators in liquids were reviewed.
Vascak It is a site to find simulators for the subject of Physics.	Pure	Simulators on the theme of pressure were shared.
Virtual Laboratory: Physics On this page you will find several experiments of the different branches of the Physics subject.	Pure	In this laboratory, the sections of fluid statics that included Archimedes' Principle, hydrostatic pressure and pressure variation with height were worked on. https://labovirtual.blogspot.com/p/fisica.html

Table 3 Technological tools used according to experience cone

Participants

The sample was non-probabilistic and by convenience, made up of 42 students, of which 45.23% (19) were female and 54.77% (23) male, between the ages of 16 and 18 years old, enrolled in the ENCCH Plantel Vallejo, who were taking Physics III, which is studied in the fifth semester.

Evaluation instruments

Three corresponding evaluation instruments were designed for the topics of fluid pressure measurement, Pascal's principle and Archimedes' principle.

It should be noted that the evaluations were carried out through written tests with a total of 24 items, which were classified according to the cognitive levels of Bloom's taxonomy (Knowledge, Comprehension and Application); they were designed using the Microsoft Forms tool, which were applied at the end of the synchronous sessions (Table 4).

Cognitive level	Number of items	Evaluation activity
Knowledge	12	Multiple choice and true-false questions.
Comprehension	6	Reflection and comprehension essay type questions.
Application	6	Questions of application of procedures and problem solving.

Table 4 Structure of the evaluation instruments applied at the end of the asynchronous sessions

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It should be noted that the results were classified into three levels, based on the number of correct answers obtained by the students (Table 5).

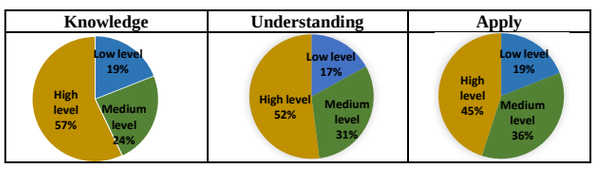
Cognitive level	Ranking criteria according to number of correct answers
Knowledge	1 to 4 hits Low level
	5 to 9 successes Intermediate level
	10 to 12 hits High level
Comprehension	1 to 2 hits Low level
	3 to 4 successes Intermediate level
	5 to 6 successes High level
Application	1 to 2 hits Low level
	3 to 4 successes Intermediate level
	5 to 6 successes High level

Table 5 Classification of the results obtained by the students according to the number of correct answers obtained

Results

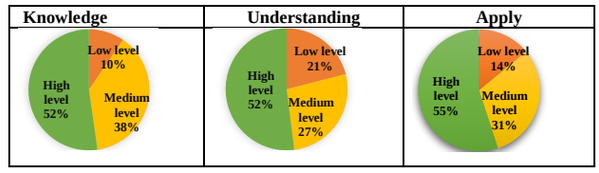
In relation to the evidence collected, it was obtained that for the topic of measuring the pressure of a fluid, more than 50% of the students reached the levels of knowledge and understanding; however, for the application stage, only 45% of the trainees achieved a high level, the reason for this may be due to the fact that young people have to use a procedure that includes a greater number of steps in order to solve a new problem.

Likewise, it is required to highlight that the percentage of learners who were located in the low level, almost is the same percentage for the three cognitive levels reviewed, which allows inferring the importance of developing lower order skills, to achieve the deepening of knowledge (Caeiro, 2019), all this seems to affirm that if young people do not recognize and understand the necessary concepts hardly, they will be able to implement it in problem solving (Graphic 1).



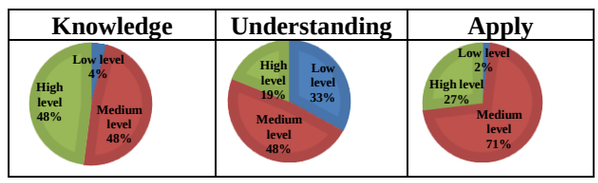
Graphic 1 Results by cognitive level for the topic of fluid pressure measurement

It is worth considering that for the topic of Pascal's Principle, the three cognitive levels evaluated obtained a percentage higher than 50% and even for the last stage evaluated the maximum value was achieved with 55%, note that in addition, for the comprehension level, specifically for the low item, 21% of the students were located, perhaps this is a consequence of using essay-type reagents for this section, where in most cases they had notions, however, their answers were scattered among the concepts of density, pressure, force and area, showing that the trainees had difficulty interpreting and explaining Pascal's Principle (Graphic 2).



Graphic 2 Results by cognitive level for the topic of Pascal's principle

Graphic 3 shows the results obtained for the topic of Archimedes' Principle, in this case the values were very varied and this is not difficult to understand, given that it is a complicated topic for the students to understand, although it is necessary to highlight that for level three of Bloom's Taxonomy only 2% of the students were located in the low category, this is significant, since it is necessary that the young people integrate different definitions and at the same time use mathematical skills to solve the exercises.



Graphic 3 Results by cognitive level for the topic of Archimedes' principle

About the previous perspectives, it can be alluded that the cause of the achievements in the subject of Archimedes' Principle, is that when considering this learning difficult to acquire by students, the use of pure activities such as simulators was emphasized, which are very useful tools to promote the learning of natural sciences, especially for the subject of Physics considered by many students, complicated to understand due to its level of abstraction (Ayón & Víctores, 2020).

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Conclusion

Throughout this study, a strategy was presented through the application of a techno-pedagogical model such as TPACK, where the importance of aligning pedagogical, disciplinary, and technological aspects has been established. In the case of this research, it was evidenced that a large percentage of students achieved skills to solve exercises or problems, which based on our teaching experience, is sometimes difficult to achieve for young people because of the different previous skills needed to perform this task.

It is interesting to note that, although the results were intermediate, they are considered to be significant, given that the topics reviewed include different abstract concepts, which make it difficult to achieve the learning proposed in the Program of Studies; although this task was difficult to obtain in a face-to-face context, in an online modality it was not easy either, hence the TPACK model is considered a viable option to plan the actions to be implemented in the teaching-learning process.

It should be noted that it is necessary to understand that the use of technology is the means and not the objective; therefore, it is suggested to use free, intuitive technological tools, according to the educational level; based on a methodology or model, therefore, teachers have the responsibility to be constantly trained in these issues.

Finally, it can be deduced that the TPACK model can support a greater number of students to achieve higher order learning levels; however, it is proposed as future work to conduct a longitudinal research to evaluate the long-term effects and at the same time to determine the variables that mainly intervene in the process of knowledge assimilation.

Acknowledgments

This work was carried out with the support of the UNAM-DGAPA-INFOCAB-PB100821 Initiative.

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ISSN 2523-2479

Article **Journal of Critical Pedagogy**
June, 2021 Vol.5 No.13 10-19

A didactic sequence design for the use of augmented reality in the teaching process of the human body in elementary education

Diseño de una secuencia didáctica para la utilización de la realidad aumentada en el proceso de enseñanza del cuerpo humano en educación primaria

GORDILLO-ESPINOZA, Emmanuel†*, DOMINGUEZ-GUTU, Jesús, TREJO-TREJO, Gilberto Abelino and CONSTANTINO-GONZÁLEZ, Fernando Exiquio

Universidad Tecnológica de la Selva, Mexico.

ID 1st Author: *Emmanuel, Gordillo-Espinoza* / **ORC ID:** 0000-0002-2467-8209, **CVU CONACYT ID:** 657274

ID 1st Co-author: *Jesús, Dominguez-Gutu* / **ORC ID:** 0000-0001-8025-6089, **CVU CONACYT ID:** 524210

ID 2nd Co-author: *Gilberto Abelino, Trejo-Trejo* / **ORC ID:** 0000-0003-2808-3939, **CVU CONACYT ID:** 334014

ID 3rd Co-author: *Fernando Exiquio, Constantino-González* / **ORC ID:** 0000-0002-9701-1990, **CVU CONACYT ID:** 79617

DOI: 10.35429/JCP.2021.13.5.10.19 Received January 15, 2021; Accepted June 30, 2021

Abstract

The following research evaluates the impact on 4th grade elementary school students´ meaningful learning through the design and implementation of a didactic sequence that includes the use of augmented reality applications in order to teach about the circulatory, respiratory and digestive systems. Such didactic sequence was designed over the content of the SEP free text books, including as an augmented reality tool the application called Arloon Anatomy. The results obtained through statistical tests, U de Mann-Whitney and Wilcoxon, show that the impact is positive in the teaching-learning process, finding that the use of Augmented Reality aroused interest and stimulated the desire to learn motivating students to be more proactive, increased the level of attention and fostered an investigative spirit through the discovery of the functioning of the human body.

Augmented Reality, meaningful learning and didactic sequence

Resumen

En la presente investigación se evalúa el impacto en el aprendizaje significativo de los estudiantes del cuarto grado de primaria, a través del diseño e implementación de una secuencia didáctica para incluir el uso de aplicaciones de Realidad Aumentada para la enseñanza de los aparatos circulatorio, respiratorio y digestivo. La secuencia didáctica fue diseñada con base a los contenidos de los libros de texto gratuitos de la SEP, incluyendo como herramienta de realidad aumentada la aplicación Arloon Anatomy. Los resultados obtenidos a través de pruebas estadísticas, U de Mann-Whitney y Wilcoxon muestran que el impacto es positivo en el proceso de enseñanza - aprendizaje, encontrando que el uso de la Realidad Aumentada despertó el interés y estimuló las ganas de aprender motivando a los alumnos a ser más participativos, aumentó el nivel de atención y fomentó un espíritu investigador a través del descubrimiento del funcionamiento del cuerpo humano.

Realidad Aumentada, aprendizaje significativo y secuencia didáctica

Citation: GORDILLO-ESPINOZA, Emmanuel, DOMINGUEZ-GUTU, Jesús, TREJO-TREJO, Gilberto Abelino and CONSTANTINO-GONZÁLEZ, Fernando Exiquio. A didactic sequence design for the use of augmented reality in the teaching process of the human body in elementary education. Journal of Critical Pedagogy. 2021. 5-13:10-19.

* Correspondence to Author (E-mail: egordillo@laselva.edu.mx).
† Researcher contributing as first author.

Introduction

Technological progress took off at the end of the 20th century and in the 21st century it has become part of people's daily routine, in such a way that technology has revolutionised the way of doing things even in areas where it was difficult to imagine that it could be useful, education is no exception; many teachers have started to use it as a support tool to motivate or diversify the teaching-learning process. This is the case of augmented reality technology, which since its inception has been seen with good eyes and accepted by some institutions to the extent of having it as a support tool. In this sense, augmented reality currently represents a powerful tool that has shown its versatility in a wide range of applications in different areas of knowledge. In the field of education, it has found great possibilities for the dissemination and knowledge of content that is presented in an attractive and pedagogical way at the same time (Ruiz, 2011).

In Mexico, there are many primary education institutions that are reluctant to use ICT (Information and Communication Technologies) as a support strategy for the diversification of content delivery, due to many factors ranging from infrastructure, access to technology and lack of digital skills among teachers (Díaz-Barriga, 2010).

The use of technology provides an opportunity to generate new teaching strategies that are in line with reality, since most of the thematic content is disconnected from reality or the context in which students develop. A clear example is Chiapas, which ranks as the state with the highest rate of educational backwardness, due to the fact that 13.7% of the population aged 15 and over are illiterate, 10.5% of the population between 6 and 14 years old do not attend school and 48.1% of the population aged 15 and over do not attend school. 1% of the population aged 15 and over have incomplete basic education (Consejo Nacional de Evaluación de la Política de Desarrollo Social [CONEVAL], 2021), so the quality of education is poor compared to other states; in addition, there is a large digital divide and a fragmented teachers' union, with resistance to change and to proposing new teaching-learning strategies. (Pacheco, 2015)

The above represents a problem of learning where this is reflected as a margin of memorising without deepening or internalising the content, therefore, there is a need to link teaching-learning strategies mediated by the use of ICT, specifically Augmented Reality, presenting a great opportunity to make use of it, being a tool of great interest and of great impact today, providing information from the real world and interspersing it with the digital world. The great boom of mobile devices has helped many technological tools to be included as support in the teaching-learning process, because they do not have many limitations and access to resources can be too intuitive, as stated by Estebanell (2012) "AR applications not only respond to this type of requirement but extend it in a qualitatively significant way by providing information located, contextualised, from the place and at the time that the consumer needs it" (p. 290).

The relationship between ICT and education is more than evident, several studies point out that technology will continue with or without us, future generations will be increasingly related to technology "so orienting its use and exploitation to educational processes from a proactive perspective helps the application and improvement of the pedagogical elements of the present and the future" (Angarita, 2019, p. 144).

Theoretical framework

Augmented Reality in education

In recent years, Augmented Reality has been widely used and is becoming increasingly relevant in various areas of knowledge, thus demonstrating that it is a versatile tool that offers a wide range of possibilities.

In this sense, Orozco, Esteban and Trefftz (2006) define Augmented Reality (AR) as a technology capable of complementing perception and interaction with the real world, providing the user with a real scenario, augmented with additional information generated by computers (pp.141-145).

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It should be noted that within the academic world, the most widely accepted definition of Augmented Reality is that of Azuma (1997), who defines it as "the technology that allows the real and the virtual to coexist in the same space, giving the possibility of interacting with these elements in real time" (pp. 73-272). Although this definition is many years old, it still retains the essence, although clearly, in recent years, new functionalities have been added both to interact and to connect. This is due to the great evolution of mobile devices that are nowadays known as Smartphones.

On the other hand, Badia et al. (2016) indicate that the use of Augmented Reality in education has had a great impact and this is due to the great evolution of technology and the information society, which have allowed for a large number of didactic resources. In his research entitled "The perception of the usefulness of technology shapes its use for teaching and learning" he found how the use of this technology as a support tool helped to improve the teaching-learning process.

Another research by Toledo and Sanchez (2017) defined this technology as an opportunity in the acquisition of knowledge and an option to improve performance, proving to be desirable and beneficial. However, it is worth mentioning that they found limitations, in that some subjects do not fit the content with what they have in the application and this limits its use.

The biggest challenge in using this technology lies in the digital competences of teachers, since they are the ones who must change the new teaching approach; as indicated by Toledo and Sánchez (2017), a teacher with digital competences can make the teaching-learning process more effective; however, training to acquire digital competences in teachers and the application of these in the teaching and learning process has been left to the Mexican government, implementing digital education programmes from 1997 to 2016, but without knowing the impact they have had on student learning. (Silva, 2021).

Significant learning

Ponce (2004) states that "meaningful learning requires students to carry out various activities to establish relationships between what is new and what they already know" (p. 22), i.e., they must know how to reformulate, differentiate, discover, order, classify, hierarchise, relate, integrate, solve problems and understand a text. In order to achieve a great educational task and achieve meaningful learning, it is necessary to take into consideration three elements of the educational process: the teachers and their way of teaching, the structure of the knowledge that makes up the curriculum and the way in which it is produced, and the social framework in which the educational process takes place. (Sansevero, Lúquez and Fernández. 2006. p. 279).

According to the theory put forward by Ausubel (1973, 1976 and 2002), which is still valid today, student learning depends on the previous cognitive structure that is related to the new information, understanding cognitive structure as the set of concepts and ideas that an individual possesses in a certain field of knowledge, as well as its organisation. In this sense, this type of learning plays a very important role for teachers and students, and even with the didactic material used to transmit this knowledge.

Larios and Rodríguez (2011) state that knowledge must be organised in a logical structure in such a way that its elements are related to each other. But the logical structure of knowledge is not enough; it is also necessary that the person shows a predisposition for learning and is motivated. This is a great challenge because the main enemies of learning can be textbooks, the number of students, the timetable, a very tight curriculum, teachers limited to change the didactic sequence and the fear of change. (Albornoz, 2009)

Didactic planning

Planning is a requirement that is imposed on a daily basis in every activity carried out by human beings. "Teaching work does not escape this requirement, especially if we take into account the moral and social consequences that it implies" (García and Valencia, 2014. P. 15).

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The Ministry of Public Education defines didactic planning as the organisation of a set of ideas and activities that will make it possible to develop an educational process. It constitutes a model or pattern that allows teachers to face their practice in an orderly and congruent manner (SEP, 2009). It involves analysing and organising thematic content, determining the objectives, intentions and educational purposes to be achieved, as well as establishing the sequence of activities in time and space.

Teaching practice is determined by the teaching-learning actions that take place in learning environments, and didactic planning is a tool that teachers must use to make these actions effective. (Islas et al. 2014). In this sense, a good planning of the strategies, techniques and resources that will support the classroom to achieve the objectives, skills and competences will allow the teacher to achieve the expected results.

Lule (2003), in his research, points out that teaching practice is made up of various teaching-learning activities that must be carried out in the classroom, which must be in accordance with the thematic content of the curriculum.

Therefore, it is essential for teachers to design a didactic sequence that allows them to organise activities for students to acquire their learning (Lozada, 2018). The didactic sequence should be designed taking into account the objectives to be achieved in the subjects, through activities that allow them to be contextualised and that generate meaningful learning in students, as well as including ICT to contextualise those scenarios that cannot be contextualised on a daily basis in the classroom. (Domínguez et al. 2020).

Objective

The present research project aims to design and implement a didactic sequence for the teaching of natural sciences through the use of augmented reality, in order to strengthen meaningful learning in fourth grade federal primary school students. In this way, the research project is justified because it helps to formulate new proposals for innovation and diversification in teaching-learning strategies, through the design of didactic sequences mediated with the support of ICT.

The project will establish a pedagogical proposal that will be very useful for educational institutions.

Methodology

This research project worked under a quantitative approach, which is characterised by privileging empirical-deductive logic, based on rigorous procedures, experimental methods and the use of statistical data collection techniques (Barrantes, 2014).

The methodological approach was under a descriptive quasi-experimental design, having a sample of three groups from different federal schools, obtaining the study sample was non-probabilistic and intentional; we worked with students from three different schools that met the selection criteria of the lowest, middle and highest academic performance of the 2018-2019 school year, having a single control group and an experimental group, where tests (test) designed for the study and diary of the researcher were applied.

The tests (pre-test and post-test) were designed with dichotomous questions, attached to the contents of the topics that were addressed in the intervention of the study, its reliability was verified through the KR20 test with the SPSS statistical software, obtaining a value of 0.862, being a Very High reliability coefficient according to Ruíz (2013).

The participants in the study were 107 students in the 4th grade of federal primary education in the municipality of Ocosingo, Chiapas. There were also three regular teachers, who were present only as observers during the interventions. The age of the students ranged between 9 and 10, and in total there were 80 females and 47 males. The control group used a traditional teaching method and the experimental group used the didactic sequence with activities related to the circulatory, respiratory and digestive systems, with the inclusion of the augmented reality tool.

Pedagogical proposal

In order to design the pedagogical proposal, the following phases were considered (Figure 1): Selection of the subject and topics that would be related to the free textbooks of the chosen school grade.

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Choice of the augmented reality tool attached to the chosen topics; Design of the intervention through the didactic sequence of learning, with the activities to be developed by the teacher and the students, in order to generate meaningful learning; Implementation of the Insitu intervention, according to the designed didactic sequence; Providing feedback on the results obtained from the study to the authorities of each selected primary school.

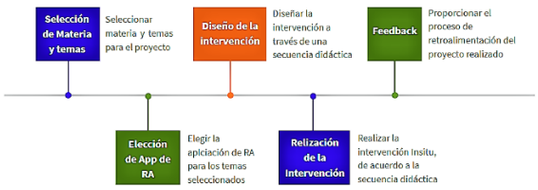

Figure 1 Implementation phases of the pedagogical proposal
Source: Own elaboration

Phase 1. Selecting the subject matter and topics for the project

In this phase, the contents of the free textbooks provided by the SEP were analysed in order to select those topics that are difficult to contextualise in the classroom. For this reason, the subject of Natural Sciences and the topics of the functioning of the circulatory, respiratory and digestive systems in the fourth grade of primary school were selected, so that these topics would not remain theoretical and could be interacted with more realistically with the help of an augmented reality tool.

Phase 2. Choice of the augmented reality tool

This phase was carried out at the same time as the choice of subject matter and themes, and the criteria used were usability, licence and usefulness. As we worked with children, we selected the Arloon Anatomy application (Figure 2), which is easy to use and does not cost a lot to purchase, and it visualises the topics chosen for the subject, so that the students could interact and learn how the parts of the human body work.

Figure 2 Arloon Anatomy application
Source: Research Images, 2020

Phase 3. Design of the intervention through a didactic sequence

In this phase, the didactic sequence was designed for the implementation of the intervention in the experimental group (Figure 3), Díaz-Barriga (2013) proposes three types of activities: opening, development and closing, as well as activities for evaluation and feedback of the activities, therefore, the didactic sequence implemented was designed based on these activities indicated by the author, for each selected topic.


SECUENCIAS DE APRENDIZAJE:

OBJETIVO:

SECUENCIAS DE APRENDIZAJE:

Sesión y duración	Contenidos	Actividades	Tiempo	Recursos y material didáctico	Productos

EVALUACIÓN:	
Actividades	Porcentaje
Total del Curso:	100%

REQUERIMIENTOS PARA LA INSTRUMENTACIÓN DEL CURSO:

Fuentes de información
•

Figure 3 Didactic sequence format
Source: Own elaboration, based on Díaz-Barriga (2013)

Opening activities

An ice-breaking activity was carried out, as it was the first time that the group of researchers had contact with the group. The next activity consisted of applying the pre-test to the experimental group to assess the level of prior knowledge they had about the topic to be taught, in addition, the same pre-test was applied to the control group, in order to compare the results and measure significant learning through the didactic sequence designed and the traditional method. It was explained to the students that the pre-test was not to give them marks or grades, but to find out the level of prior knowledge they had of the topic to be addressed that day.

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Development activities

An electronic presentation was made (Figure 4), in such a way that it was dynamic to develop the topic, then a video presentation was used to learn about the functioning of the apparatuses of the human body, which was in the augmented reality tool Arloon Anatomy.

Subsequently, interaction activities were carried out with the Arloon Anatomy application, where the students were divided into teams of 4 members, the group of researchers handed out a tablet and an augmented reality marker, so that the students could identify the parts of the human body of the topic that was addressed that day.

Closing activities.

To generate significant learning in the students, a series of knowledge exercises were carried out (identification of the parts of the body) that the application has (Figure 5), where they collaboratively answered the exercises, which were then carried out individually.

To conclude these activities, feedback on the exercises answered in the application was given by one of the teachers of the research group, in order to clarify doubts on the subject.

Evaluation activities.

To conclude with the topics, at the end of the intervention the post-test was applied, on the other hand, in the control group it was applied by the teacher of the group at the end of its topic in a traditional way, the above, in order to determine with the statistical test of the Mann-Whitney U, if the learning of the students was significant between both groups.

Phase 4. Implementation of the intervention.

In this phase, the opening, development, closing and evaluation activities, which were designed in the didactic sequence for each topic, were carried out.

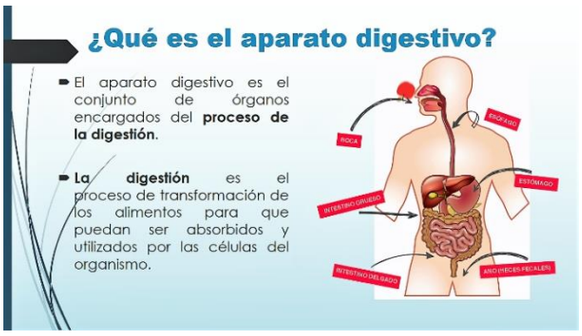

Figure 4 Presentation of the digestive system
Source: Research images, 2020

Figure 5 Interaction with the AR application
Source: Research Images, 2020

Phase 5. Feedback on the results obtained.

Each principal of the schools selected for the study was provided with the results obtained from the study, emphasising that the results were favourable when using a didactic sequence with the help of an augmented reality tool for the teaching of Natural Sciences.

At the beginning of the present study, it was agreed with each principal of the selected schools to offer a workshop to their teachers in order to include an augmented reality tool for teaching the Solar System, through the Arloon Solar System application; however, due to the national health contingency, this activity was postponed until the conditions to carry it out exist.

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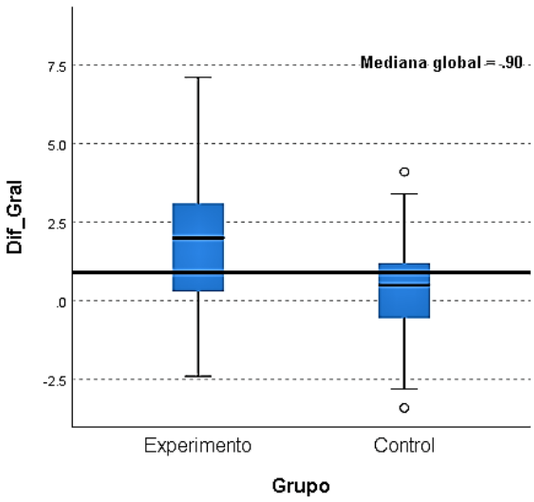
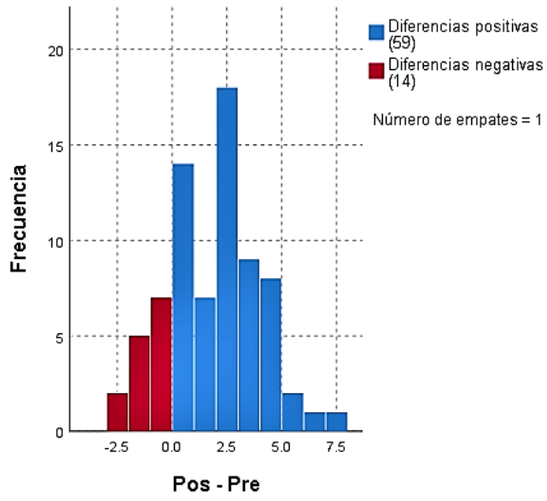
Results

To verify whether learning was significant for the students when using a didactic sequence with the support of an augmented reality tool, using SPSS software, the Mann-Whitney U test was performed for independent samples, obtaining as a result that the p-value=0.000 is less than the established significance level α=0.05, so the results support that there is a significant difference between the two groups. In graph 1, it can be seen that in the experimental group there are more students who obtained better results after the intervention following the didactic sequence designed and with the use of the augmented reality tool.



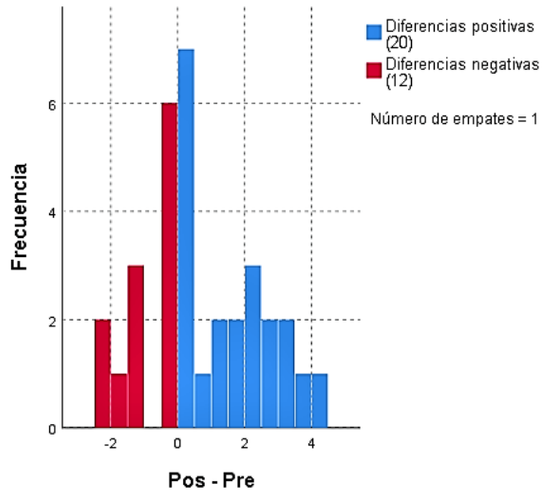
Graphic 1 Mann-Whitney U test for independent samples
Source: Research data, 2020

To support the previous result, using SPSS software, the Wilcoxon test was performed between the pre-test and post-test in the experimental group, obtaining that the value of p=0.000 is less than the established significance level α=0.05, graph 2 shows that 80% of the students improved their score after the intervention.



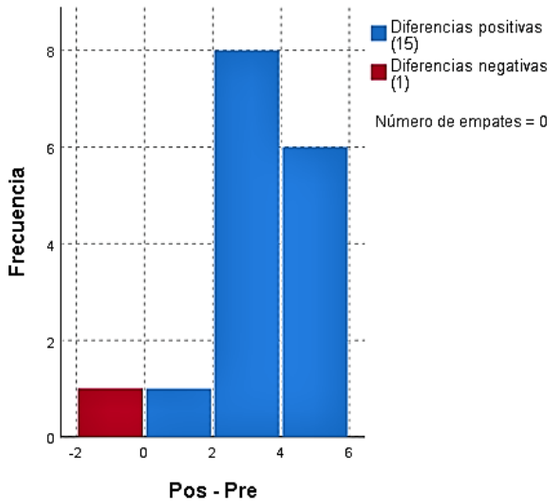
Graphic 2 Wilcoxon signed-rank test for related samples
Source: Research data, 2020

If we look at the results by school, graph 3 shows that in Cuauhtémoc school only 61% of the students improved their score after the intervention, in Marcos Villanueva school 94% (see graphic 4) and in Niños Héroes school 96% (see graphic 5), being in the latter schools where most of the students improved their score after using the augmented reality tool.

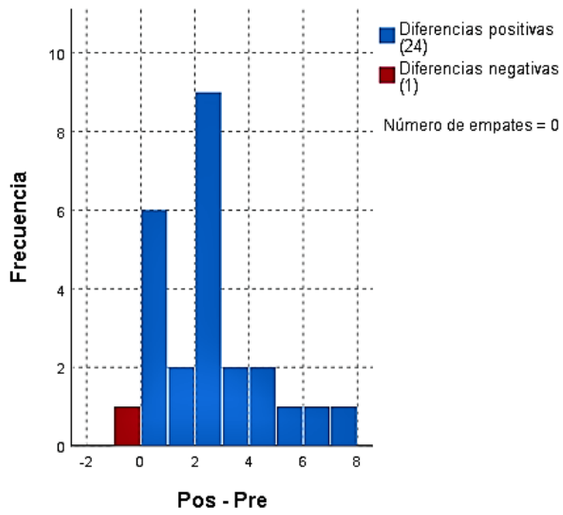


Graphic 3 Wilcoxon signed-rank test for related samples at Cuauhtémoc school
Source: Research data, 2020

ISSN 2523-2479



Graphic 4 Wilcoxon signed-rank test for related samples at Marcos Villanueva school
Source: Research data, 2020



Graphic 5 Wilcoxon signed-rank test for related samples at Niños Héroes school
Source: Research data, 2020

Acknowledgements

This study was financed with resources from the Universidad Tecnológica de la Selva, through the Convocatoria Fomento a la Formación de Recursos Humanos de Alta Calidad y Desarrollo de Proyectos de Investigación. For this reason, we would like to thank them for their support.

We would also like to thank the directors and teachers of the primary schools, who provided us with all the facilities, spaces and resources to carry out this research project.

Conclusions

The results obtained from statistical tests show that the design of a didactic sequence and the use of an augmented reality tool have a positive impact on the teaching-learning process, being of great value to obtain significant learning in students. It was possible to break the barrier of disconnection between theory and practice, due to the fact that, in traditional teaching, it is impossible to observe the characteristics and functioning of the circulatory, respiratory and digestive systems.

On the other hand, it is shown that a good design of a didactic sequence and the academic experience as indicated by (Larios and Rodríguez, 2011), made the use of Augmented Reality stimulate the desire to learn, arouse interest, motivate and make students more participatory, increase the level of attention and encourage a spirit of research through interaction with the AR tool, as stated by Barfild, W. and Caydel, T. (2001). and Caydel, T. (2001), and above all the learner is in the readiness to acquire knowledge as stated by Ausubel (1973, 1976 and 2002).

Finally, it was an example of how the use of Augmented Reality can represent a meaningful and motivating experience in institutional environments with limited access to technology and few digital skills.

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ISSN 2523-2479

Article **Journal of Critical Pedagogy**
June, 2021 Vol.5 No.13 20-27

Design and construction of an educational software that can be used as a teachin resource to improvereading learning in 1st and 2nd grade children

Software educativo como recurso didáctico para el aprendizaje de la lectura en niños de 1° y 2° grado de educación primaria

SANTOS-HERNÁNDEZ, Enriqueta†*, PÉREZ-ESPINOZA, Emma and MARTÍNEZ-HERNÁNDEZ, Mariela Lizeth

Instituto Tecnológico Superior de Tamazunchale, Computer Systems Engineering Division, Mexico.

ID 1st Author: *Enriqueta, Santos-Hernández* / **ORC ID:** 0000-0002-7077-367X

ID 1st Co-author: *Emma, Pérez-Espinoza* / **ORC ID:** 0000-0003-4493-2427

ID 2nd Co-author: *Mariela Lizeth, Martinez-Hernandez* / **ORC ID:** 0000-0002-8635-1930, **Researcher ID Thomson:** H-8093- 2018, **arXiv Author ID:** 2233455, **CVU CONACYT ID:** IT17A492

DOI: 10.35429/JCP.2021.13.5.20.27 Received January 20, 2021; Accepted June 30, 2021

Abstract

This research aims to show the results obtained in the elaboration of the design and construction of an educational software that can be used as a teaching resource to improve reading learning in 1st and 2nd grade children of the Ignacio Allende elementary school of the community of La laguna, Pisaflores Hidalgo, in the development of the application was taken as a guide the agile methodology XP since this methodology is focused on small projects and with small time periods for which it was based on 5 phases (idea generation, analysis, design, development and testing or implementation) of which only the first three and 50% of phase 4 were achieved. In order to achieve the results obtained, research was carried out on similar projects that would help to inform the research as well as to know if both students could accept it and teachers qualitative research was used and the data collection tools were the interview and survey, Applied to the students and teachers of the institution. The scope of such research was to generate the design of the application "game with Kika" as well as part of its programming.

Educational software, Methodologies, Reading learning

Resumen

La presente investigación tiene como objetivo mostrar los resultados obtenidos en la elaboración del diseño y construcción de un software educativo que pueda ser utilizado como recurso didáctico para mejorar el aprendizaje de la lectura en niños de 1º y 2º grado de la escuela primaria Ignacio Allende de la comunidad de La laguna, Pisaflores Hidalgo, en el desarrollo de la aplicación se tomó como guía la metodología ágil XP ya que esta metodología está enfocada a proyectos pequeños y con periodos de tiempo reducidos por lo que se basó en 5 fases (generación de la idea, análisis, diseño, desarrollo y pruebas o implementación) de las cuales sólo se lograron las tres primeras y el 50% de la fase 4. Para lograr los resultados obtenidos, se realizó una investigación sobre proyectos similares que ayudaran a fundamentar la investigación así como a conocer si tanto los alumnos podían aceptarla como los profesores se utilizó la investigación cualitativa y las herramientas de recolección de datos fueron la entrevista y la encuesta, aplicadas a los alumnos y profesores de la institución. El alcance de dicha investigación fue generar el diseño de la aplicación "juego con Kika" así como parte de su programación.

Software educativo, Metodologías, Aprendizaje de la lectura

Citation: SANTOS-HERNÁNDEZ, Enriqueta, PÉREZ-ESPINOZA, Emma and MARTÍNEZ-HERNÁNDEZ, Mariela Lizeth. Design and construction of an educational software that can be used as a teachin resource to improvereading learning in 1st and 2nd grade children. Journal of Critical Pedagogy. 2021. 5-13:20-27.

* Correspondence to Author (E-mail: L17isc015@tamazunchale.tecnm.mx).
† Researcher contributing as first author.

Introduction

At present, the use of technologies has brought great benefits to humanity, thanks to this several aspects have been improved in society and in its different areas; as in health, another area in which tics have brought great benefits is education, thanks to this learning methods have been improved as well as the tools so that both students and teachers can achieve a better acquisition of knowledge.

As Pereiro (2014) expresses, the way of learning is evolving, which is why new teaching methods and tools have emerged. Nowadays students begin by losing interest in the methods of knowledge acquisition, so to help the student not lose interest in reading and allow it to develop in a better way, the proposal is made that, with the use of new technologies, students will improve in this aspect.

Based on the tools that technology provides us today and analyzing the use of software within the field of education was given the task of innovating the teaching and learning of children, based on this achieve a better development in oral and written expression this based on the use of educational software, thanks to this it is possible to have more knowledge, fluency in the pronunciation and intonation of the syllyas, the formulation of the words and the knowledge of them.

In the present research, the topics of reading and writing were addressed, which are a problem that affects many of the educational institutions of basic level, in this case especially focused on the Ignacio Allende institution of the community of La Laguna Pisaflores Hidalgo, which contains a high rate of students who still do not know how to read or write. This research aimed to design and build an educational software as a resource or didactic tool to improve student learning. It is worth mentioning that this application will not be implemented due to the limitations generated by the pandemic that is currently being experienced, but once the situation normalizes, the possibility of its implementation will be analyzed and will be taken as a tool during online classes.

Likewise, it was proposed as a hypothesis that the educational software must contain images, sounds and colors that attract the attention of children and allow them to learn to identify letters, can form words, these in turn allow them to acquire the necessary knowledge so that they learn to form words and approach Reading. In the same way, the general objective was established: To design and build an educational software as a didactic resource to improve the learning of reading in children of 1st and 2nd grade of primary education.

The research allows to base analyzing the methodologies that are used for the elaboration of an educational software depending on the degree of complexity that it has, for example for the elaboration of the design of the software the agile XP methodology was used which is focused on small projects and with a short period of time, Likewise, the stages that constitute this research were carried out, which were generation of the idea, analysis, design, development and tests, it should be noted that the development phase was 50%. Finally, the conceptual framework which allows to know the concepts that are used in the research to be able to understand more the topic that is addressed.

The contribution of this research in terms of the others, is that this research uses the method of learning by syllables which allows a better acquisition of knowledge and in an easy way. This research carried out is important because the problem was identified and based on this it was proposed the development of an application based on the problem found in the children and the way of teaching of the teachers, the application will help the children in the knowledge of the syllyas and in the formulation of the words through them.

Literary magazine

"Didactic programs, when applied to the educational reality, perform the basic functions of the didactic means in general and, in addition, in some cases, according to the form of use determined by the teacher, they can provide specific functionalities." "On the other hand, as with other products of current educational technology, it cannot be said that educational software by itself is good or bad, everything will depend on the use made of it, the way it is used in each specific situation (Chacón, Moreno and Gómez, 2014, pag.31).

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Ultimately, its functionality and the advantages and disadvantages that its use may entail will be the result of the characteristics of the material, its adaptation to the educational context to which it is applied and the way in which the teacher organizes its use. (Chacón, Moreno and Gómez, 2014, pag.31)

As Pereiro (2014) expresses, the way of learning is evolving, which is why new teaching methods and tools have emerged. Nowadays students begin by losing interest in the methods of knowledge acquisition, so to help the student not lose interest in reading and allow it to develop in a better way, the proposal is made that, with the use of new technologies, students will improve in this aspecto.

In this regard, Rodríguez (2014) mentions that today the use of technologies in education is a topic that day by day is taking more highlight, in Ecuador because not all students have knowledge of these technologies and much less have access to one of them, which is why it was decided to implement the use of educational software in schools with the aim of creating tools for teachers and promote student learning, this in turn improves and changes the educational process in a positive way.

As Vega (2014) points out, due to the insufficiencies that affect learning and reading, it is proposed to work with methodologies with a psychopedagogical approach as a dynamic, continuous and developer and forecasting process. So that the student acquires a better learning. For the collection of information and analysis of the problem, different methods were used in the collection of information, in this case through the bibliographic method different sources of information about educational software were investigated and how these can help in the process of literacy in students and in this way based on the research theories were compared and the requirements of the software were formulated. In the implementation of this software as proposed by Chillogallo and Llivigañay: teachers agree that the software developed presents the topics in a clear and simple way, which encourages self-learning in children for its didactic quality, in addition to its simple language in the different interfaces, accelerates the process of adaptation of children when using it, in this way it is demonstrated that the software meets the expectations and educational needs of users. (2015, p.58)

In the opinion of Franco (2015) education becomes increasingly important for societies, since it contributes to social transformation, today the digital era is booming and thanks to ICTs have allowed new learning networks to be generated not only in children but also in young people contributing in a better way to their academic training.

As Gómez (2015) points out, with the passage of time day by day technologies are required or used more, which is why a study was carried out on which are the most used devices and which are those that are used for an educational purpose, so at this point the methodology with which these apps work was analyzed and what is the branch to which it belongs and what type Methodology has either branching or customization. Based on this, he concluded that the use of educational software is a tool that allows to be of great support for both students and teachers in the process of learning to read which so far has had favorable results.

Molano (2015) expresses, the need to improve our percentage in the reading of Mexicans raises this software, which allows a mediation for the improvement and increase of the learning of reading in children and young people, it adopts measures so it follows a study methodology based on evidence that is carried out nationally and internationally. Since the selected methodology allows to develop the competences in reading and writing through a technological development.

Nowadays a technological mediation is a response to the different difficulties that students show in the first school grades due to this, a software aimed at teaching reading and writing favors the autonomous learning of children and increases skills in these areas. A world without reading or writing is a world without dreams and without illusions, Reading and writing are two basic life skills; therefore, building a software based on the Affective Method for Learning - MACPA- that accelerates the processes of acquisition, use and development of reading and writing is an imperative to improve the quality of life of children and young people. (Molano, Quiroga, Romero and Pinilla, 2015, p.1)

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According to Pérez (2015) the use of ICT as a didactic strategy in the classroom facilitates the construction of knowledge acting as a forceful process since images, sounds and words allow greater capture of information in a dynamic way.

Based on the shortcomings of second-grade students in basic education in the area of literature as Quevedo points out, it was decided to resort to the use of ICT: Interactive learning techniques allow students the opportunity to participate with new material as they learn, helps them process information and cement their knowledge. Interactive learning includes activities with the use of new technologies, in which the teacher is a facilitator of knowledge. (2015, p.44) For the development of this software, the different methods of learning to read were analyzed, which were implemented in this tool .According to Bustos, (2016) iterative applications can be of some support for the development of skills in children, so that the child manages to retain, learn and reinforce certain knowledge the teacher must make an accompaniment so that the student formulates his own hypotheses, therefore regarding the use of these softwares serve to enhance basic skills such as reading and can be used in combination with other resources and strategies than teachers establish. According to Bustos and Valverde (2016) to attack the problem of low learning in children, the proposal is made to use an educational software in order to implement the use of ICT and in turn obtain a work tool for teachers. Therefore, the "Educaplay" software is used, with which favorable results are obtained both from the students and from the teachers. This software helped students get better concentration, memory development and improve learning. Citing Caiza and Álava (2016) the way of teaching has become routine, so it is intended to generate innovation processes by teachers in such a way that the use of information and communication technologies is implemented within the classroom.

Developing methodology

The type of research that was used to carry out the research was qualitative because it is required to know the benefits that could cause the use of educational software as a didactic tool for learning to read in children of primary age.

Therefore, the scope is to obtain as a result the analysis and design of the application, which should be attractive for children to show interest in using such software if it is implemented. The design to be followed will be as follows: definition of the problem, design of the work, data collection, analysis of the data, validation and proposal of the design of the software.

This work is important because the place where the research was developed was an educational institution of basic level, where it has traditional methods for teaching such as the paint and marker, however, today with the pandemic that still crosses the country, it becomes more complex so it is very helpful the development of the proposed software. For this it was necessary to go with experts in teaching topics to obtain recommendations and points of view to develop the tool and make it suitable. To achieve the stated objective, it was necessary to go through 5 steps or stages:

Figure 1 Research process
Source: Own elaboration (2020)

Developing

Step 1: Designing and Selecting Instruments. The instruments selected and designed were two:

Interviews: The interview was applied to the teachers and directors of this institution, to know their opinion regarding this project and what is the experience or knowledge they have regarding Ict and what is the opinion of using an educational software as a tool in reading learning and if they would use it**.**

Surveys: This instrument was applied to first and second grade students in order to know the use of technologies and what is the level of acceptance of an educational software, as well as to know what design such software can have so that it is attractive and can be used by them.

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Step 2: Selecting unit of analysis: We considered 20 students who were surveyed so they selected by calculating the sample size for finite populations in the 1st and 2nd groups. For the application of the interviews were selected using the simple random method and two of the teachers who work with these students were taken into account.

Step 3: Implementation of instruments: To carry out the application of the surveys the first thing that was done was to notify the director about the project and that the data collection would be carried out so the principal provided the list of the students who were selected to answer this survey so the survey had to be carried out the survey of the students in their homes. For the application of the interviews, first, the teachers were informed about what the project consisted of and the date on which the interview would be conducted with each of them was planned, once the dates were established, the interview was carried out, so the zoom tool was used.

Step 4: Analysis of the results obtained from the application of the instruments: To carry out this activity, Excel spreadsheets were used and the information collected from the interviews was analyzed, with which it was possible to report the findings obtained, as well as the quantification of the results of the survey.

Step 5: Development of proposal: Once the application of the instruments and the analysis of the information as a proposal to the research was made the proposal of the design of an application which can be applied in that institution to reduce the problem of reading, the content of the application is divided into two parts one is the pronunciation of the syllables and the other includes the formation of words using the syllables of the first section, the development of this application was based on the XP methodology, which has the following stages idea generation, analysis, design, development and testing. From these stages it was possible to conclude until the design stage; the development of the application was done in visual c #.

Product

Product 1: Product of the formula applied for the calculation of the sample.

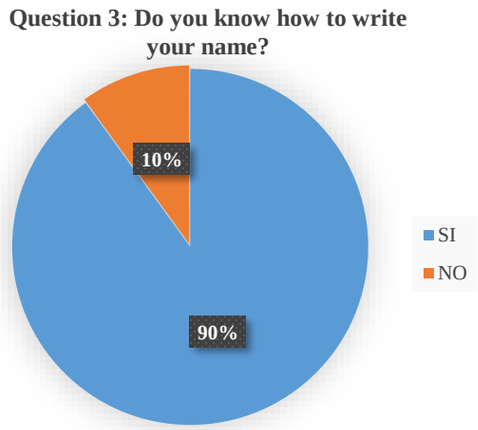
Sample size of the population

Parameter	Insert value		
N	20		Sample size
Z	1.96		"n"=
P	50%		19.05744618
Q	50%		Redobde
e	5%	Sample size	19.06
	19.208		

Table 1 Application of the formula for sample calculation
Source: Own elaboration, (2020)

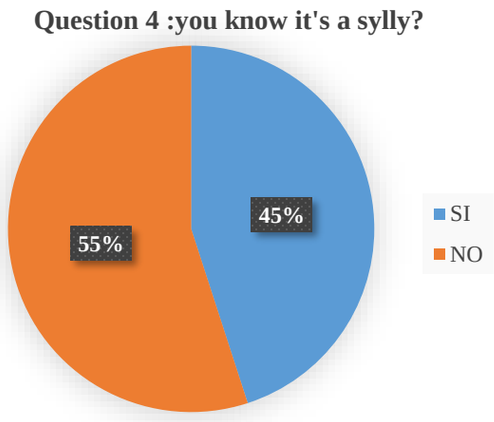
Product 2: Aplication of survey

The analysis of the data obtained was carried out, in relation to the survey the results were the following:



Graphics 1 Impact of the use of educational software
Source: Own elaboration (2020)

In relation to the question, 90% of the students surveyed know how to write their name but cannot read.



Graphic 2 Knowledge of sylly
Source: Own elaboration (2020)

The results of the majority of the students 55% were that they did not identify that it is a sylly, on the other hand, 45% more if they knew, but did not know that this was known.

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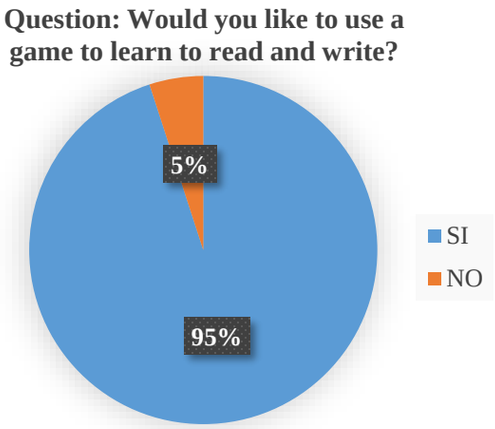

Graphic 3 Using educational software
Source: Own elaboration (2020)

The results for the use of an app are very favorable. Students' responses are based more on learning by using games to make it non-monotonous. 95% of students would like to use an application to learn to read and would be willing to manipulate it.

Most students would like to learn, but in a fun way.

Product 3: Interface of the proposed application

Based on the answers obtained from the instrument that allowed to diagnose the current situation, we proceeded to elaborate the software for primary school students, then the environment and design are shown in a synthesized way:

Figure 2 App home screen layout
Source: Own elaboration (2020)

The image above shows the main access screen to the application.

Figure 3 Main menu interface of the game with Kika application
Source: Own elaboration (2020)

Interface of the main menu is responsible for linking all the forms of the application as well as the pronunciation and those of the divination of the words.

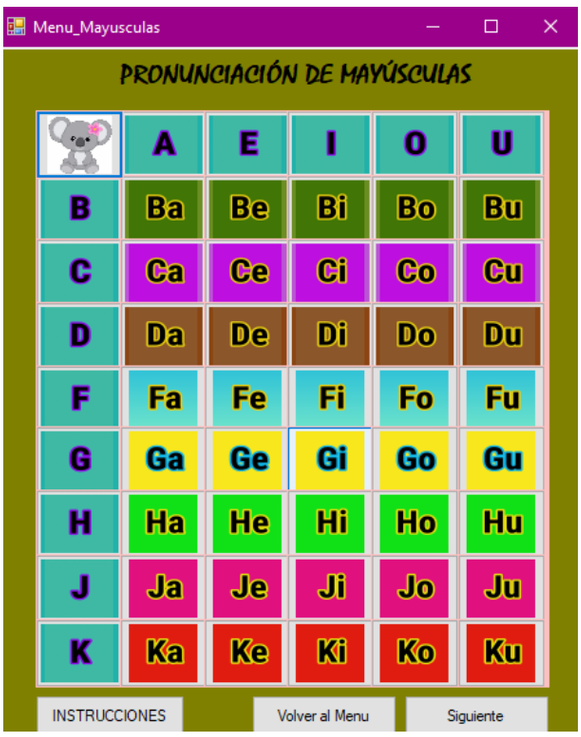

Figure 4 Interface of the pronunciation of capital letters
Source: Own elaboration (2020)

Allows you to select the syllables and listen to their pronunciation as well as the way they are written.

Figure 5 Interface of guessing the words of animals
Source: Own elaboration (2020)

Interface of the form where the user can guess which syllables are missing in each word and can place it to be able to win.

Closing

Most of the students know how to write their names but do not know how to read, in the same way few know that it is a syllable, in relation to the way of teaching of the teachers you can see that they do not use the technologies of the information to favour the learning of the students, in the same way it is concluded that the students have different styles of learning but the one that more predominates is the visual learning, finally, students agree to use an interactive application for their learning from the information obtained in the interviews carried out it was obtained that none of the teachers has worked with an educational software to teach the students, however they have used it for their professional training, in the same way that they do not use a planning for each of the grades, and in the approaches of the activities they do not use activities that favor each of the different learning styles, in relation to the use of an educational software teachers would like to use it in this way would favor them so that students learn to read more easily and would be willing to train themselves to be able to use it in the classroom as a tool in their work.

As for the software developed is user-friendly and visually appealing to basic level students, which will allow it to be interesting for them and it is expected that once it is implemented students will learn through more interactive activities. It is also intended to train teaching staff on the handling, use and installation of software.

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ISSN 2523-2479

Article **Journal of Critical Pedagogy**
June, 2021 Vol.5 No.13 28-35

Educational program aimed at the population of Chuquisaca, on the importance of complementary dental examinations

Programa educativo dirigido a la población Chuquisaqueña, sobre la importancia de exámenes complementarios en odontología

RAYA, María†, CUETO, Mariana, GARNICA, Tatiana, MOLINA, Yusara and QUIROGA, Dayana

Universidad Mayor, Real y Pontificia de San Francisco Xavier de Chuquisaca, School of Medicine, Calle Final Colón, S/N, Sucre, Bolivia.

ID 1st Author: *María, Raya*

ID 1st Co-author: *Mariana, Cueto*

ID 1st Co-author: *Tatiana, Garnica*

ID 1st Co-author: *Yusara, Molina*

ID 1st Co-author: *Dayana, Quiroga*

DOI: 10.35429/JCP.2021.13.5.28.35 Received January 30, 2021; Accepted June 30, 2021

Abstract

The present work determined the importance of the complementary examinations in the odontological attention, whose main target is directed to emphasize the necessity of the same to orient a trustworthy diagnosis, and post-operative odontological treatment adapted pre and. And this way, to make of the odontological attention a more reliable professional practice, Integra, person in charge, to the benefit of the oral and general health of the patient and the community. The investigation was realised in three phases: An exploratory phase that I include the bibliographical revision about the complementary examinations in Odontolgy and its importance in the behavior clinical for praxis daily; a diagnostic phase that focus in the rise of data from the interview semi-structured to the corresponding authorities in Sucre, and in the same way, a survey type to the population and one third phase in which I am realised the analysis of the collected data, which threw data that indicate the importance of the project. The work of investigation verified that the population chuquisaqueña wishes to have major knowledge about the necessity and importance of these examinations, because on this depends one better attention to its health and majors guarantees in its treatments

Education Program, Supplementary Exams, Comprehensive Care, Prevention, Health, Welfare

Resumen

El presente trabajo determinó la importancia de los exámenes complementarios en la atención odontológica, cuyo objetivo fundamental está dirigido a resaltar la necesidad de los mismos para orientar un diagnóstico fidedigno, y posterior tratamiento odontológico adecuado pre y postoperatorio. Y de ésta manera, hacer de la atención odontológica una práctica profesional más confiable, integra, responsable, en beneficio de la salud oral y general del paciente y de la comunidad. La investigación se realizó en tres fases: Una fase exploratoria que incluyo la revisión bibliográfica acerca de los exámenes complementarios en Odontología y su importancia en el proceder clínico para la praxis diaria; una fase diagnóstica que se enfoca en el levantamiento de datos a partir de la entrevista semi-estructurada a las autoridades correspondientes en Sucre, y de la misma manera, una encuesta tipo a la población y una tercera fase en la que se realizó el análisis de los datos obtenidos, los cuales arrojaron datos que señalan la importancia del proyecto. El trabajo de investigación comprobó que la población chuquisaqueña desea tener mayor conocimiento acerca de la necesidad e importancia de estos exámenes, pues de esto depende una mejor atención a su salud y mayores garantías en sus tratamientos.

Programa de educación, exámenes complementarios, atención integral, prevención, salud, bienestar

Citation: RAYA, María, CUETO, Mariana, GARNICA, Tatiana, MOLINA, Yusara and QUIROGA, Dayana. Educational program aimed at the population of Chuquisaca, on the importance of complementary dental examinations. Journal of Critical Pedagogy. 2021. 5-13:28-35.

† Researcher contributing as first author.

Introduction

Oral health encompasses not only dental health but the health of the entire oral cavity and its components, it is more than the traditional scheme of stopping tooth decay and preventing periodontal disease, it encompasses the overall health of the body. A condition not treated in time, free to continue with the disease process, inevitably has an impact on the patient's life.

A correct diagnosis is the basis for the treatment of any disease. It is important to understand that oral diseases have been established in the mouth long before the first clinical manifestations appear in the form of visible lesions. From the above it can be deduced that it is possible to predict the severity of the disease before visible lesions have developed and thus avoid complications at the systemic level, through complementary examinations such as hemogram, blood pressure and others.

This analysis allows us to adopt a multidisciplinary dental medical criterion in favor of the patient's wellbeing. Once the risk is diagnosed, the treatment will be focused, due to the multifactorial nature of the disease, to control the etiological factors present in the patient and depending on what is detected, it will be possible to intervene opportunely and adequately.

Thanks to the complementary examinations it will be possible to detect systemic diseases that put at risk the health and even the life of the patient; since to perform certain dental interventions it is necessary to know the general condition of the patient, especially if we are dealing with patients at risk, and even with those who are unaware of the risk they may run because they are unaware of certain systemic alterations and/or pathologies that are in progress.

Materials and Methodology

The present research is a Descriptive Study by means of surveys, using quantitative research, whose purpose is the exact measurement of the behaviour of certain variables in an objective manner, explaining causes and effects, all with a strong support in statistics.

The research design is cross-sectional and exploratory, since information is collected in a single moment, at a single time, and the purpose is to describe variables and analyze their incidence and interrelation at a given moment.

Instruments

A semi-structured interview with the corresponding authorities in Sucre and a survey of the population of Sucre will be used as instruments to determine the degree of knowledge and acceptance of complementary examinations in dentistry in our city, in order to determine the degree of knowledge.

To carry out the present research project, the following phases are proposed:

Exploratory phase

In the first phase of the research, a literature review was carried out on complementary examinations in dentistry and their importance in clinical procedures for daily practice. Several sources of information were taken into account, such as: web pages, articles, magazines, books, among others.

Diagnostic phase

This second phase focuses on the collection of data from a semi-structured interview with the corresponding authorities in Sucre, and likewise, a survey of the population, to determine the degree of knowledge and acceptance of complementary examinations in the area of dentistry in our city.

Evaluation Phase

In this phase, the analysis of the data obtained through the instruments mentioned above was carried out, which yielded data that indicate the importance of the project and promoted the realization of the diagnosis with the conclusions and recommendations, which promote the implementation of an Educational Program on the importance of complementary examinations in Dentistry.

To make a comparison of the population, a hierarchical ranking was made with respect to the variables sex (male and female) and age (17-19, 20-29, 30-39 and 40 and over).

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Data analysis

The data were manually classified by classifying similar responses, underlining them with the same colour and assigning a number to each type, which made it possible to convert the information obtained into quantitative data.

For the analysis of the data, the student's t-test was used to demonstrate the variables used in the research. The "Tearkson" test, to compare the variables; and the ANOVA test, to compare the opinions with respect to the ages of the participants.

Population and sample

In the present study, the population currently concentrated in district 1 of the city of Sucre was taken into account. The representative sample in this case is a random probability sample, since it allowed all elements of the population to have the same possibility of being chosen. In this case we worked with a sample made up of 180 households located in district 1 of the city of Sucre, a figure determined by the following formula:

$$n = n´ 1 + n´/N \quad (1)$$

As data we have that:

N = 329 blocks within district 1 of the city of Sucre.

n´= unadjusted sample size (S2/V2)

y = 1

Se = 0.015 (standard deviation of the sampling distribution) V = Population variance (Se)

S2 = sample variance expressed as the probability of occurrence of y Substituting:

n´= S2/V2

S2= p(1-p) = 9(1 – 0.9) = 0.009

V = (0.015)2 = 0.000225

n´= 0.09 / 0.00025 = 400

Setting:

N = 400 = 400 = 180 addresses 1 + n / N 1+400/329

Environment

The data collection through the survey used as the main instrument was carried out in different households in District 1 of our city, according to the guidelines detailed above.

Results obtained

The results achieved are shown graphically as follows:

Interview

Ask	Responses	Percentages
What is the purpose of complementary dentistry?	Identify latent health problems that may influence that may influence post-treatment.	50
	Not very necessary.	20
	Necessary only in some cases	30
	Total	100
What educational activities does the municipality carry out on the subject?	Forums, debates, seminars.	30
	Not many activities.	40
	Exhibition fairs.	30
	Total	100
What educational activities do you carry out in health in general?	Exhibition fairs	70
	Seminars and/or workshops	30
	Total	100
What activities do you consider to be the most appropriate for the dissemination of the topic to society?	Use of media radio, press and TV.	40
	Seminars and/or workshops on the subject.	20
	Exhibition fairs in strategic areas.	40
	Total	100
Would the municipality be willing to implement within its activities a specific space for the application of an Educational Program on the subject?	Yes, to the extent possible.	50
	With security.	50
	Total	100
Which sector do you consider an educational program?	to all sectors of the population.	50
	with priority to young people	20
	women in particular	30
	Total	100
What activities do you consider necessary to improve timely and effective care?	Continue to promote education programs on the subject. On the subject.	50
	Disseminate its importance by organizing seminars, conferences and other events	50
	Total	100

Table 1

In the interview, information was collected about the knowledge of the authorities on the subject and the activities they develop to socialize the different educational programs in the health area and specifically in dentistry. The table shows the questions and the answers to them, reflected in percentages.

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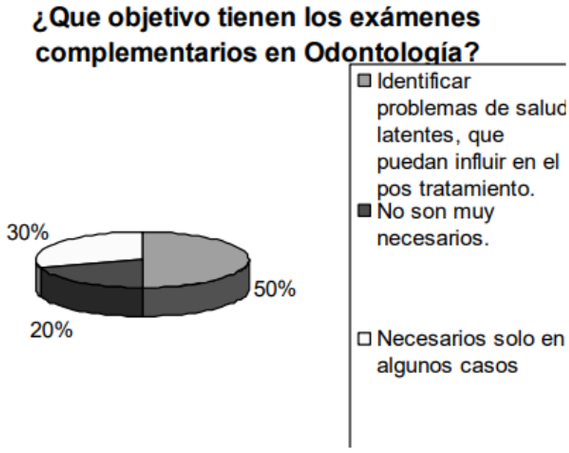
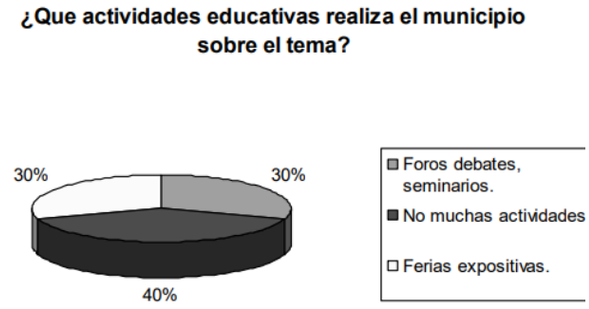
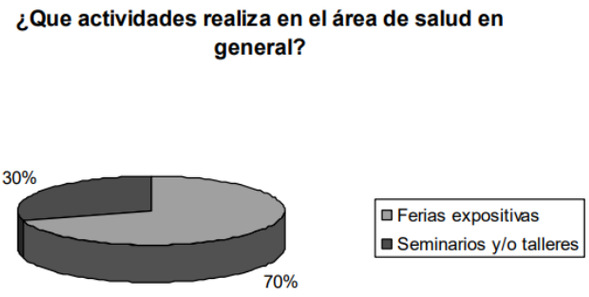
A total of 10 authorities were taken into account considering the Honorable Municipal Mayor's Office and the Prefecture of the Department with their respective dependencies.



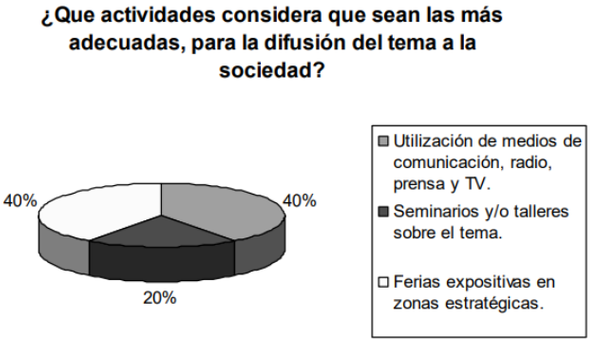
Graphic 1



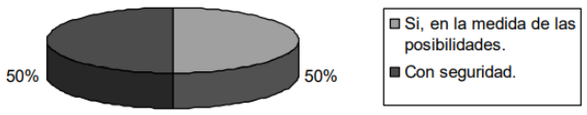
Graphic 2



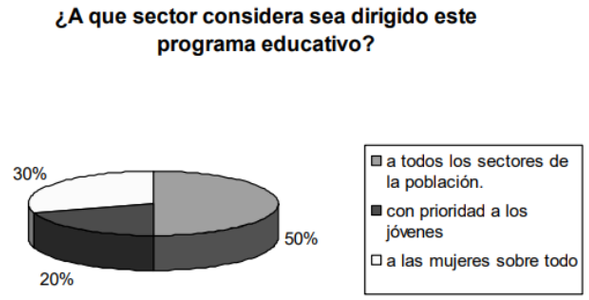
Graphic 3



Graphic 4



Graphic 5



Graphic 6

N°		Population		Men		Women		17-19 years old		20-29 years		30-39 years		40 and onwards	
		Media	Desv. tip.	Media	Desv. tip.	Media	Desv. tip.	Media	Desv. tip.	Media	Desv. tip.	Media	Desv. tip.	Media	Desv. tip.
1	Do you know what the complementary exams in dentistry are?	1,84	0,83	1,86	0,84	1,82	0,82	2,38	0,94	2,10	0,74	1,65	0,78	1,50	0,68
2	Do you know some diseases that can alter the results of a treatment in dentistry?	1,79	0,96	1,84	1,02	1,74	0,91	2,42	0,99	1,96	0,70	1,78	1,04	1,32	0,87
3	Consider important to carry out this type of important to carry out this type of exams?	1,78	0,73	1,82	0,76	1,73	0,70	1,88	0,71	1,84	0,55	1,72	0,94	1,72	0,64
4	Have you agreed to take such examinations when prescribed by a prescribed?	1,98	0,84	2,01	0,89	1,96	0,78	2,73	0,53	2,10	0,68	1,74	0,97	1,74	0,69
5	Do you know anyone who has had a blood test blood test, for example at the for example at the request of a dentist??	1,63	0,58	1,64	0,61	1,62	0,55	1,77	0,65	1,80	0,45	1,56	0,66	1,48	0,50
6	Would you like to receive more information on the subject?	2,39	0,92	2,33	0,95	2,44	0,90	3,00	0,00	2,72	0,70	1,93	1,01	2,24	0,98

Table 2 Survey

Descriptive statistics

The table shows the descriptive statistics, in each of the questions we can see how when rounding the data of the results, the population in total has as average, the option "2" that expresses disagreement, which means that in question 1 they do not know which are the complementary tests, in question 2 they do not know which diseases can alter the results in a dental treatment, and so on in all the questions; The least accepted question is question 5, which shows the lack of knowledge that someone has had a blood test done, for example, at the request of a dentist, and the most accepted question is question 6, which expresses a greater acceptance of receiving more information on the subject. These two questions remain as the most and least accepted in the population variables of sex and age, varying only with greater acceptance of question 6 in the ages between 17 and 19 years.

Average Female = 5,75 Average Male = 5,66 The Levane test: F=1,631; p>0,203, Accepted Homogeneity of variances t (178) = 0.29; p>0.774 Not Significant

Table 3 Independent samples t-test: Total – Sex

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Table 3 is the first table of contrast tests, which shows the comparison of the variables sex, with respect to attitudes towards knowledge about the importance of complementary examinations in dentistry, which shows that the criteria of both sexes is similar and there are no differences with respect to the subject. The result falls within the area of acceptance (0.774).

Average Female = 7,35 Average Male = 7,14 The Levane test: F=1,729; p>0,190, Accepted Homogeneity of variances t (178) = 0,468; p>0,6 No significative

Table 4 Independent-samples t-test: Knowledge – Sex

Table 4 is of contrast statistics, and compares the variable knowledge about the subject, between the population variables of sex; as results show that the criterion is similar in both populations (males and females), since its result also falls within the area of acceptance (0.64%), and that the criterion is similar in both populations (males and females), since its result also falls within the area of acceptance (0.64%).

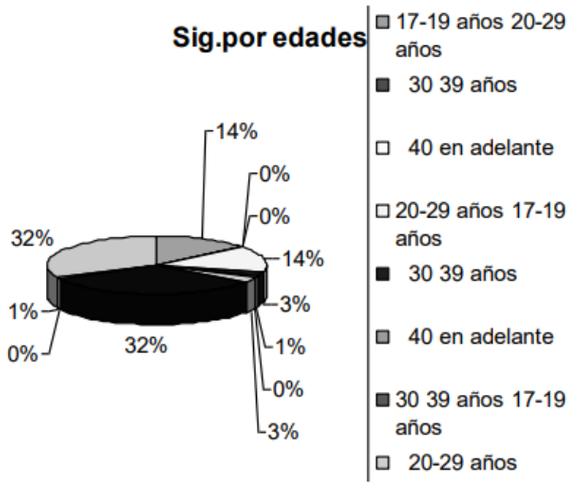
Average Female = 4,15 Average Male = 4,18 The Levane test: F=3,44; p>0,065, Accepted Homogeneity of variances t (178) = 0,097; p>0,923 Not significative

Table 5 Independent samples t-test: Participation – Sex

This table compares the knowledge about the importance of complementary examinations in dentistry, with respect to men and women, whose result shows that the participation criterion is similar in both sexes, as it falls within the area of acceptance (0.923)

(I) age	(J) age	Sig.
17-19 years old	20-29 years	,432
	30 39 years old	,003
	40 onwards	,001
20-29 years	17-19 years old	,432
	30 39 years old	,078
	40 onwards	,030
30 39 years old	17-19 years old	,003
	20-29 years	,078
	40 onwards	,977
40 onwards	17-19 years old	,001
	20-29 years	,030
	30 39 years old	,977

Table 6 One-factor Anova test: Total – Age



Graphic 7

Mean 1= 7.09 Mean 2= 6.26 Mean 2= 5.18 Mean 2= 5.00. Levane test: F=10.13; p>0.00, Homogeneity of variances is rejected. Anova (3) = 8.104; p<0.00. Significant.

Table 7

In the comparison of the attitudes with respect to the population variables by age, the Anova test was carried out, which shows that the criteria vary according to age, since the result fell within the rejection area (0.00), in a comparison to know between which populations this difference occurs, it shows that the greatest differences occur in the ages of 17-19 with respect to those of 40 years old and older (0.001) and to a lesser degree with those of 30 to 39 years old (0.003).

(I) age	(J) age	Sig.
17-19 years old	20-29 years	.277
	30 39 years	.003
	40 onwards	.000
20-29 years	17-19 years	.277
	30 39 years	.178
	40 onwards	.011
30 39 years old	17-19 years	.003
	20-29 years	.178
	40 onwards	.680
40 onwards	17-19 years	.000
	20-29 years	.011
	30 39 years	.680

Table 8 One-factor Anova test: Knowledge – Age

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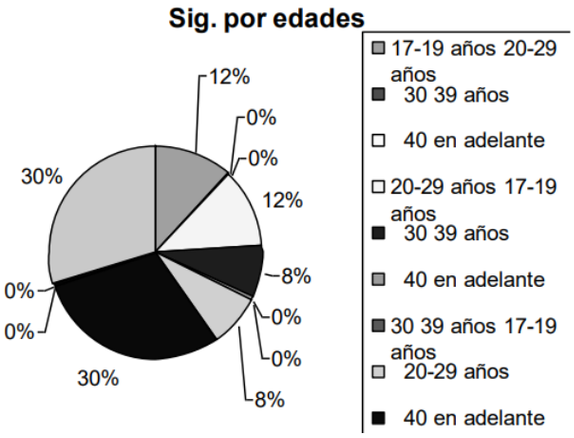


Graphic 8

Average 1= 9.31 Average 2= 7.96 Average 2= 6.72 Average 2= 6.04 Levane test: F=7.1195; p>0.00, Homogeneity of variances is rejected. Anova (3) = 9.326; p<0.00 Significant

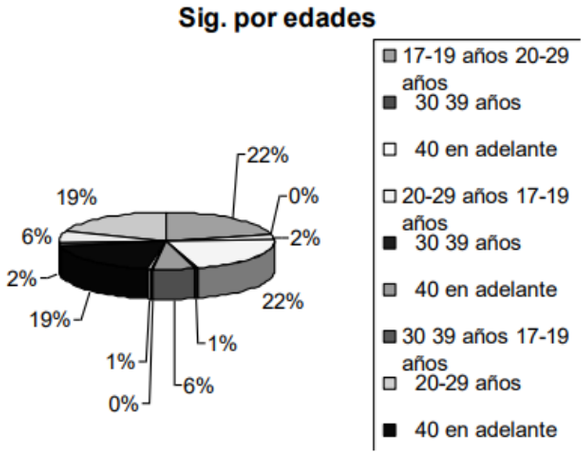
Table 9

In the comparison about knowledge with respect to ages, it is shown that the criterion is different, the result falls within the rejection area (0.00). To compare between which ages this difference is found with the anova test, whose result shows that the biggest difference is found between the ages of 17-19 and 40 onwards (0.00). And the largest divergences between the ages of 30-39 and 40 onwards (0,68).

7 One-factor anova test: Participation - Age

(I) age	(J) age	Sig.
17-19 years	20-29 years	,842
	30 39 years	,007
	40 onwards	,084
20-29 years	17-19 years	,842
	30 39 years	,021
	40 onwards	,249
30 39 years	17-19 years	,007
	20-29 years	,021
	40 onwards	,761
40 onwards	17-19 years	,084
	20-29 years	,249
	30 39 years	,761

Table 10



Graphic 9

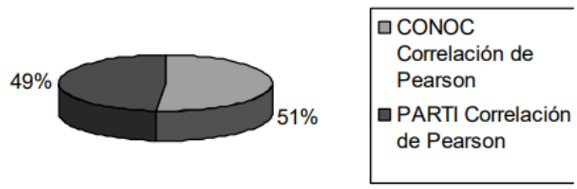
Mean 1= 4.88 Mean 2= 4.56 Mean 2= 3.64 Mean 2= 3.96 Levane test: F=40.14; p>0.00, Homogeneity of variances is rejected. Anova (3) = 5.816; p<0.01 Significant

Table 11

In the comparison of the degree of knowledge of the importance of complementary examinations in dentistry, between the variable age, it is shown that the criterion is different between the populations (0.01). The populations in which there are the greatest differences are those of 8 Correlations

		TOTAL
Conoc	Pearson correlation	,984
Parti	Pearson correlation	,936

Table 12



Graphic 10

The statistical test for Pearson's correlation shows that both variables influence each other, since their results are close to 1, with a minimum difference.

Conclusions

During the research carried out, and the diagnosis obtained after the evaluation of the instruments used, the following conclusions were reached:

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The municipality of Chuquisaca under the jurisprudence of its authorities, has not carried out many activities in the city of Sucre, related to complementary examinations in dental practice, among the few that were carried out are for example the exhibition fairs in the area of health in general, These are oriented to programs such as uterine cancer detection, vaccinations for the population and pets, school dental insurance, Universal Maternal and Child Insurance, among others, and in the area of dentistry itself, they are focused on programs of promotion, prevention and treatment of stomatological ailments.

Complementary examinations in the area of dentistry are not given on a regular basis, few patients agree to undergo them, considering them unnecessary for the clinical care itself, this is due to the very few outreach activities that have been held in the city on the subject, There is a notable difference between young people and young adults who know something about the subject and older adults and adults who know almost nothing or nothing, so it is assumed that the activities of the municipality are not enough, or do not contain in their themes the importance of the use of complementary examinations in dental practice.

The attitudes of the population with respect to the subject are of ignorance and astonishment, both in the participation and use of complementary examinations in the dental practice, there is no difference of criteria with respect to the sex variable, both men and women do not know much about the subject and have not participated in the application of a complementary examination.

What could be evidenced in the interview data collection is that the authorities of the municipality have different criteria with respect to the knowledge on the subject, apparently there is no clear and defined information about what is a complementary examination in dentistry, what are its objectives, to which sector it is directed, which may be due to the lack of information on the subject.

Therefore, the need arose to plan, organize and execute teaching activities on the importance of complementary examinations in dental practice aimed at the population of Chuquisaca in general.

It is essential to promote and encourage the application of complementary examinations such as blood tests, blood pressure among others in the dental practice, demonstrating their importance to the community of Chuquisaca.

In view of the above, the need for the implementation of an educational program aimed at the population of Chuquisaca, on the importance of complementary examinations in the dental practice, whose primary objective is the comprehensive care of the patient, in search of their well-being in total integrity, was demonstrated.

It has been possible to establish that the main objectives of the Educational Program are formative, since it creates new knowledge in the community about the importance of complementary examinations in dental practice.

Acknowledgments

The researchers would like to thank the Dirección de Investigación Ciencia y Tecnología (DICYT) of the Universidad San Francisco Xavier de Chuquisaca for their support in the development of this work.

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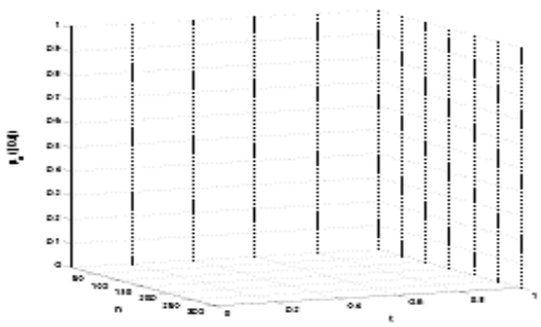

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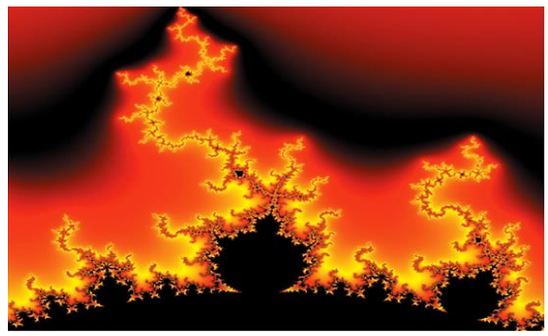

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