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Journal of Technology and Education

Definition of Journal

Scientific Objectives

Support the international scientific community in its written production Science, Technology and Innovation in the Field of Engineering and Technology, in Subdisciplines Standards of digital skills for education, learning projects through the use of information and communication technologies, development of digital teaching skills, digital skills programs, management of technological and educational consultancy, technological training fields applied to education.

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Journal of Technology and Education is a Journal edited by ECORFAN-Mexico S.C in its Holding with repository in Republic of Peru, is a scientific publication arbitrated and indexed with semester periods. It supports a wide range of contents that are evaluated by academic peers by the Double-Blind method, around subjects related to the theory and practice of Standards of digital skills for education, learning projects through the use of information and communication technologies, development of digital teaching skills, digital skills programs, management of technological and educational consultancy, technological training fields applied to education with diverse approaches and perspectives , That contribute to the diffusion of the development of Science Technology and Innovation that allow the arguments related to the decision making and influence in the formulation of international policies in the Field of Engineering and Technology. The editorial horizon of ECORFAN-Mexico® extends beyond the academy and integrates other segments of research and analysis outside the scope, as long as they meet the requirements of rigorous argumentative and scientific, as well as addressing issues of general and current interest of the International Scientific Society.

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Instructions for Scientific, Technological and Innovation Publication

Knowledge Area

The works must be unpublished and refer to topics of Standards of digital skills for education, learning projects through the use of information and communication technologies, development of digital teaching skills, digital skills programs, management of technological and educational consultancy, technological training fields applied to education and other topics related to Engineering and Technology.

Content Presentation

As first article we present, *Virtual learning environments for digital electronics using augmented reality*, by DELGADO-GUERRERO, Sergio Humberto, LOPEZ-ÁLVAREZ, Yadira Fabiola, JARA-RUÍZ, Ricardo and GALLEGOS-RAMÍREZ, José Luis, with adscription in the Universidad Tecnológica del Norte de Aguascalientes and Universidad Politécnica de Aguascalientes, as second article we present, *Intelligent system in sensory and cognitive development for the pre-reading stage*, by FOKIN, Sergei Konstantinovich, ARICEAGA-PAREDES, Rafael and PÉREZ-PÉREZ, Tomás, with adscription in the Escuela Normal No. 3 de Toluca, Universidad Autónoma del Estado de México, Centro Clínico de Oído, Nariz y Garganta and Instituto Tecnológico de Toluca, as the third article we present, *Impact of technology for educational development at the higher education level at the Universidad Veracruzana in times of SARS-CoV2 in Poza Rica Veracruz, Mexico*, by RÍOS-HERNÁNDEZ, Sara Anahí, LAGUNA-CAMACHO, Juan Rodrigo, ESCAMILLA-RODRIGUEZ, Frumencio and JIMÉNEZ-CRISTÓBAL, Juan Daniel, with affiliation at the Universidad Veracruzana, as last article we present, *Programming: From abstraction to practice*, by TIJERINA-MARTÍNEZ, Felipe, TOVAR-GONZÁLEZ, Claudia and GARCÍA-CEDILLO, David Rey, with affiliation at the Universidad Tecnológica Santa Catarina.

Content

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Virtual learning environments for digital electronics using augmented reality

Ambiente virtual de aprendizaje para electrónica digital utilizando realidad aumentada

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Abstract

The 2020 pandemic represents another challenge for universities concerned with guaranteeing Educational Quality and the training of their graduates, which must be in accordance with the demands of the current global labor market. Distance Education, one year after becoming the global resource, has become monotonous and routine for many students. At the same time, augmented reality has become more accessible in many ways and represents a viable option that complements learning environments in a motivating way. Its application in education has been reported with success in various disciplinary areas and its advantages are listed in various investigations. In this work, a methodology for the development of virtual learning environments through augmented reality is reported, which can be developed and applied in any subject of higher education, with which it is presumed that AR can be a tool of general application for the creation of innovative learning objects and environments that improve learning outcomes.

Interactive learning environments, Augmented Reality, Logic Gates

Resumen

La pandemia de 2020 representa un reto más para las universidades preocupadas por garantizar la Calidad Educativa y la formación de sus egresados. La Educación a Distancia, a un año de haberse vuelto el recurso global, se ha tornado monótona y rutinaria para muchos estudiantes. Al mismo tiempo la realidad aumentada se ha vuelto más accesible en muchos sentidos y representa una opción viable que complemente de manera motivadora los entornos de aprendizaje. Su aplicación en la educación se ha reportado con éxito en diversas áreas disciplinares y sus ventajas se enumeran en diversas investigaciones. En este trabajo se reporta metodología de desarrollo de entornos de ambientes de aprendizaje virtuales a través de realidad aumentada, que pueden desarrollarse y aplicarse en cualquier asignatura de educación superior, con lo que se presume que la RA puede ser una herramienta de aplicación generalizada para la creación de objetos y entornos de aprendizaje innovadores que mejoren de los resultados de aprendizaje.

Ambientes de aprendizaje interactivos, Realidad Aumentada, diseño instruccional

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Introduction

Since January 2020, the whole world has been submerged in a pandemic of global levels that has caused dizzying changes in behaviors and behaviors, both individual and social and in dimensions as diverse as care, social coexistence, continuous attention to sanitary measures, work restrictions, mobility restrictions and, of course, in the educational dimension, due to the mandatory restrictions regarding face-to-face attendance in classrooms.

At all academic levels, in an emergent and urgent manner, measures had to be adapted that, to a certain extent, allowed the continuity of academic processes and school cycles.

For universities with four-month periods, such as the Universidad Tecnológica del Norte de Aguascalientes (UTNA), the four-month period from January to April 2021, is already the fourth cycle under this modality of distance education and of a mentioned hybrid education.

Undoubtedly, learning levels have been reduced, so it is urgent to envision measures and strategies that guarantee that students who are graduating from Higher Education Institutions (HEIs) have the minimum competencies that allow them to develop and begin growth. and why not, conclusion of their training, already within companies and the labor field, under whatever line it may be.

That is why, in the universities most committed to this end, innovative didactic strategies have begun to be explored that combat problems parallel to the pandemic and that have emerged, such as the apathy of students for study and learning.

To all this must be added what is mentioned in the study by Cabero Almenara and Fernández Robles (2018), the already tense situation in today's universities caused by globalization, the transformation of new students, internationalization, competition between universities due to the recruitment of students, the vertiginous evolution of knowledge, learning elements, and information technologies, so accelerated, that it seems that there are not enough budgets to be a little up to par.

All this has repercussions in a series of challenges for universities, ranging from new competences that teachers must possess and new competences that must be developed in the curricular contents; but more than anything and initially, the challenge of new instructional designs that are more in line with the new technological scenarios. And according to Álvarez-Arregui & Arreguit (2019), the use of intensive, accessible, versatile and low-cost platforms for management, research, teaching and transfer are progressively acquiring greater relevance due to the added value they generate to processes and the results.

Bueno (1976) points out that all knowledge is based on observation, as a prime and essential starting point. That is why, almost naturally, advances in technology and ubiquitous access to mobile devices have increased the popularity of augmented reality (AR) in recent years. Speaking of today's universities, practically any student has a tablet or a cell phone with a camera and internet access; This facilitates the incorporation of AR in teaching processes without raising costs too much.

Conceptualization of AR

According to Cabero (2016, p. 111), “Augmented reality is characterized by the incorporation of digital information including images, video and audio in the real world. AR aims to mix reality with the virtual, allowing users to interact with both objects, the physical and the digital. " Based on a layer of physical information, digital information is added in different formats (video, image, audio, text ...), thereby causing an increase in information.

The study by Cabero Almenara and Fernández Robles (2018) lists different areas and disciplines where AR has been incorporated for its teaching, some of these are: engineering, architecture, urban planning, medicine, mathematics and geometry, art and history, learning of languages, design, natural sciences, chemistry and physics, geography; It also specifies that the educational level where the highest and best results are being achieved is higher education.

This same author identifies different advantages and possibilities of the application of augmented reality, to mention a few: i) the information is enriched, including that already printed, to make it more understandable to the student, ii) the object can be observed from different points of view. view, iii) it can be used at different educational levels and in a diversity of subjects, iv) ubiquitous learning and active learning are promoted, v) the training scenarios are really motivating, vi) it is capable of encouraging students to become in producers of other learning objects with which they can improve divergent processing.

According to Cabero et al. (2019), the most enriching situations for learning are those where the student must experiment, analyze, test the initial conception of it and can also provide clues and suggestions; and that the levels of student satisfaction after AR experiences do not depend on the level of studies or on the specific curricular content in question. This last conclusion agrees with those of the study by Fombona et al. (2017).

Background

The application of AR within learning environments is an innovative way to apply new technologies in educational settings from basic level to higher education, continuously seeking to generate greater interest on the part of students by motivating them to acquire knowledge through means that are different from the traditional ones. In addition, it should be mentioned that AR, with respect to virtual reality (VR), is considered with a broader level of application, because it integrates digital elements within the real world (Martínez García & Dalgo Flores, 2018); It should also be mentioned that with AR the student remains in the real world and does not lose contextualization.

The study by Estapa, A. & Nadolny, L. (2015) showed that AR improved students' motivation towards learning mathematics; applied the possibility of observing videos, web pages, audios and different images that were added through AR to printed documents.

The study by Lobo Quintero, et al (2019) reports the use of the Unity 3D program in conjunction with the Vuforia SDK (software development kit) for the development of a learning system focused on teaching basic science courses in the Autonomous University of Bucaramanga - UNAB.

Justification

Many of the articles on this topic mention theories, conceptualizations, different proposals and even the potential advantages that the application of AR in learning environments would bring. Others point out the feasibility of its application and the specific possibilities of use; but not many of the articles show specific results of its application, therefore the justification for this work comes from the fact that this proposal for a virtual learning environment will enable, in future work, the specific application in a subject that is currently taught at the UTNA.

Cabero Almenara & Fernández Robles (2018) highlight, as one of the disadvantages of AR, the lack of educational materials; Through this work, a reproducible methodology is presented with which a large number of learning objects can be carried out, applicable in practically any subject without involving significant work for the teacher.

AR is a technology that must continue to be experienced and applied directly in the classroom because the research by Tekedere & Gökera (2016), which analyzed results from 2005 to 2015, the effect of applying AR to education is 0.677, which implies a positive effect that should continue to be exploited.

On the other hand, Fombona et al. (2017) carried out an exhaustive review of the scientific literature up to 2016 in the Web of Science (WOS) about RA and found the results shown in Table 1. The same author reports the numbers of articles with the term RA distributed by the main subject areas in Table 2.

Theme	Used as theme	As part of the title
Augmented reality	10,155 ref.	4,262 ref.

Table 1 RA references in WOS until 2016
Source: Fombona, (2017)

AR in the subject área	As theme	As part of the title
Social Sciences	755	319
Technological Science	1888	811
Computing and engineering	1694	726
Physical sciences	302	174
Biomedicine	464	105
Arts and Humanities	158	66

Table 2 RA references in WOS up to 2016 by subject area
Source: Fombona, (2017)

The previous data show that the application of AR has increased in recent years, as reported by Ruiz Cerrillo (2020), the application in education has not been homogeneous in terms of methodology, approach, or instrumentation. This work can provide a homogeneous methodology to the teachers of the UTNA.

The central hypothesis is that it is possible to develop an AR-based learning environment for the introductory topic on digital logic gates.

The main objective of this work is to develop an interactive learning object, specific for the topic of Introduction to digital logic gates of the Mechatronics Engineering career at UTNA.

Method

Due to the fact that at the higher level the highest dropout percentages are located in the first semesters or semesters, one of the first specialty subjects was selected for Mechatronics Engineering students at UTNA.

The specific topic of digital logic gates was chosen because this topic is of great relevance because it is the basis of another diversity of topics of industrial application such as counters, ladder logic, embedded systems and microcontrollers and that together make up one of the great branches for mechatronic engineers: digital electronics. An additional advantage of selecting one of your first specialty subjects is that it can motivate students to enter additional programming languages on their own, which would provide them with very relevant tools for the development of their professional careers.

Lobo Quintero, et al (2019) mentions that three elements are essential in any learning environment: learning strategies, learning technologies and a pedagogical model.

In this work, the learning strategy is to support multiple perspectives of the student, through presenting information in different ways to the student so that they can create connections and also their own explanations, acquiring flexible and meaningful knowledge structures. The learning technology is the AR that will be developed using a Merge Cube® (Figure 1) and will be programmed on the CoSpaces® platform (Figure 2). The pedagogical model is that of augmented learning, proposed by Klopfer in Ketelhut, D. J. (2009) and which is defined because the learning environment adapts to the needs and inputs available to students.

Figure 1 Original Merge Cube. [Photography]. (2020)
Source: https://www.adorama.com/merarc01.html

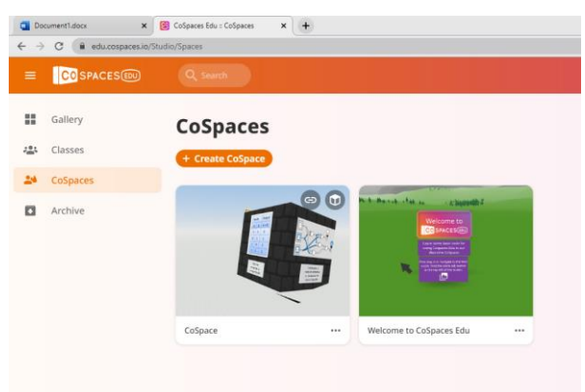

Figure 2 CoSpaces platform on the computer
Source: https://edu.cospaces.io/Studio/Spaces

Development

For the production phase of learning technologies, the following stages were developed:

- The specific content of the topic for which the learning object was developed was determined.

- The visual elements that could contribute the most to meaningful learning were identified and created; made sure they all had a high resolution.

- The distribution of the elements present in the merge cube was planned, according to the learning sequence, defined in the digital electronics course sheet, where the topics of: description of the gates, symbologies, truth tables and Boolean functions.

- Multimedia content was located to complement the learning experience, in this case it was a review video tutorial and an online simulator.

- A free teacher account was created on the CoSpaces® platform and a test access was managed that would allow the use of the Merge Cube® addon.

- A Merge Cube (R) was assembled from the printable version of it (Figure 3); to give a little more physical robustness, it was printed on matt opaline paper with a laser printer. Practically this would be the only investment on the part of the students.

- All the elements were uploaded to the platform: images, texts and multimedia files.

- It was created that created a main stage to welcome the student and to navigate through the different gates; As part of this main scenario, access to a padlet was placed, which in this case is the tool that will allow the student to interact with other classmates, while recording their learning in a dynamic and free way.

- A separate stage was created for each gate. This scenario is composed as follows: i) a very brief textual introduction accompanied by the gate symbol, ii) the gate truth Table, iii) the gate configuration in a real integrated circuit, as well as a photo of it, iv) an access to the video tutorial, v) the link for the online simulator and vi) a button to return to the main stage.

- A program was made for each scenario using block logic in CoSpaces®. The main stage program allows navigation to each of the seven gates as well as access to the padlet for recording learning. The program of the scenarios of each gate allows a fluid movement of the elements as well as what shows certain messages that provide a sensation of greater interaction.

- Finally, the CoSpace created, was shared in the platform's own cloud and the code and QR were generated for free access.

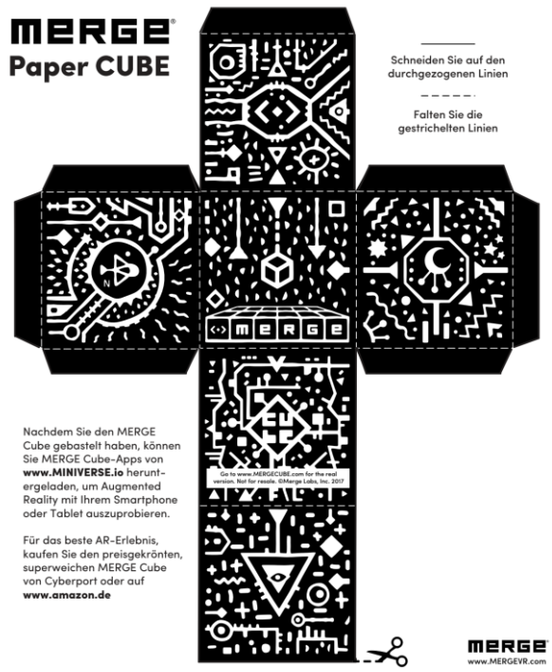

Figure 3 Merge Cube printable
Source: https://www.mergevr.com

Results

Figure 4 shows the CoSpaces® layout for the main stage. To access each of the gates and their specific content, on the screen of the cell phone or tablet, you must press the corresponding button. To access the created padlet, click on its logo and a balloon will be displayed indicating the access link, which was simplified through a personalized shortener. The student must enter the address on the device from which they want to navigate, since the current version of CoSpaces® does not allow direct linking to internet links or other web commands.

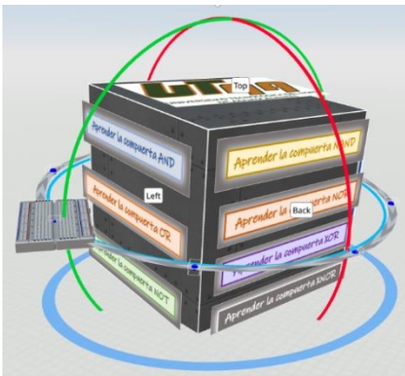

Figure 4 CoSpaces® design of the main stage
Source: Own elaboration

In Figure 5 the main scenario is shown as RA on the screen of a cell phone where the CoSpaces Edu application was previously installed. This application is free and can be installed on cell phones or tablets with Android or IOS operating system, does not require registration, does not include shopping offers and the only requirement is that the device where it is installed has a rear camera (Figure 6).

Figure 5 RA of the main stage observed through a cell phone
Source: authors

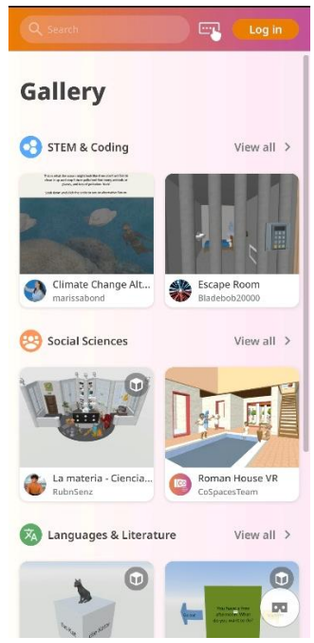

Figure 6 Screenshot of the CoSpaces application running on a Xiaomi cell phone
Source: Own elaboration

Figure 7 shows the distribution of the elements that make up the stage for each logic gate and their location on the faces of the Merge Cube®. When the graphic elements were integrated into the cube, they were located in such a way that they are part of it, but are separated from their surfaces and edges; this was done in order to increase the sensation of the AR to the user.

Figure 8 shows the program developed for one of the gates, in this case for the OR gate. Elements were integrated that increase the possibility of user interaction with AR, to increase motivation.

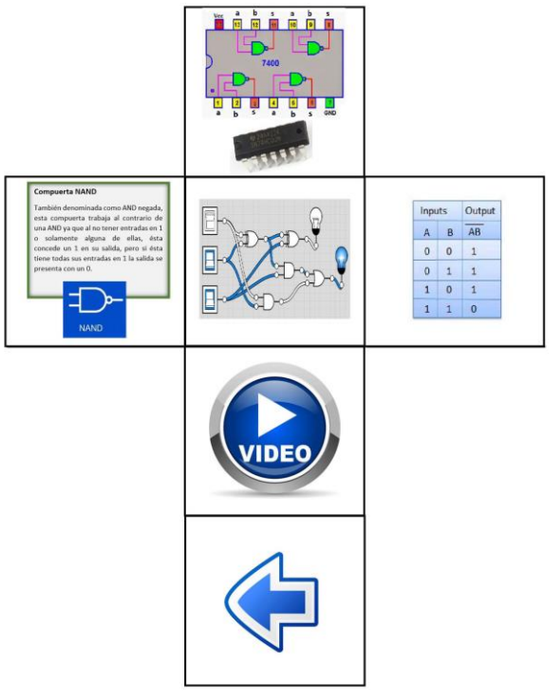

Figure 7 Merge Cube printable layout
Source: Own elaboration

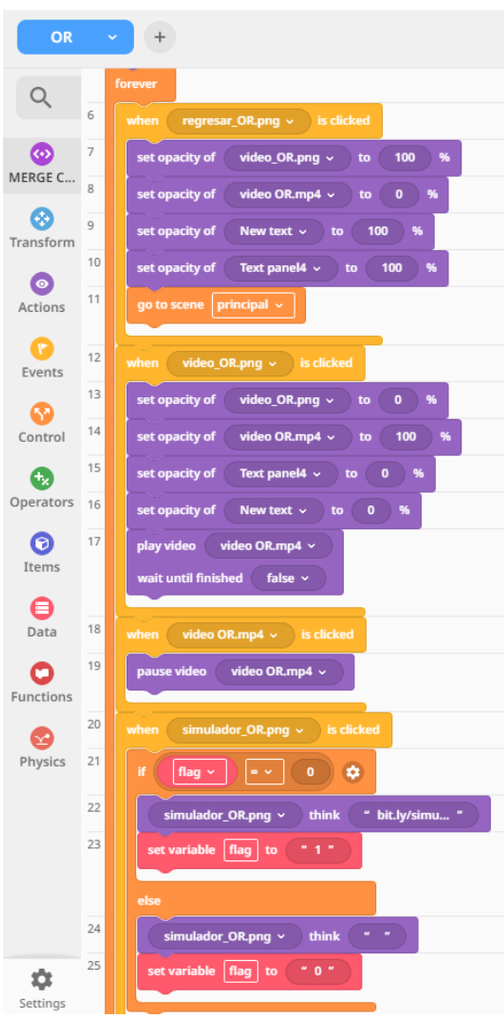

Figure 8 Program for the OR gate made in CoSpaces®
Source: Own elaboration

In Figure 9 the QR code is presented, which in turn integrates the alphanumeric code to access, from the CoSpaces Edu application, the learning scenario created.

Figure 9 QR and alphanumeric code to access the created learning scenario
Source: Own elaboration

Finally, in Figure 9 and Figure 10 the completed and fully functional learning scenario is presented; the execution of the AR can be observed through the screen of the cell phone where the test was done.

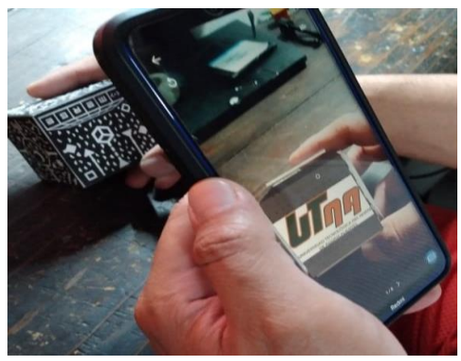

Figure 10 RA of the main stage observed through a cell phone
Source: Own elaboration

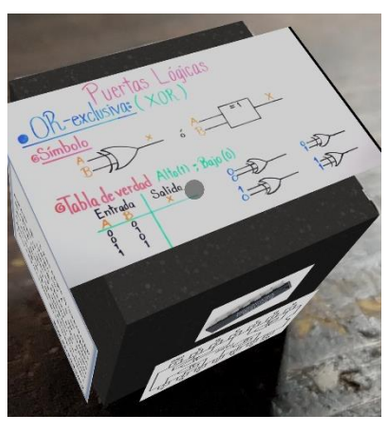

Figure 11 AR of the tutorial video observed from a cell phone screen
Source: Own elaboration

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Conclusions

The use of learning environments with AR in the first subjects of Digital Electronics, can accelerate the achievement of learning results and allow more advanced results at the end of the course.

With the constant advancement and development of AR content creation tools and technologies, coupled with the fact that these are increasingly being made available to society in general for free, it is presumed that AR can be a tool of widespread application for creating innovative learning objects and environments.

The use of the CoSpaces® platform allows the integration of multifunctions in the objects used, thanks to its integrated programming tools, which increases the possibilities and options of interaction in the learning environments with AR created from this platform.

Future job proposal

Train the UTNA faculty to apply the proposed methodology in the development of learning objects for their particular subjects.

Generate a free repository where the learning objects produced can be accessed, enriched and reused by all teachers. This repository would require basic information such as the description of the object, career and subject to which it belongs, explanatory video of the operation of the object, app required for its use, accompanying or complementary material, as well as contact with teachers who have worked in each object. This repository can be extended to several State Universities.

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Annexes

League for Printable Merge Cube: https://mergeedu.com/download/file.php?f=paper-merge-cube.pdf

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Intelligent system in sensory and cognitive development for the pre-reading stage

Sistema inteligente en el desarrollo sensorial y cognitivo para la etapa prelectura

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Abstract

The article is dedicated to the problem of acquiring knowledge and skills for the pre-reading stage in basic education. It examines the reciprocal relationship between the development of the cognitive and sensory system of the subjects in school classroom and knowledge formation. It is shown that the notion "tonal ear" is an ability to differentiate by ear the sound complexity in the ratios of sounds by height. At the same time, "the balance" of the ear is determined as a need for the development of the listening of the educator and the student. It will be granted that the game, as one of the valuable pedagogical strategies, must be the distinctive part of the intelligent system, represented by software's TOTEM 1.1, 1.2 and NOMOS 1.0. Objectives are to develop the tonal ear and its balance for the pre-reading stage in phonetic-phonological training through the realization, creation, and implementation of programs; to strengthen auditory knowledge of tone for the balance of the hearing system in school classroom subjects. Methodology: theoretical-experimental. Considerations: it is mentioned that the pre-reading stage is important in the development of phonetic-phonological knowledge and skills and inevitable in the communication between school classroom subjects.

Game, Software´s, Tonal Ear

Resumen

El articulo está dedicado al problema de la adquisición de los conocimientos y habilidades para la etapa prelectura en educación básica. Se examina la relación reciproca entre el desarrollo del sistema cognitivo y sensorial de los sujetos en aula escolar y formación de los conocimientos. Se muestra que la noción "oído tonal" es una capacidad para diferenciar mediante oído la complejidad sonora en las relaciones de los sonidos por altura. Al mismo tiempo, "el equilibrio" del oído se determina como una necesidad del desarrollo de la escucha de la educadora y el estudiante. Se concederá que el juego, como una de las estrategias pedagógicas valiosas, tiene que ser la parte distintiva del sistema inteligente, representada mediante softwares TOTEM 1.1, 1.2 y NOMOS 1.0. Objetivos son: desarrollar el oído tonal y su equilibrio para la etapa prelectura en la formación fonética-fonológica a través de la realización, creación e implementación de programas; fortalecer el conocimiento auditivo del tono para el equilibrio del sistema de audición en los sujetos de aula escolar. Metodología: teórico-experimental. Consideraciones: se menciona que la etapa prelectura es importante en el desarrollo de conocimientos y habilidades fonético-fonológicos e inevitable en la comunicación entre los sujetos de aula escolar.

Juego, Softwares, Oído Tonal

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Ludendo discimus
Leibniz, Gottfried Wilhelm (1646-1716)

Introduction

Boy hears but doesn't understand

At the same time something happens with one of our senses, with hearing: we hear everything, when we want and do not want to, when we can give an account and when we cannot, when we can pay attention and when we cannot: breaking the wind, piousness of a mosquito, noise of the mechanical workshop, hoarseness of the grandfather, cry of the teacher ... Poor ear! The teacher said something, but her squeaky voice was as low as that of a lady in her third age, which the student, although characterized as very considerate, could not hear. But he still heard and didn't understand what the teacher was about. It is a problem of the formation of the knowledge and teaching of the teacher, the expected and significant learning of the student in basic education. Listen or hear? Hear or listen? The "listening" process, unlike the "hearing" process, is a cognitive process, which develops for the most part in education. Cognitive development is the development of mental processes: perception, memory, imagination, formation of notions and logic.

As we know, the principle of educational processes is in the communication between the subjects of the classroom: the educator and the student. Among them is constantly developing the change of information, basis by which knowledge is constituted. The communication process follows not only in one direction, that is, from the educator to the student, but vice versa (Figure 1). Verbal relationships between classroom participants are direct and retroactive (Saussure, 1968–1974).

Figure 1 Communication
Source: Saussure F. Course in general linguistics

On this basis it is necessary to consider that the information with which the subjects of communication are exchanging with each other is not yet knowledge. For some knowledge to be true, the student must perceive the information that is a knowledge of the educator, then feel it, reason it, and return it to her. The educator perceives the student's information, reasons, verifies, and verifies the knowledge. We are faced with processes that come from the consciousness and mind of the educator and the student. Since then, perception, sensation, feeling, and reason are the constitutional powers of human consciousness and the state on which depends on the development of the skills and abilities of the latter.

Problem

Everyone hears, but not everyone listens! Verbal communication, which has a direction vice versa in school classroom between teacher and student, can be positive only in this, when and nothing else, only in this there is a tuning in the speech and listening of the subjects in the classroom. The principle of auditory attunement is a simultaneous differentiation of speech tones in the listening process. Guessing a tone, you hear is a skill of great importance in the communication process between teacher and student in Basic Education, since tone is the basis of the word. The word, which depends on the tone, can have any meaning, different understanding and be pleasant or offensive. The question: Do educational actors can differentiate tones?

The labyrinths of science

The medium of sound and hearing is so complex that, from very distant times to the present day, intellectuals seek answers in the fields of philosophy, science, medicine, and psychology. Sound is investigated by acoustics, which has thousands of years of discoveries. Hearing is explored by psychoacoustics, the basis of which are acoustics and psychology. In other words, psychoacoustics, which is a part of psychophysics, is dedicated to studying the quantitative dependence between the sound stimulus and the sensation it evokes.

Speaking, it shows the interest in the perception of pure tone through the two different procedures of the nervous system of the human being. It is undoubtedly that hearing is presented by two processes: one is hearing and the other is listening. It is important to clarify that to describe the cognitive process "listening" it is not enough to apply the knowledge and theories of acoustics, psychoacoustics, psychophysics, neurolinguistics, and music. Obviously, the explanation of listening, in the common, also determines as a cognitive process in its definition as a process of attention. Process of hearing (to hear) is well investigated and analyzed. It is based on the following scientific theories, from: microphone, electromechanical, string theory by Hermann von Helmholtz and current wave theory by Georg von Bekesy.

The process of listening (to listen) is little studied, some approaches prevail for the definition and revelation of specific characteristics, such as: modes of hearing by Pierre Schaeffer, who established a four of hearing modalities depending on the relationships between sound perception and sound attention: hearing, listening, understanding and comprehending (Schaeffer, 1966); by Ernst Schachtel, who described the hearing process according to where the hearing itself was focused: on the subject or on the object, the *auto centric mode of hearing* is a mode of subjective hearing based on the feeling of satisfaction or dissatisfaction of the subject before the sound stimulus (Schachtel); by Denis Smalley, who clarified the modes of indicative hearing, reflective and interactive, which describe the process of sound perception centered on the object and consider sound as a message and as a sign to be decoded (Smalley). The basis of the theories mentioned is in psychoacoustics, particularly, in the perception of a sound thing through the sense of hearing.

To the common state of hearing as a natural phenomenon are dedicated the searches of Casey O'Callaghan (O'Callaghan, Object Perception: Vision and Audition, 2008), (O'Callaghan, Sounds: A Philosophical Theory, 2007), and Matthew Nudds (Nudds, 2001). Different theoretical research on hearing defines the process of "listening" as "paying attention", but this can be incorrect and confusing. No theory of hearing that did not manage to oppose this phenomenon could be considered as a theory of listening.

Let's admit for the moment that listening, mentioned above, is a cognitive process and we turn our attention to this issue, considering that without hearing there is no listening. But to say something needs to be followed successively.

A tone is presented with a sound and is defined as "that attribute of auditory sensation in terms of which sound may be ordered on a scale extending from low to high" (ANSI, 1994). It is known of all, that sounds are classified: speech, musical, nature and noise. The sounds of speech and music, unlike the sounds of nature and noise, are organized into exact systems and with inherent nothing more than them, isolated, constant, and generating, being the artificial product of human creation. Sounds should be highlighted and distinguished by the individual's ear.

The difference between speech sounds and musical sounds as two distinct artifacts that are transmitted through the ear organ to the central fields of the brain, is in the following specifications: for speech sounds, the main constants are the specific timbres; in other words, the spectral characteristics of the voice, its basic frequency does not transmit the function of differential meaning and in the perception of speech we do not perceive this frequency; musical sounds have other characteristics of their constants and their emergence, their generating source is the height of the sound, and their constants are presented in the relationships of the sounds at their height.

In accordance with the above, the definition of sounds through their recognition by the ear is: the ear of speech, which is the ringing ear; the musical ear, which is the tonal ear. The tonal ear, similarly, with psychologists (Leóntiev, 1981), is an ability to differentiate by ear the sound complexity in the relationships of sounds by height, in classifications: high, medium, and low.

The ability to discriminate the tone is relevant in the process of communication in the school classroom based on understanding during teacher-student interpretation, for the formation of the necessary knowledge in teaching and learning.

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Taking as a reference the analysis of the results obtained in the experiments of the application of the tonal ear test, created with its own method in the development of the research, speech sounds and musical sounds have as a common basis through the ability of the human being, to be discriminated by his ear in the precise height of the sounds (speech recognition, the musical scales, the sung word, the vocal lyrics in the prolonged pronunciation: the ancient religious songs and the arias of the operas of the "bel canto" style. We call this ability the ability of the tonal ear.

The tonal ear known since distant times as "the absolute ear", generally in people dedicated professionally to music, is the ability of the human brain to discriminate the tone. With this ability the sounds are distinguished or differentiated in their height and in their relationship by the precise height. Thinking about the situation of Basic Education, the state of teaching and learning of teachers and the human formation of students, the requirement of the development of the auditory system through the balance of the tonal ear was specified. Thus, consequently, an idea and a model were engendered to develop and implement the guessing game: Guess what tone you listen!

Theoretical reference

Provided that we consider that the absolute ear as the tonal ear is a basis of the listening process and the ability to differentiate the tones by the explicit height, it is necessary to specify the characteristics of the listening.

Listening, and this is the common thing between hearing or listening, is characterized by the movement of sound perception, being like the auditory sensation in its first appearance in the consciousness of the human being. Then, particularly, it is recognized as a sound object, imagining it, and then begins to know giving the notion to the sound, thinking, if it is sound of the precise height that he hears, knows, and distinguishes. That is, the listener with his absolute hearing capacity can find the same sound, which he perceived, in thousands of others.

Similarly, we support Kant who describes in the "Criticisms", where a distinction is made between mind and knowledge that thinking and knowing self-object is not a similar thing (Kant, 2001-2006), considering that to know a sound there must be the notion and contemplation. To determine the process of listening you must persevere in the intervention with a method: stimulus – response, and not as in psychology: stimulus – reaction. The difference is in the discernment between action of the mind and action of the immediate opposing movement. We must continue along the path to discover the intellectual development of the agents of education, where it is important to develop the tonal ear as the basis of understanding and comprehending between the teacher and the student.

Methodological reference

In line with the essential interest of the subjects of the school classroom to learn, it is important to agree on the importance of play as one of the valuable pedagogical strategies. Since ancient times the thinkers of the world admired the game as a harmonious union between man and cosmos and discovered in the game the mechanisms of the development of the mind and ability to know the Universe.

According to Huizinga, the game is a function of the living being and is not reduced to the culture of humanity, but the culture itself has the nature of the game (Huitzinga, 2000). The game extends towards mind and cognition, logic, and sense (Heidegger, 2006), increases development (Vygotsky L., 1933) and intellectual formation (Fokin S., Aprendiendo a leer, 2008).

To be more specific, the following is transferred, that the game: a reality and a treasure of the intellectual world of the player is presented; the need of man in his native perception and realization is satisfied; it lights up the way to discover the truth and its implication; it marks the difference and equality in the search for the measure of the balance of the possibilities of the human being. Learn by playing!

Playing the child learns

In situ, with respect to the theories of speech perception and speech sounds, the priority is motor theory: identification of speech elements and their sounds by listening is based on the motor characteristics of pronunciation and acoustics. Therefore, listening (e.g., right ear) in the perception of the acoustic signal of tone "*a" define* the auditory description "*x", looks* for the driving commands "*y1", "y2"..."yj" with* the discriminated signal "*f1", "f2"..."fj"* and the variation of the reason based on the intention "*I1", "I2"....*" Ij"; this phenomenon forms an image of the tone "*c" in* the consciousness and mind of listening.

Speech: $c \rightarrow \{I1, I2, \dots I j\} \rightarrow \{y1, y2, \dots yj\} \rightarrow \{f1, f2, \dots fj\} \rightarrow \{x1, x2, \dots x j\} \rightarrow a$
Listening: $a' \rightarrow \{x'1, x'2, \dots x' j\} \rightarrow \{f'1, f'2, \dots f'j\} \rightarrow \{y'1, y'2, \dots y'j\} \rightarrow \{I'1, I'2, \dots I'j\} \rightarrow c'$, $a = a'$ $(c = c')$

Returning to the topic at hand, methods of the tests were created, which were applied to a population of students of the degrees in preschool and Artistic Education, baccalaureate, and preschool education, as well as to teachers of Normal Education, to create an expert system in the assessment of the state of the auditory system. Two expert systems "TOTEM 1.1" (Fokin S., TOTEM 1.1 Registration Number 03-2017-110611425000-01, 2017) and "TOTEM 1.2" (Fokin S., TOTEM 1.2 Registration Number 03-2017-110611410400-01, 2017) were created to examine the auditory system of children, youth, and adults. The results of application of the tests described the situations with the negative magnitudes: $a \neq a'$ $(c \neq c')$; $a \geq a'$ $(c \geq c')$; $a \leq a'$ $(c \leq c')$. Henceforth, in experiments with the application of the test, the situation $a = a'$ $(c = c')$ was a unique case, i.e., the subject had absolute hearing.

3.1 TOTEM

It should also be said that a unique case allowed us to begin to develop not only a cognitive model, but a physical model and implement software such as expert systems to know the behavior of the balance of the tonal ear in the process of listening. I was aware of the following circumstances and conditions:

- The objects of this procedure are the object of the notion and sensitive object.
- The cognitive model is also physical model, based on physical magnitudes.
- The basis of the model should be the particularities of absolute hearing, which are perception, auditory exposure, memory retention and recognition of pitch patterns.
- The auditory sensation depends on the height of the tone, time, and mental capacity in discrimination of this.
- The act of cognition is performed in the mind

Let's explore a little the idea that the nature of the mind is physical nature, so it is possible to establish relationships between two natures using the "stimulus-response" system (Figure 2).

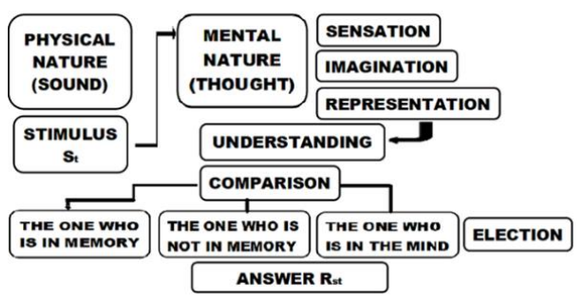

Figure 2 Stimulus (St) – Answer (Rst)

The stimulus between the peripheral auditory system and then the central auditory system, proceeds in the mind appearing as a sensation, then as imagination and then as a representation, then a cognitive work of comparison and choice is made, which represents a game like the games that accompany human beings all their lives, then the answer is given. Psychologically the answer can feel like a triumph of man's voluntary choice. There is the satisfaction and interest of playing.

TOTEM

Playing like a child

To better understand what I wrote above, it is necessary to deploy and concretize the guessing game, and it is not a simple game, but an intellectual game: listen, perceive, think, differentiate, and respond.

TOTEM 1.1 software is an expert system that acquires information, analyzes, and presents results. It is divided into different screens: register, choice of sound timbre (pure or piano), stimuli for each ear separately, search field and choice of tone of the stimulus heard, a differential calculation system and two representations of results, on the one hand, is of each of the two ears separately and, on the other, is a total, the results will be checked in different mathematical applications.

The core of the stimulus system (15 st´s) is the modal attraction of tones in a tonality. In contrast to studies of psychoacoustics (Weber-Fechner empirical law, Stevens scales), the use of a characteristic of sound: intensity, manifested as unnecessarily. This situation made it possible to specify the alteration of the auditory balance that appears at the same time as negative and positive. That is, that listening, which is the perception of tone, and response, which is the movement of thought, in the left ear is altered positively, while in the right ear negatively. Graphs (10, plus a standard pattern that is time) of alterations were formed. The content of the riddle is constituted by the finding of the isolated tone as a perceived stimulus in the corresponding field of sound without the intervallic relation.

Functions of TOTEM 1.1

- Teacher perceives, then listens to the tone, guesses, looking for the same tone among others and finding the tone, confirms it (Figure 3).

- Expert system acquires the results of "Riddle", analyzes, and gives the numerical answer of the Tonal Ear Balance of the Auditory System of the teacher, presenting the positive o negative alterations in the cognitive process: mind-knowledge.

- Constant of tonal discrimination by both ear is equal to 0. 4999... Probability = 0.001851851...

Figure 3 The teacher plays like a girl. Application of the test TOTEM 1.1

TOTEM 1.2

Playing as an adult

The structure, content, and functions of the TOTEM 1.1 and TOTEM 1.2 software are similar. The only difference is the magnitudes of the stimuli. This was determined for only one reason: the difference in the field of auditory perception of the child and adult. Relationship between two software's is regulated with some constants.

The child plays with totem 1.2 software (Figure 4).

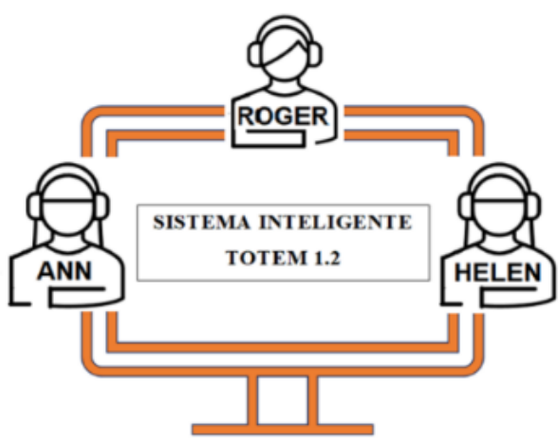

Figure 4 The child plays like an adult. Application of the test TOTEM 1.2

I would have made it a huge mistake that the listener does not hear the same as the speaker, i.e., that the auditory mechanism of the listener (the mechanism of auditory perception) is not prepared for the speech perception of the speaker, who transmits the auditory information prepared by the auditory mechanism of himself. And since the communication process is vice versa, the speaker who is a listener does not perceive something that is spoken by the listener who is the speaker.

Imagine, a student hears, but doesn't listen to the teacher and doesn't understand, and the teacher hears, but doesn't hear it and doesn't understand either! But the reality is already sincere: playing I learn. Do I learn what he tells me? Therefore that, it is necessary to increase the capacity of the tonal ear and develop my auditory system using a set of exercises of a cognitive software.

The child thinks by learning

Oh, no! To think that I, as a child, have difficulty listening to the teacher, because I don't understand, what she is saying. I pay attention and again and again I don't understand. As a result, a displeasure arises; I think, that's an effect that caused my ear and ... of the teacher. Deafer as walls!

NOMOS

According to the results of the application of the TOTEM tests, it is stated that there is an imbalance of the tonal ear in the subjects of the school classroom. The communication process runs with difficulties.

That is why they created the blocks of integral exercises and software NOMOS 1.0 (Fokin S., NOMOS 1.0 Registration Number 03-2017-110611390300-01, 2017) for the development of the tonal ear as a basis for increasing the hearing capacity of the teacher and the student in basic education. The exercises were organized into 72 blocks with four exercises in each for left (36) and right (36) ear, time of each exercise is 0'14". The basis of the creation of integral exercises based on musical methodology were the following sources: the theories of acoustic structures of ancient Greeks, Byzantines, Italians, and Germans, employing a hypothetical structure of the attraction of sounds in different modes of the tempered musical system.

Greek scientists knew that in a string you can get several sounds not only with the entire length, but also with their parts: 1/2, 2/3 and 3/4. The sounds they obtained by oscillating the parts of the string formed the intervals with their fundamental tone: octave - 1/2, fifth - 2/3, fourth - 3/4. That formation was called the "Pythagorean Formation."

The formation of Pythagoras was done with the mathematical method. When 2/3 of the whole string gives the sound of a fifth above its fundamental tone and 3/4 of the whole string gives the sound of an ascending fourth of the same tone, for 2/3 of any part of the string must give the sound of a fifth above this part and 3/4 of any part of the string give the sound of a fourth above this part. However, if the fundamental tone is "C" and when you take 2/3 of 2/3 of the string (4/9), then you get the sound corresponding to the tone "D1". This sound is out of bounds of the octave C – C1. You take instead of D1 the tone D, which is at a distance of octave down, and you get the tone of 8/9 of the string.

Then, the tones are formed as follows:

- 2/3 of 8/9 (16/27) is tone A.
- 2/3 of 16/29 (32/81) is the tone E1, this tone is out of bounds of an octave C – C1, the tone E is going to have the magnitude of 64/81.
- 2/3 of 64/84 (128/243) is the H tone.

In this way the major diatonic scale of Pythagoras is formed (Table 1):

C	D	E	F	G	A	H	C1
1	8/9	64/81	3/4	2/3	16/27	128/243	½

Table 1. Pythagoras. The larger diatonic scale

The Pythagorean formation is an infinite formation, that is why in the sixteenth (Zarlino) and eighteenth (Werckmeister) centuries the sound magnitudes of the tempered musical system were corrected and established, which until the present day are in the utility. "International Organization for Standardization (IOS)" adopted for the tempered music system the frequency (Pitch) of note A5 which will be 440 Hz.

According to Fokine S., to distinguish the fingerboard of different musical instruments and voice, which is used in Mexico, the tempered organization, for example, of the piano contains seven complete octaves and two incomplete ones, from the beginning of keyboard to the end and is divided into indices (Fokine, 2004).

Then, A5 belongs to the octave of index 5. In the research and application of the tests, tones of the tempered musical system of the octaves were used in different indices. In the tests "TOTEM1.1 and "TOTEM1.2", which were presented as "stimulus" the pure tones of the octave of index 5, related to grades I, IV and V in Ionic mode (Ursprung, 1940), and as "the answer" was a set of tones distributed randomly.

The integral exercises were created according to the magnitudes of the tempered musical system (the corrected Pythagorean formation of the sounds), the results obtained in the application of the auditory tests and the hypothesis of the attraction of the sounds. For each of the groups and subgroups of the subjects in the classroom, different blocks of exercises were created.

The main idea was to establish the balance of the ear you need to “go up" (ascend), "lower" (descend) and "fix" the physiological structure of the auditory system or its part. It should be mentioned that to this day in science there is no definite and clear answer of how the peripheral and central auditory system works in the process of listening in tonal discrimination.

Well, from the point of view of the problem, the following is specified, for example: that for children of subgroup I (negative alteration of the right ear) they need some exercises to "raise" the physiological structure of the ear; for children of subgroup IV, they need some exercises to "lower" the called structure.

According to hypotheses of the attraction of sounds and the anatomy of the cochlea, the idea of using the small intervals (2m and 2M) in fingerboard of an octave in the voice and ear area of the child in the form of upward and downward movement with harmonic support, considering the classical harmonic laws and rules was embodied. The thing is that the use of intervals (2m and 2M) only without harmonic support has no relation to the tonal mode.

This situation causes the chaotic formation of sound structures. In this case there is a need to order the movement of the tones by means of the harmonic rules that allow the movement of the attraction between them.

The exercises were created based on the tempered musical system that is constituted by the tones formed in two fundamental structures, which were approved and determined historically and by the sound space (tonal ambitus) that is around the human being: one is the complex modal tetrachord, and another is the octave. The sounds of exercises were formed by the principle of the functioning of the aforesaid structures, i.e., by the principle of attracting stable and unstable sounds (passive and active).

For the formation of auditory knowledge and development of the tonal ear the exercises must be heard and sung at the same time, although the systems of the phonation and auditory apparatus are linked with the afferent and efferent pathways. Likewise, the control of speech and listening is carried out with these systems. The exercises are sung with the vocal lyrics (A, E, I, O and U) in certain sequences. Therefore, the exercise blocks were created with the purpose of increasing the strength of the student and the teacher in the acts of hearing and singing, at the same time controlling the tonal change and enlarging their will in the activity of listening. The increase in strength (ability) is defined and the development of tonal ear balance is demonstrated. The student and the teacher with such intelligence can discriminate the tone because their relationship in the classroom communication is attuned.

Based on the material presented through the research, software "NOMOS1.0" will be created, a program for the development of the auditory system of the student and the teacher. The word "nomos" of Greek origin means the germ of the most extensive melodic formations, an expressive turn that occurred in a certain region of the voice.

Functions of NOMOS 1.0

- Principle: to establish the Balance of the Tonal Ear for listening it is necessary to "go up" (ascend), "lower" (descend) and "fix" the psycho-physiological structure (mind-knowledge) of the auditory system or its part.

- Student/teacher from results of Tonal Ear Balance execute through NOMOS 1.0 in the form of a game the auditory-phoniatric musical exercises, developed by the Greek, Byzantine, Italian and German theories about the hypothetical structure of the attraction of sounds (Figure 5).

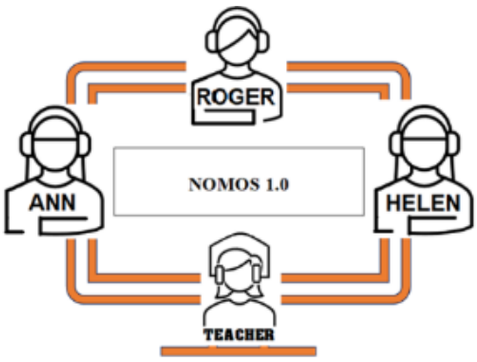

Figure 5 Learning, I think. Application of the software NOMOS 1.0

The child develops thinking

An important point of the goal of education is the formation of the Human Being who defines himself as a thinking man. Humanizing education is an objective of world politics. Pedagogy with its human essence is guided to the path of cognitive development of the faculties of man, so requested in society. Among the intelligences of the subjects of the school classroom in Basic Education is appropriated the development of the auditory system around the balance of the tonal ear.

Increasing the cognitive ability to discriminate tone in both the speaker and the listener means the development of the auditory system, the necessary condition in the pre-reading stage. For this, it is necessary to diagnose the auditory state (tonal ear) of the speaker and the listener, to later implement a program of adjustment and balance of the ear.

Conclusion

The intelligent system, cognitive and sensory software, which includes the programs TOTEM 1.1, TOTEM 1.2 and NOMOS 1.0, is a kind game in the form of guessing for children and adolescents, which allows to acquire necessary information, analyze, present results for the development of the tonal ear and its balance in the auditory system of the Human Being.

The pre-reading stage was completed with the establishment of tonal ear balance and the formation of phonetic-phonological knowledge and skills, so necessary so that the child can begin to learn to read.

EVERYONE HEARS, EVERYONE LISTENS!

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Impact of technology for educational development at the higher education level at the Universidad Veracruzana in times of SARS-CoV2 in Poza Rica Veracruz, Mexico

Impacto de la tecnología para el desarrollo educativo a nivel de educación superior en la Universidad Veracruzana en tiempos de SARS-CoV2 en Poza Rica Veracruz, México

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Abstract

Evaluating the use of ICT at the higher education level is essential for every educational institution, because it allows knowing the degree of user satisfaction and the required needs, to later carry out a planning with strategies and actions that support their improvement. This research work is an analysis study carried out on the digital strategies used by the Faculty of Mechanical and Electrical Engineering of the "Universidad Veracruzana" in Poza Rica Veracruz, Mexico, during the COVID-19 contingency. Through an opinion survey applied to a sample of 300 students. Which allows us to identify the strengths and weaknesses of using a 100% virtual teaching in turn to know the difficulties that students presented, the attention they received, and how confinement affects school performance.

Virtual education, SARS-CoV2, ICT

Resumen

Evaluar el uso de las TIC a nivel de educación superior es fundamental para toda institución educativa, debido a que permite conocer el grado de satisfacción de los usuarios y las necesidades requeridas, para posteriormente realizar una planificación con estrategias y acciones que apoyen su mejora. El presente trabajo de investigación es un estudio de análisis realizado sobre las estrategias digitales utilizadas por la Facultad de Ingeniería Mecánica y Eléctrica de la "Universidad Veracruzana" en Poza Rica Veracruz, México, durante la contingencia por covid-19. Mediante una encuesta de opinión aplicada a una muestra de 300 estudiantes. La cuál nos permite identificar las fortalezas y debilidades de utilizar una enseñanza 100% virtual a su vez conocer las dificultades que presentaron los estudiantes, la atención que recibieron, y como afecta el confinamiento el rendimiento escolar.

Educación virtual, SARS-CoV2, TIC

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Introduction

Faced with a situation like the one we live in today, where a global pandemic has forced us to modify not only the way we live together as human beings, but also the way we teach, the challenge of modifying face-to-face classes to adapt them to a digital format was not easy. Although online classes are not new, it is an issue of great impact in our country because not all regions have internet and not even with adequate electrical infrastructure, another issue to consider are the electronic devices needed to develop the projects. Within the Universidad Veracruzana, Faculty of Electrical and Mechanical Engineering in Poza Rica Veracruz, Mexico. There is a community of students from different places, where these problems occur. Beyond considering that no one was prepared for this new reality.

Target

Determine the needs of the students and create improvement strategies to maintain the quality standards of the Universidad Veracruzana.

Why is it important to know the perspective of the student community regarding the virtual modality?

Given the need to cancel face-to-face classes due to the current contingency. The Universidad Veracruzana in an attempt to continue maintaining the quality standards resorting to different digital tools including EMINUS, to continue providing attention to 87,388 students [1] enrolled in formal education within the university community. It is worth mentioning that the proposal presents some difficulties and above all the impartiality with which the model can be developed. Some factors to consider are the availability of electronic equipment, to the student's emotional state in the face of confinement and possible health problems.

To determine this situation, the Faculty of Mechanical and Electrical Engineering of the Poza Rica-Tuxpan Region, through surveys of a sample of 300 students from the four educational programmes offered in the period February-July 2021, which are: Mechanical Engineering, Electrical Engineering, Electrical Mechanical Engineering and Industrial Engineering.

It is essential to stop and analyse the impact, repercussion and return of each of the actions that have been carried out to face the challenge of modifying the face-to-face teaching method to a digital format. There is no point in launching actions without knowing if they are effective or, on the contrary, if they have not had the expected impact.

Hence the need for a research process.

Methodology

Through a quantitative and qualitative analysis that arises from the analysis of each response related to the students who were part of this work, it is of utmost importance to carry out a clear and concise work on our strengths and weaknesses in this area. It is necessary to apply a research method that collects all the data in order to get an idea of our current situation.

Each stage in the development of our process is explained below.

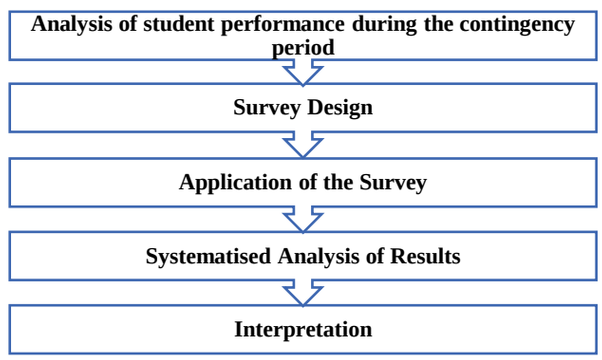


Figure 1 Phases of research development
Source: Own elaboration

Analysis of student performance during the contingency period

This consists of carrying out a visual inspection and detecting the number of students who have had difficulties in accrediting a subject.

Design of the survey

The questions are formulated according to the observations, regarding the possible problems that the students had when sending the evidence of their respective educational experiences.

Opinion survey on the impact of technology for educational development at the undergraduate level at the Universidad Veracruzana in times of SARS-CoV2.	
1.	Do you have an internet connection with an acceptable bandwidth to access the virtual classes taught by the professors of the Faculty of Mechanical and Electrical Engineering, Poza Rica-Tuxpan Region?
2.	What electronic device do you usually use? When doing homework, submitting evidence and connecting properly in the virtual classes of the Educational Experiences you are taking during the contingency.
3.	How often did you send activities or participate in virtual forums and meetings within the activities proposed by the professors of the Universidad Veracruzana?
4.	What were the difficulties you encountered and why did you not participate in the proposed activities of the Educational Experiences you carry out online?
5.	Do you consider that you have the ability to use digital tools, conduct research work, carry out quality activities and use digital platforms to access virtual meetings?
6.	How do you consider the learning gained from the Educational Experiences you are taking during the virtual classes due to Covid-19?
7.	The Universidad Veracruzana has the EMINUS platform to promote education systems. Do you consider that the platform meets all the requirements for online education?
8.	During the contingency, do you incur additional costs for e-learning?
9.	Has the quarantine confinement established by the health authorities affected health?
10.	How do you consider the use of digital platforms (Skype, Zoom, Line, WhatsApp, Telegram, among others) has supported teaching processes?
11.	How would you rate the performance of the School of Mechanical and Electrical Engineering in virtual teaching during the contingency period?

Table 1 Survey questions
Source: Own elaboration

Application of the survey

This work has a sample of 300 students, formed by students of the educational programmes of mechanical engineering, electrical engineering, mechanical and electrical engineering and industrial engineering, which were carried out virtually through the Google Forms application.

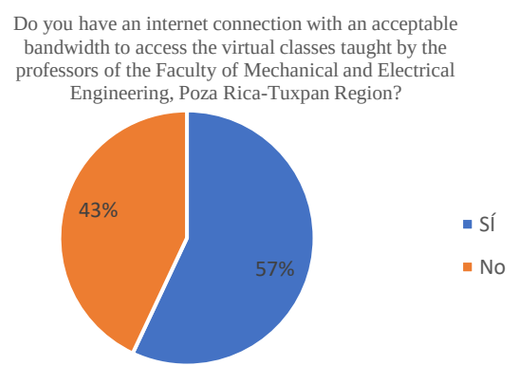
This survey seeks to generate the necessary information to be able to correctly develop the fourth step.

Figure 2 Screenshot of the survey conducted on the Google Forms platform.
Source: Own elaboration

Systematised analysis of results

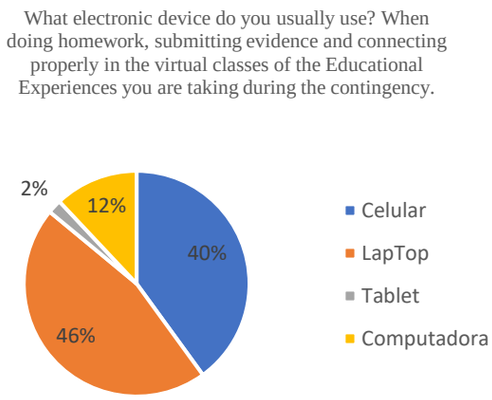
Data was collected from the students who participated as a sample from the different Educational Programmes. The data were obtained quantitatively, the results obtained in each of the questions are shown below.

Despite the fact that nowadays most of the country has telecommunications infrastructure, it is a reality that it is not always in ideal conditions, an example of this is represented in Graphic 1, where it can be seen that 43% presented connection problems when trying to connect to take a virtual class.

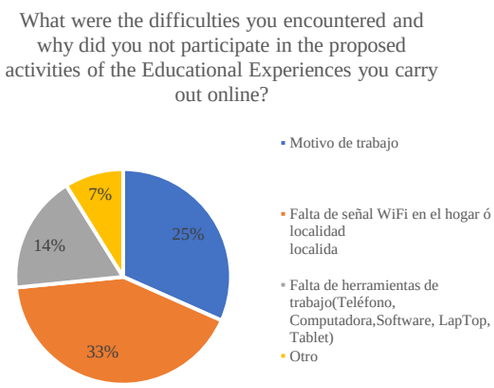


Graphic 1 Question Results 1
Source: Own elaboration

The devices that students tend to use for their practicality are those shown in Graph 2, where the mobile phone and laptop show a high demand for its practicality, portability and economy, because some students do not have enough money to purchase a fixed equipment as shown in Graph 3, which also shows the rest of the possible difficulties that students presented during the contingency period, such as: poor internet signal reception, the acquisition of software that serve as support tools that can be used when developing the respective projects for each educational experience.

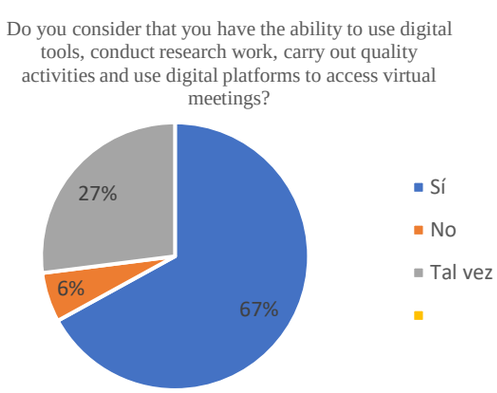


Graphic 2 Question Results 2
Source: Own elaboration



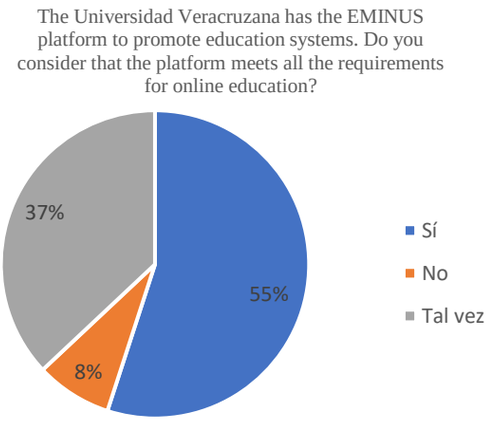
Graphic 3 Question Results 4
Source: Own elaboration

Currently, during their academic training, students have been developing and perfecting technological skills, which is why taking classes in this modality is not complicated for them, as shown in Graph 4; however, it should be noted that there is still a lack of culture at the time of intervening in a virtual class, considering delivery and participation times within the same.

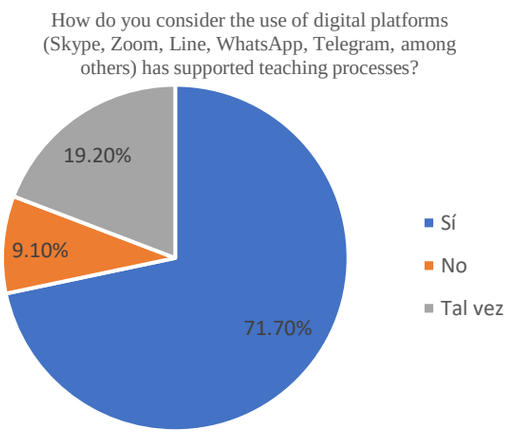


Graphic 4 Question Results 5
Source: Own elaboration

Within the Universidad Veracruzana, the EMINUS platform is available. On the other hand, 71.70% consider that the use of messaging tools such as WhatsApp, Line, Skype, Zoom, Teams, etc., support the teaching processes, as shown in Graph 6. support the teaching processes as shown in Graph 6.

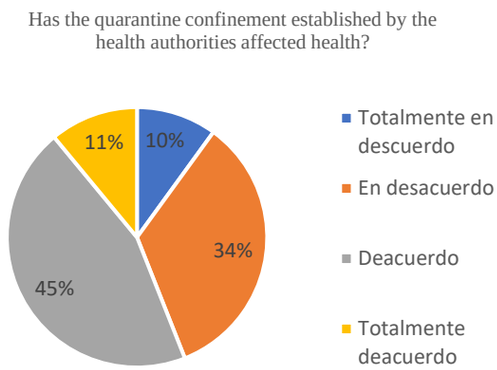


Graphic 5 Question Results 7
Source: Own elaboration

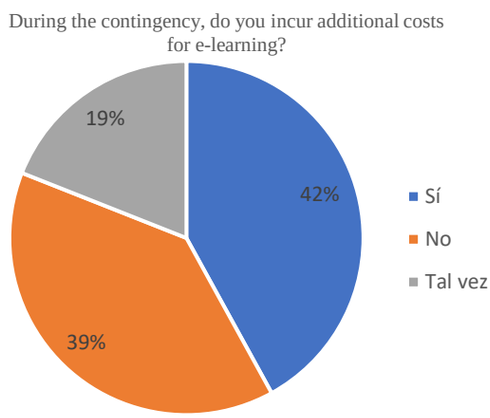


Graphic 6 Question Results 10
Source: Own elaboration

During the contingency, not only has it affected health, but also the psychological aspect by drastically changing the lifestyle not only of students and teachers but also of the population in general, as shown in Graph 7. It can be seen that 45% of the students have presented problems of anxiety, irritability and insomnia. Another aspect to consider is that confinement has increased household expenses by 42% when doing e-learning, as shown in Graph 8.

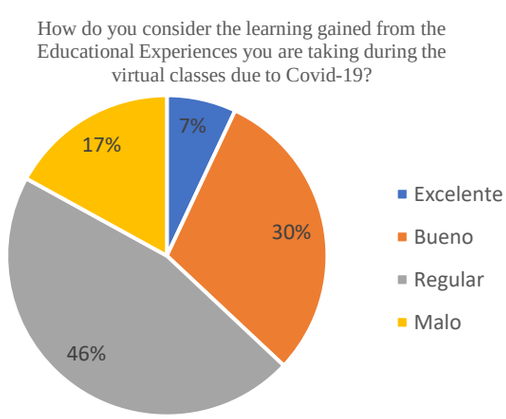


Graphic 7 Question Results 9
Source: Own elaboration

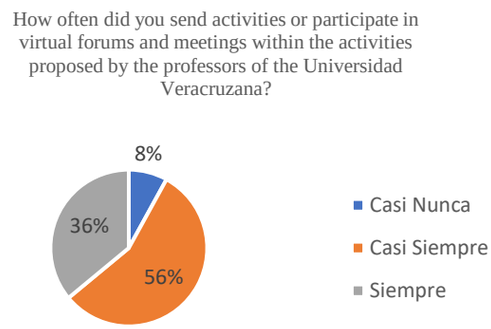


Graphic 8 Question Results 8
Source: Own elaboration

Derived from all the factors mentioned above, the question shown in Graph 9 was formulated, which reflects that students consider learning to be regular with 46% during the virtual modality. It is worth mentioning that according to the census, the submission of activities and student participation was 56% for students with regular participation, for students who submitted all activities it was 8% and with 36% for students who hardly ever submitted activities. As can be seen in Graph 10.

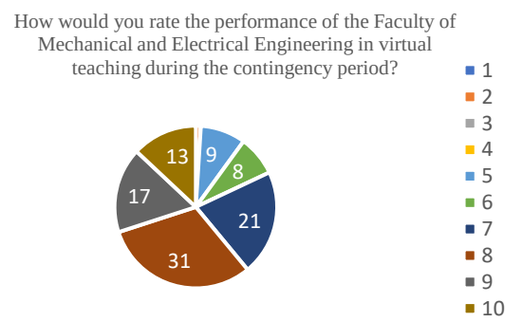


Graphic 9 Question Results 6
Source: Own elaboration



Graph 10. Question Results 3
Source: Own elaboration

According to the performance of the teachers, when teaching their classes in the virtual modality, the students of the Faculty of Mechanical and Electrical Engineering, position it with 31%, placing it with a score of 8, giving a result in a "Good" level as shown in Graph. 11, however, it is worth mentioning that there are still aspects to work on in order to achieve excellence.



Graphic 11 Question Results 11
Source: Own elaboration

Results

As can be seen in the analysis of the graphs, the Universidad Veracruzana has shown a Regular performance, however this category is not only the result of the performance of the teacher in a virtual classroom, several factors also influence the student, it is important to mention that not all communities have the infrastructure, not all students have access to technological devices to carry out their activities, Another important point is the commitment and responsibility on the part of the student to attend virtual meetings and comply with project deadlines, as well as the responsible use of electronic devices, because sometimes they are used as a distraction instead of as a support tool to access the information that is essential for their training.

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Conclusions

Although, as a teacher, it is important to have a mastery of ICT, and that given an epidemiological situation, which forced us into a confinement where most teachers were not prepared to face such challenges, and that today will be a new reality, where: conventional classes became obsolete, the duality of face-to-face classes and the virtual will be essential for the development of new skills and competencies, being aware of this, the Universidad Veracruzana developed a virtual training through the Academic Training Program (PROFA) [5]. In which, courses are offered by the University itself, which allows updating teachers covering areas such as: Design, Technology, Management and Awareness that contribute to the development of five competences: Communication, Self-learning, Planning, Research and Evaluation. On the other hand, it is also important to carry out training courses for students on how to use institutional platforms such as: EMINUS and the complementary ones Teams, Zoom... etc., with the aim of taking advantage of the tools and reinforcing the learning obtained.

On the other hand, it is worth mentioning that the application of these strategies does not guarantee that the objective of excellent teaching is achieved one hundred percent, because there are factors that exceed us as a public institution, although within the facilities of the Faculty of Mechanical and Electrical Engineering there is a computer lab and a wireless Wi-Fi network, however, many students do not have the resources to have a laptop or internet at home or in their community, just as they need to leave their home to work.

Our country, in spite of its richness in terms of culture, agriculture, livestock, etc., still has the problem of not having an electrical infrastructure and services that reach all communities, in addition to the fact that job opportunities are reduced.

On the other hand, it is important to raise awareness among students to create a culture of how to behave in virtual meetings, to learn to organise themselves and meet deadlines and probably avoid problems of insomnia, anxiety and stress when sending evidence.

The present work showed a reality that our teaching system cannot be 100% virtual, because not everyone has the digital tools, even with the money to pay the increased cost of services produced by being in online classes, however, a possible solution could be to implement a blended learning to ensure proper student-teacher interaction.

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Programming: From abstraction to practice

Programación: De la abstracción a la practica

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Abstract

This article presents a study based on the experience acquired in 18 years working as a teacher in the Information Technology career in the area of software development. Where it has been seen that when students enter the career the range of knowledge is very varied, since there are students who come from technical high schools in which they have already had experience in the programming area and on the other hand we have students who come from a non-technical high school in which they have no experience in the area. Hence the problem of teaching a programming class in which we can achieve the goal that all students develop their logic. This is why a survey is applied to find out if the student has the basic concepts of the programming area since most students learn to program mechanically, not developing their critical thinking to solve problems other than those solved in class. The contribution of the study shows us that to a certain degree, most of the students have the theoretical concept, but they do not know how to apply it in practice.

Abstraction, Programming, Paradigm

Resumen

Este artículo presenta un estudio basado en la experiencia adquirida en 18 años de trabajo como docente en la carrera de Informática en el área de desarrollo de software. Donde se ha visto que cuando los alumnos ingresan a la carrera la gama de conocimientos es muy variada, ya que hay alumnos que vienen de bachilleratos técnicos en los cuales ya han tenido experiencia en el área de programación y por otro lado tenemos alumnos que vienen de un bachillerato no técnico en el cual no tienen experiencia en el área. De ahí el problema de impartir una clase de programación en la que podamos lograr el objetivo de que todos los alumnos desarrollen su lógica. Es por ello que se aplica una encuesta para saber si el alumno tiene los conceptos básicos del área de programación ya que la mayoría de los alumnos aprenden a programar mecánicamente, no desarrollando su pensamiento crítico para resolver problemas distintos a los resueltos en clase. El aporte del estudio nos muestra que, hasta cierto punto, la mayoría de los alumnos tienen el concepto teórico, pero no saben aplicarlo en la práctica.

Abstracción, Programación, Paradigma

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Introduction

At this time the growth of technology has been by leaps and bounds with respect to Hardware, but unfortunately at the Software level they do not meet the perspectives that are sought, for example, the construction of quality software, generate reusable software and make software with engineering processes.

Always at a historical level, Hardware has been ahead of Software development, so there is a great demand for quality software developers, who exist, but most do not meet expectations.

Various ways to improve are not used them properly to provide the desired solutions as in the case of programming paradigms.

Whenever we are going to solve a problem, we face the difficulty of having to find just that, a solution.

Rarely do we stop thinking there is a structural path to solve any problem, obviously having to go into the minimum of detail depending on the problem. Nevertheless, do we really follow that path or is there a path that will help us to find the right solution?

Seeking to be more practical than abstract that would be the solution to all our projects in the programming area.

Methodology to develop

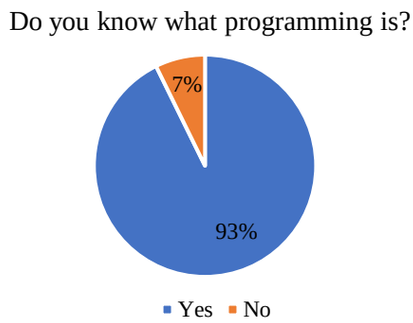
To carry out this research, the Quantitative methodology is used. This questionnaire was applied to 110 people (people who work in the IT area).

Over time, it has been identified that the students enrolled in the different careers of the Technological University have been struggling in the area of programming. In addition, we have found that they used to memorize the processes and not to reasoning the steps of the algorithms that they design and they do it in a mechanical format

A questionnaire is applied; it contains true or false questions. The objective is to verify that 100% of the sample responded positively, because they are people who are already work in the systems area.

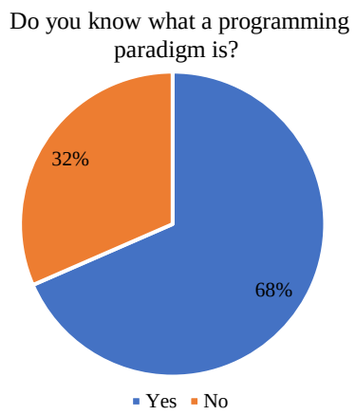
The questions are as follows:

1. Do you know what programming is?



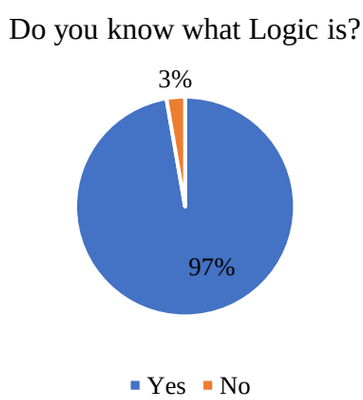
Graphic 1 Question 1

2. Do you know what a programming paradigm is?



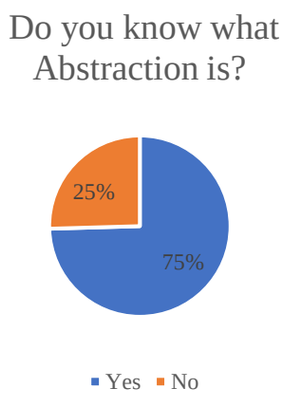
Graphic 2 Question 2

3. Do you know what Logic is?



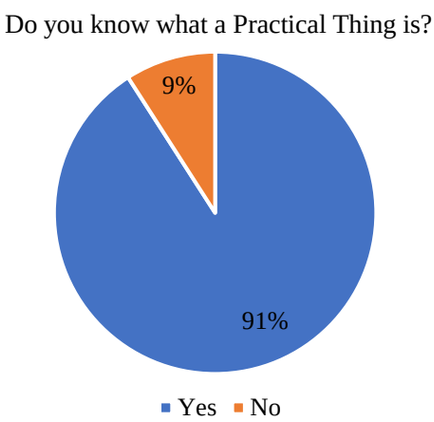
Graphic 3 Question 3

4. Do you know what Abstraction is?



Graphic 4 Question 4

5. Do you know what it is something practical?



Graphic 5 Question 5

The answers to the questions are True or False.

The results obtained for each question are shown below.

The information that we get, taking account that the people are from the systems area tell us, we have to analyze the situation urgently. The results obtained were the following:

In the first question, do you know what programming is? 92.7% of the sample answered Yes and No 7.3%. For the question, do you know what a programming paradigm is? 62.7% answered Yes and No, 37.3%. In the question, do you know what is logical? the 97.2% answered Yes and No, 2.8%. In the next question, do you know what abstraction is? the 74.5% answered Yes and No, 25.5%. For the last question, do you know what is practical? the 90.9% answered Yes and No 9.1%

Reviewing the terms, of each concept evaluated in the questions, some descriptions are described below.

Programming. Programming is the process used to devise and order the instructions necessary to carry out a project, prepare certain machines or devices that start working at the time and in the desired way, or develop programs for use in computers.

A programming paradigm is a form or style of software programming.

There are different ways to design a programming language and various ways of working to get the results that programmers require. It is a set of systematic methods applicable at all levels of program design in order to solve computational problems.

Logic is one of the branches of philosophy of an interdisciplinary type, understood as the formal science that studies the principles of proof and valid inference, fallacies, paradoxes and the notion of truth.

Abstraction (from the Latin abstrahere, to move away, subtract, separate) is a mental operation focused on conceptually isolating a specific function or property of an object and that is to think, discarding other properties of the observed object.

As for the practical, we refer to a simple path in which, leads us to a solution as soon as possible.

We are going to start with the practical and ask ourselves a question: What is a paradigm?

The concept of paradigm is somewhat complex, since the use of the term often depends on the area of knowledge from which it is viewed. However, it is generally understood as a synonym for Model.

Throughout history, the different disciplines and aspects of human knowledge have operated according to very different paradigms, that is, to different ways of proceeding and thinking. However, as new discoveries or developments became possible, the human capacity for reason allowed demolishing old structures and building new ones, which translates into a paradigm shift.

It is important to break paradigms. We must learn to break concepts (paradigms) to be able to see more options for the development of our activities and not fall into the routine.

The paradigms are divided into two branches, which are the following: Imperative and declarative programming.

The Imperative seeks to define clearly the algorithm that is going to be the source code and the steps that must be executed in an application in a sequential form.

The Declarative describes what the software must solve, that is, the result, not how that Objective was reached.

Discussion and analysis of results

There is a great concern in the area of systems worldwide since there is a shortage of personnel in the programming area of high level.

Lately they have even been inviting well-known personalities in the area of technology (systems development) to come to study programming through different media.

The basis of programming is the logic that is part of mathematics. Taking into account the mathematics as basis, even a single part as Algebra, which helps us to shape our logic and learn how to make decisions. In general, Mathematics is something abstract that we continually take to practicality.

However, what is Abstract? That is which differs from what is not empirically observable but can only be thought or imagined. It is that which can only be conceived in the mind since it has no Material Reality.

Worldwide there is the problem that Students prepare in the area of Programming and programs such as ALICE has been developed whose purpose is to help students of any level not to have difficulty of learning the programming languages since they are the means of communication between humans and Hardware

An abstract problem becomes a concrete problem when the instances and solutions are coded in the form of formal languages.

Abstract problems are usually defined in two parts: the first describes the set of instances and the second describes the expected solution for each instance.

Programming, although it is not a simple subject, and it is not an impossible subject either. The basis of programming is logic, which in simpler words is an achievement of steps to carry out an activity. With very simple exercises and examples, you can understand and exercise logic. Think of things as simple as the steps to change a light bulb, go buy some bread. They are all done with a series of finite consecutive steps.

Once logical thinking is developed, it is very easy to begin by learning the flow of programming, which consists of knowing at which moments in our series of steps there are variables, conditions or cycles. Continuing with the previous examples, a variable can be the amount of money you have to buy bread, which can be a lot or a little. One condition is whether you have money to pay for the bread, in each case there will be a different outcome. For the cycles, suppose that you have a box of five bulbs of which only one works. For this, we have to test all the bulbs to find the right one, every time we test a bulb we are doing a cycle that is repeating the steps repeatedly until it breaks, or rather until we find the bulb that works.

Conclusions

In conclusion, it is determined that students in all areas of knowledge can improve as long as they are taught to handle more practical concepts about their work areas, but in this practical case we are talking about the programming area.

We have been working with special pilot groups with students with disabilities giving real life examples for example, explaining them how the person who sells tacos prepares them, gives you what to drink, and finally charges you and you tell them that this is a multi-user system. Moreover, the student gets involved in the subject and gives ideas about the same concept. In addition, when an example begins to be programmed, they do not have problems and in based on paradigms they locate the solution to the problems.

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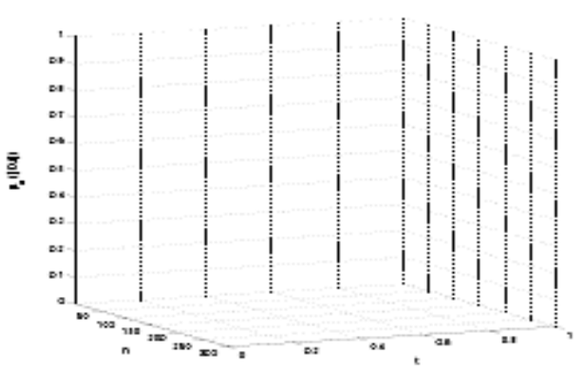

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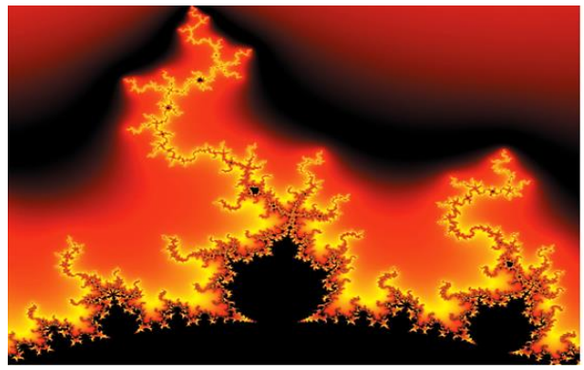

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