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Support the international scientific community in its written production Science, Technology and Innovation in the Field of Engineering and Technology, in Subdisciplines of Multimedia information, networks, terminals, technological services, interactivity and interconnection, e-administration, video games, e-government, immateriality, digitization and innovation, image and sound quality parameters.

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The works must be unpublished and refer to topics of Multimedia information, networks, terminals, technological services, interactivity and interconnection, e-administration, video games, e-government, immateriality, digitization and innovation, image and sound quality parameters and other topics related to Engineering and Technology.

Presentation of content

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Content

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Development of ICT competencies for Higher Education teachers in COVID-19 time

Desarrollo de competencias TIC a profesores de Educación Superior en tiempo de COVID-19

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Abstract

In the 2020-2021 academic year, due to the COVID-19 pandemic, in many countries, face-to-face educational activity in any of its manifestations had to be suspended, forcing the teachers of these educational institutions to plan and develop a new virtual teaching-learning process. Given this scenario and the current uncertainty, technological resources become an ally for teachers, making it necessary to disseminate experiences such as the one collected in this study: the use of video tutorials in higher education. Based on a quasi-experimental research design, only post-test of a group of teachers who took the courses, after applying an electronic questionnaire to 29 teachers, the planning and implementation of videotutorials for the transmission of theoretical and practical contents in each of their subjects is analyzed. The evaluations carried out show a high level of acceptance of the resource, especially for analyzing and reflecting on the contents; solving practical problems and organizing the study. Likewise, the relationship between the perceived usefulness of the videotutorial and the intention of future use is reflected. The study concludes by highlighting the educational potential of the use of videotutorials in distance higher education.

Educational video, Digital transformation, COVID-19

Resumen

En el curso 2020-2201, debido a la pandemia COVID-19, en muchos países, la actividad educativa presencial en cualquiera de sus manifestaciones tuvo que ser suspendida, obligando a los docentes de estas instituciones educativas a planificar y desarrollar un nuevo proceso de enseñanza-aprendizaje virtual. Dado este escenario y la incertidumbre actual, los recursos tecnológicos se convierten en un aliado para los docentes, por lo que es necesario difundir experiencias como la recogida en este estudio: el uso de videotutoriales en educación. Basado en un diseño de investigación cuasi-experimental, solo post-test de un grupo de profesores que realizaron los cursos, luego de aplicar un cuestionario electrónico a 29 docentes, la planificación e implementación de videotutoriales para la transmisión de contenidos teóricos y prácticos de cada uno de los profesores fue analizada. Las evaluaciones realizadas muestran un alto nivel de aceptación del recurso, especialmente para analizar y reflexionar sobre los contenidos; resolver problemas prácticos y organizar el estudio. Asimismo, la relación entre la utilidad percibida del videotutorial y la intención de uso futuro se refleja. El estudio concluye destacando el potencial educativo del uso de videotutoriales en educación superior a distancia.

Video educativo, Transformación digital, COVID-19

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† Researcher contributed as first author.

Introduction

The confinement that was decreed during the pandemic in the year 2020, forced to generate multiple changes in the way of imparting education to students. It was of major importance to establish innovative didactic strategies, which although they had existed for a long time, they had not been implemented regularly; always taking care of the emotional part of the students, which was affected, in many occasions, by the social distancing. The design of activities that involve both characteristics represents one of the main challenges during the pandemic. Teachers have had to make use of all their professional experience and adapt it to the needs, learning different technological tools, many of which were unknown, but which finally renewed the teacher's profile for distance education.

Today, with the uncertainty generated by the pandemic in all educational contexts, teachers are asking themselves what teaching will be like in the coming years. Studies such as the one conducted by Trujillo, Fernandez, Montes, Segura, Alaminos & Postigo (2020), support the idea that it is the right time to rethink the educational model completely. Therefore, the current challenge, in the way of quality higher education, lies not only in overcoming the adversities originated by the COVID19 pandemic; but, as Pérez-Gómez (2019) points out, before the pandemic, that it was necessary:

> "to design and organize space, time, social relations, activities, curriculum and evaluation to help form the educated, supportive and autonomous citizen that the complexity of this contemporary global and digital scenario demands" (p.4).

For several years, technology has been considered a factor that facilitates the delivery of education, however, due to current circumstances, a situation has arisen in which education is entirely dependent on technology (Mateo-Berganza & Lee, 2020). During the confinement that took place in Mexico between March and June 2020, the use of different technological resources (virtual campuses, discussion forums, videoconferences, etc.) has been of great help in the delivery of courses in the period 2020-2021.

However, the availability of resources has not been the only problem, due in part to the lack of experience and insecurity that non-presence has generated in teachers (Cabero & Valencia-Ortiz, 2021); on the other part, students were not prepared for the situation that occurred, so they have not been able to organize their time in the new modality and have felt overloaded with work.

Development

Multimedia materials, such as audio, videos, and interactive activities, emerge as a powerful tool to support education, allowing teachers to design activities in a different way. Multimedia requires planning for its incorporation in education, since its achievement depends not only on the material being attractive, but also on the objectives for which it was designed being fulfilled correctly. It is important to point out that learning strategies must be conceived for the informative part, plan the student's performance, monitor the execution, and finally evaluate the results obtained so that it works as expected.

Today, more than ever, teachers are facilitators of learning and must always prepare teaching opportunities for their students. In this sense, it is essential to stimulate the students' desire to learn in order to maintain a high level of motivation.

Some alternatives offered by the use of multimedia for the design of teaching activities are: animations, highlighted words in a text, display of images, words or symbols, hypertext, self-monitoring learning systems, and the most recent ones, video tutorials, among others.

In the words of González (2013), the activities to be developed for the creation of multimedia materials include the following aspects:

- Content organization.
- Analysis of the ways of presenting information.
- Special lessons considering the technological skills of the students.
- Graphics to represent situations.

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- The contents should serve as reference material.

Based on these premises, it can be stated that videotutorials are multimedia elements that allow providing the informative part of the teaching process in a dynamic way, which attracts the student to follow it as a guide in learning. Videotutorials as a teaching strategy rather than a learning strategy are well valued, because they allow to review the content as many times as necessary, until the student achieves the desired knowledge or the development of some proposed skill.

The use and application of different directions for learning allows this to be achieved in a better way, for example, it is better to listen and see, than just see or just listen, the more senses you use in the teaching process, the better the learning process will be. What is seen remains more in the memory than what is heard, but if you listen and see, the understanding of that knowledge is lasting. It is a dialectical and dynamic activity of the teaching process in the educational process (Solovieva, 2019).

The video tutorial as a learning strategy allows receiving the information in a visual and auditory form to subsequently put it into practice effectively and obtain the desired learning result. In computer science, video tutorials are currently becoming very popular, due to the ease with which they allow learning and also focus attention on the completion of only one task at a time, so the student puts all his attention and interest in the development of that skill or knowledge. As proposed by Palomino, Salinas and Sanchez (2019) in their research where they conclude that video tutorials improve procedural, conceptual and attitudinal learning of students.

Theoretical framework

As is known, the restrictions imposed by COVID-19 on face-to-face teaching in Higher Education Institutions (HEIs), although its use was already a consequence that many teachers have to implement different tools to make the switch to virtual teaching (Cahapay, 2020). Among the resources employed by teachers during this period is the use of video tutorials for asynchronous explanation of content to students (Reimers & Schleicher, 2020).

The use of these was already a practice present in higher education contexts as an element of support for both face-to-face (Lai & Williams 2017) and blended (Karma, Darma, & Santiana, 2019) and non-face-to-face teaching (Scagnoli, McKinney, & Moore-Reynem, 2017). Among its main advantages is its ability to present information using different modalities, auditory and visual, which reinforce and complement each other, as well as providing an example of the process that is easy to follow and that students can replicate autonomously (Van der Meij & van der Meij, 2014).

Additionally, the use of such resources also has a positive effect on students' motivation, which is especially important in subjects that may be unattractive (Martínez-Abad & Hernández-Ramos, 2017). These characteristics mean that video tutorials are frequently employed in flipped classroom designs to guide the student's self-learning process (Murillo-Zamorano, López Sánchez, & Gogoy-Caballero, 2019). Consequently, the number of researches about the educational use of video tutorials is increasing. These can be classified into two groups:

- Research focused on academic performance: confirming the positive impact on student performance (e.g., Kazanidis, Pellas, Fotaris, & Tsinakos, 2019).

- Adoption-focused research: mainly focused on the analysis of students' opinion and satisfaction with these tools (Maziriri, Gapa, & Chuchu, 2020).

The social context generated by the pandemic in Mexican HEIs allows us to analyze the effectiveness of this technology in an exceptional moment, in which motivation and self-managed learning have played a fundamental role in the development of the learning process. The present research intends to take advantage of this circumstance to contribute to the development of the literature on the subject, analyzing the opinion of students in the course-workshop on the use of video tutorials to explain contents of each one's subjects.

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The research suggests that the mechanisms through which the teaching identity is shaped include modeling, which refers to the process through which the students of the course-workshop acquire a series of conceptions about how teaching should be and the type of professionals they aspire to be through their experience as students and the observation of the teachers who have educated them (Holt-Reynolds, 1992).

Several studies have affirmed that the use of ICT in times of pandemic has been positive. In this sense, Parada & Rodríguez (2021), point out that many of the adaptations that were made during the pandemic will continue to be used as part of the traditional model, due to their effectiveness in the learning process of students. For their part, Espinoza & Gutierrez (2021), point out that during the time of the pandemic, ICT were relevant, due to the use they were given, either in the design of teaching materials, web pages, and multiple technological tools used in the teaching-learning process.

Methodology

In order to achieve the objective and the questions proposed in the research, a quantitative study (Johnson, Onwuegbuzie, & Turner, 2007) was proposed based on a quasi-experimental research design with a single-group posttest (Campbell & Stanley, 1963). In this way, the reality was analyzed after the application of an educational intervention, or treatment, which consisted of learning the design and use of videotutorials for the transmission of theoretical and practical contents of subjects at the Universidad Autónoma de Nayarit. Due to the low level of experimentality of this research, and that a pretest-posttest longitudinal evaluation is not applied, no working hypotheses are established as such, but are intended to address the research questions posed in the introduction.

The questionnaires were implemented in the Google Forms platform and provided to students through the different subjects of the course-workshop, who answered voluntarily between May 20 and 30, 2021. After collecting the information, it was extracted from Google Forms and filtered for use with the SPSS v.24 statistical package. After confirming the validity and reliability of the scale used, descriptive and correlational data analysis was applied.

Results

1. Video editing and Videotutorials

2. Audio editing and Podcast

The topics covered in the instrument were those mentioned above, where teachers participated as students of the workshop course with a Likert scale instrument.

In terms of perception, 100% of those surveyed consider that the degree of knowledge acquired is correct and acceptable; this will allow them to carry out the creation of multimedia didactic material and that, through the teaching and use of this tool, the participating teachers will be able to create their own video tutorials for the teaching of their subjects.

To the question "How difficult is it to use Audacity for audio production? The results indicate that 80% of the participants believe that the Audacity program is easy and that it fulfills the functions of audio editing, special audio effects, creation of karaokes, voice editing, trimming audio tracks, improving audio quality, making podcasts, methodology for making podcasts, which were part of the tools they were taught in the course-workshop.

When asked if they liked the Movavi video editing software, 100% said that it is a good video editing software and 75% said that they will use the program frequently. Also, the majority said that they have a very high level of proficiency in setting up a webcam, recording in a specific format, using transitions, using effects, adding subtitles to a video, vocalizing a video, and setting a video to music.

Conclusions

The use of videotutorial courses in HEI education is advancing more and better every day, with modern steps on the approach of strategies that really serve to achieve meaningful learning.

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Students demand more multimedia material and more interaction with technology in their classes, they require teachers better prepared in the field of educational technology but, who know how to focus that knowledge to the design of learning strategies such as the videotutorial, which well oriented and designed offer great benefits to teachers at the Autonomous University of Nayarit, especially for non-conventional modalities adopted by the pandemic.

At the time when the state of alarm by the pandemic, forces the entire educational system to adapt to distance learning, the first alerts focused on the lack of technological resources in the homes of teachers and students, aggravating this problem to a greater extent in rural areas where in many cases the Internet connection is deficient. Faced with these problems, as teachers, our contributions are highly conditioned and are sometimes limited to supporting the different measures and aids taken by the administrations. However, as Cabero and Valencia-Ortiz (2021) reflect: "the digital divide refers not only to access to technologies, but also to knowledge of them, that is, what we are able to do with technologies and for what purpose" (p.119), and this is the aspect on which the present study focuses.

At a general level, the results can be valuable for the university and non-university teaching community, by showing both an alternative and a complement to the development of synchronous expository sessions (face-to-face or virtual) that allows greater flexibility and control in the planning of the teaching-learning process. The evidences obtained indicate a high general satisfaction on the part of the students, mainly regarding the potential of this methodology for the resolution and understanding of the practical contents, facilitating the reflection and elaboration of personal syntheses. It is worth highlighting this issue initially, since the organization of practices and group work activities is one of the aspects in which a greater number of drawbacks are being detected when adapting face-to-face to other training modalities (Allen, Rowan, & singh, 2020; Sánchez-Prieto, Hernández-García, García-Peñalvo, Chaparro-Pelaez, & Olmos-Migueláñez, 2019).

Likewise, the results obtained show that the use of video tutorials in university teaching promotes and facilitates reflection, analysis and understanding of the contents of the learning units, which are necessary and priority skills in an educational system based on the development of integrated professional competencies. Throughout the work, it has been shown how teachers who took this training were not prepared for a new online modality, and in some cases have been overwhelmed by this new condition. Similarly, many teachers have experienced similar situations when increasing their workload (Allen, Rowan & Singh, 2020), being necessary to rethink not only the contents of the subjects (García-Planas & Torres, 2021) but also the methodologies and resources used.

The results obtained show a correlation between the satisfaction of the teachers who took the course with the use of video tutorials and their intention to use them in their future professional practice. These educational aspects are precisely those on which the use of this type of resources has the greatest impact, which may also indicate a possible influence by modeling on the students' teaching identity that should be explored in greater depth in future research. More specifically, it seems that the use of videotutorials is especially useful in the development of practices, since they facilitate students' generalization of theoretical contents to practical cases as well as the reflection and elaboration of personal syntheses.

This issue is of special relevance, as we find ourselves in a situation of deep concern and debate in the university community about the adaptation of the practices of the subjects to a blended and even non-attendance model. This work also makes an empirical contribution in the field of the development of personal teaching identity based on experiences as a student. The use of resources such as video tutorials, which focus the educational process on student learning rather than on the content itself or the work of the teacher and the teaching-learning processes by the educational community.

This is why the integration of this type of resources in educational processes generates added value not only at the micro level of the classroom-group, but also at the macro level.

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Despite the contributions made in this work, we must be cautious with the conclusions drawn, mainly due to the limitations related to the instrumentation and sampling applied. However, the effective use of video tutorials in HEI teaching implies both their adequate technical design and their correct planning and integration into the teaching-learning processes. Organizations dedicated to teacher training have the duty to adapt their teachings to the current contexts and needs, so there is a clear need to include and influence these issues within the processes of teacher training and professional development of teachers and future teachers. In fact, it should be remembered that the development of the teaching identity is influenced not only by experiences as a student, but also by initial and continuing education processes.

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Emerging learning environments due to the COVID 19 pandemic and digital supports for teaching

Entornos de aprendizaje emergentes por pandemia ante la COVID 19 y apoyos digitales para la enseñanza

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Abstract

Study on Learning Environments, non-experimental, quantitative cross-section applied to upper secondary level students and qualitative data in field research of teaching experiences taught to 18 subjects of undergraduate, master's and doctorate (2020 - 2021), with digital tools and hybrid synchronous and asynchronous online learning modalities. The analysis refers to characteristics of face-to-face and virtual learning environments, indicated by students as support in a different and necessary teaching of digital and hybrid learning. The sample is of 300 random students, analyzed in signal readings of percentages, measures of central tendency, factorial with the method of Communalities. In the results, the students prefer clean face-to-face classrooms, with space and organized, with didactic support and teacher motivation. Digital classrooms need the use of different spaces for collaboration, communication and exchange, with diverse and motivating didactic and mathematical activities, combining talks of virtual synchrony of social and emotional support and the teacher's guide, they prefer methodologies such as: flipped classroom, case method, problem solving, virtual debates, asynchronous tasks, playful tools, formative evaluation and collaborative development of social projects with virtual social impact. Virtual tools that apply to online classes are listed to achieve collaborative, dynamic and motivating environments for learning.

Adaptations, COVID-19, Digital tools

Resumen

Estudio sobre Ambientes de Aprendizaje, no experimental, cuantitativa de corte transversal aplicada a estudiantes de nivel medio superior y datos cualitativos en investigación de campo de experiencias docentes impartidas a 18 asignaturas de licenciatura, maestría y doctorado (2020 – 2021), con herramientas digitales y modalidades de aprendizaje en línea en forma híbrida sincrónica y asincrónica. El análisis refiere a características de ambientes de aprendizaje presenciales y virtuales, señaladas por los estudiantes como apoyo en una diferente y necesaria enseñanza aprendizaje digital e híbrido. La muestra es de 300 estudiantes al azar, analizada en lecturas signalíticas de porcentajes, medidas de tendencia central, factorial con método de Comunalidades. En los resultados, los estudiantes prefieren aulas presenciales limpias, con espacio y organizadas, con el apoyo didáctico y motivación docente. Las aulas digitales necesitan el uso de diferentes espacios de colaboración, comunicación e intercambio, con actividades didáctico matéticas diversas y motivantes, combinando charlas de sincronía virtual de apoyo social, emocional y la guía del docente, prefieren metodologías como: aula invertida, método del caso, resolución de problemas, debates virtuales, tareas asincrónicas, herramientas lúdicas, evaluación formativa y desarrollo colaborativo de proyectos sociales de impacto virtual social. Se enumeran herramientas virtuales que aplican a clases en línea, para lograr ambientes colaborativos, dinámicos y motivantes para el aprendizaje.

Adaptaciones, COVID-19, Herramientas digitales

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Introducción

After the events that occurred in March 2020 by the COVID-19 pandemic, humanity was transformed, despite the fact that many were betting to return to a normality previously experienced, the world is transformed without going back and the way of life of people changes irretrievably towards new paradigms in science, technology and life forms.

Formal education was abruptly forced to new educational and pedagogical models and schemes to fulfill the necessary duties in student learning. Formal education migrated to digitized learning and forced online didactic-mathematic methodologies.

When the government closed educational institutions, more than one billion students were affected. 52% of graduate students in the USA affirmed that online college education is superior to classroom learning and 39% of college students consider online classes better than classroom ones, Colman H. (2021)

“Students come to universities to meet great people, have inspiring conversations with academic staff, collaborate with researchers in the lab, and experience social life on campus. To remain relevant, universities will have to reinvent the 2 learning environments so that digitization expands and complements, but does not replace, the student-teacher and student-student relationship” OECD (2020), Impact of COVID-19 on education. Education at a Glance. Universities have opted for a hybrid mode online model that includes the combination of synchronous and asynchronous teaching activities. Teachers have been trained in virtual and online learning tools, to adapt to a new way of teaching classes through institutional platforms and the Internet, using common electronic devices such as computers, tablets, smart phones to respond to these new learning demands.

This information is based on experiences of a teacher of undergraduate, master's and doctorate degrees and the scientific bases of a non-experimental, quantitative, cross-sectional investigation of "Quality of school life", based on a complex variable of the study analysis called Learning environments.

Ospina (1999), mentions that the learning environment is conceived as a daily construction, daily reflection, permanent singularity that ensures the diversity and richness of life.

For Naranjo and Torres (1996), the educational or learning environment is "the subject" that acts with the human being and transforms him, thus promoting personal development in the different settings in which he lives and the social aspect with whom one interacts: in the street, school, family, neighborhood, peer groups, among others.

The learning environment is a dynamic and active conception that involves the human being and therefore contains pedagogical actions in which those who are subjects of learning are in a position to reflect on the actions of their own behavior and that of others, in relation to the environment and context in which it takes place.

The learning environment is not limited to the material conditions necessary for the implementation of the curriculum, whatever its conception, or to the basic interpersonal relationships between teachers and students. On the contrary, they constitute the educational processes and involve actions, experiences and experiences by each one of the participants; attitudes, material and socio-affective conditions, multiple relationships with the environment and the necessary infrastructure for the realization of the cultural purposes that are made explicit in every educational proposal.

The general objective of all the research is to identify the variables related to the quality of school life of the students in: quality of life, academic performance and learning environments. The article only refers to the third topic and the influence for hybrid synchronous and asynchronous learning applied online. The specific objective of this complex variable refers to identifying the essential attributes of the different learning environments according to the opinion of the upper secondary level students, both face-to-face and digital. In addition, as a complement, teaching experiences are included with 18 classes of 4 semesters of undergraduate, master's and doctoral subjects during March 2020 to October 2021.

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The development of online learning is urgent as a necessary and emerging instrument of resilient adaptation to face a new universal digitized education for a different autonomous and teacher-oriented learning, with the student as a citizen of the universal world as a central figure. Emergent refers to the fact that "it is born, it leaves, it has a beginning in something else and it substitutes", Association of Academies of the Spanish Language. Royal Spanish Academy (2021).

Methodology to be developed

The research design of the complex variable School learning environments is non-experimental, quantitative, cross-sectional applied to a sample of 300 students in the data collection, randomly selected, of upper secondary level from four public high schools in the University Autonomous of Coahuila. An opinion measurement instrument was developed with a decimal scale, which contains 13 signal variables and 71 simple ordinal variables on the axis of learning environments. The instrument was validated in reliability with a pilot test, which presented 0.89 in a Cronbach's Alpha.

The analysis of results was carried out at two levels: descriptive and multivariate with the Communalities method.

The reading of data from the descriptive analysis is performed for the characterization of the pilot sample through percentages and analysis of central tendency variability. The multivariate study is prepared by Communalities with normalized Varimax rotation, with a probability of error of 0.01 and an r2 = 0.60.

For the qualitative analysis of information, evidence is collected from March 2020 to October 2021, through the virtual classrooms of Teams and the recordings of classes and academic and training activities, including tasks, evidence of projects carried out in virtual collaborative spaces such as videos, debates, projects and synchronous class expositions.

Results

Descriptive analysis

The sample of research students refers to 70% women with a representative age of 16 years, from the 2nd and 3rd semester of 4 UAdeC high schools. The significant results in the descriptive study show that students read between 1 and 2 books per year per year, 97% have the Internet, 93% belong to a middle-class socioeconomic level. The important characteristics of the learning environments axis are: learn better in the classroom, in a clean, organized, fresh and comfortable study place, it is convenient to take notes and learning is enhanced when students are motivated to attend class or connect online to synchronous sessions. Other variables that support learning, but to a lesser extent, are: learning by consulting trustworthy digital library platforms, learning is enhanced with the support of advisers, good relationship with prefects, the institution's psychologist, close relatives such as siblings, friends' contacts from social networks and the relationship, as well as classmates. The didactic support is achieved using virtual simulators and taking notes of the key points of the class topic.

School and classroom learning environments are essential for student learning, whether in person or online. It is important to attend face-to-face and / or distance classes. Respondents consider interpersonal relationships both inside and outside the institution are not immersed in the formal teaching-learning process. They believe that learning is achieved despite not having high monetary resources or having sufficient technological tools.

Factorial analysis

When applying the method of Communalities with normalized Varimax rotation, 20 factors appear from all the research, of which 2 factors correspond to the topic of Learning Environments, the one with the highest representativeness is factor four that refers to the "Ideal place of study for learn". This factor 4 has 16 simple variables, which reflect 7.77% of the 79.13% of the total explanation of the phenomenon.

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The axis of learning environments has 9 attributes: the study place is clean (r = 0.75), organized (r = 0.71), comfortable (r = 0.37), colorful (r = 0.37), I learn when I am motivated by the teacher (r = 0.34), wide table (r = 0.33), I learn better from teachers (r = 0.30) and in school (r = 0.30), instead of wide study (r = 0.26), school performance depends on understanding written texts (r = 0.24), if you have determination (r = 0.20), when you go to take an exam your stomach hurts (r = 0.15), you get nervous with people you don't know (r = 0.14) and you like school (r = 0.14).

According to the students surveyed, the space dedicated to the assimilation of the school's own content is extremely important. For this, it is necessary to plan and systematize the elements of the environment that give tranquility, through a place with a large desk that is clean, organized, colorful and that motivates learning. They like school and learning is best achieved in the classroom with teachers who encourage them to study, with didactic-mathematic activities, text comprehension exercises and tasks, and learning in problem-solving activities for decision-making. Students say they don't like raising their voices. In addition, when answering tests and not being able to remember what was studied, they reported presenting an upset stomach. They mention feeling intimidated by unknown people outside the environment that surrounds them, either in person or remotely.

Qualitative analysis of teaching experiences

As of the health contingency that occurred in March 2020, we immediately switched to teaching online, first, the teachers gave classes in the same way as in person, only through electronic devices, in addition to this, teachers and students with a emotional load of fear and confusion within the confinement forced by the health authorities, surrounded by alarming news and later when the infections arrived in Mexico with the certainty of danger of death when seeing countless deaths of strangers and friends so close. Surrounded by this environment of anxiety, the teachers were able to compensate with immediate online training and at the same time with great efforts to emotionally support the situation, which scared us on the inside.

The pandemic forced the migration to virtual classrooms and synchronous and asynchronous learning modalities, to make online classes motivating. Field evidence was collected in Teams virtual classrooms.

Acknowledgments

To the teaching staff and students of the UAdeC who collaborated and have managed to be resilient and adapt to a new educational model of teaching-learning towards a different way of life.

Conclusions

The COVID-19 pandemic achieved a crisis and put humanity to the test. We learned to face and make decisions with sudden, urgent and large-scale transformations. Changing the perspective of everything and transmuting society into learning and attitudes of resilience and spirituality.

Highlighting the indisputable need of students for the support of teachers, classmates and family. But, looking at the essential importance for the teaching-learning process of the environments that surround and accompany the development of the students, whether in a clean, orderly, and motivating face-to-face way, as well as virtual learning environments, both "a doc" the needs of the students.

Among the digital tools that teachers have been trained for in online classes are the collaborative ones for the preparation of documents and project planning: For the work environment: Office 365, ZOHO, Google and Edmodo. To communicate, discuss and collaborate: Blogger, Symbaloo, Wikispaces, Padlet, Remind wikia, Mindmeister, Stromboard, Marqueed and Voxopop. To share files: Dropbox, Jumpshare, Transfer and Google Drive. To organize work: Work Flowy, Symphonical and Highttrack. For word processing and spreadsheets: OppenOffice, Google, ZOHO Writer, Ability, Papyrus, XLS, Excel, Kspread and Calc. For diagrams and mind maps design: Power point, Smartdraw, draw.io, Padlet, Visio, Mindomo, Mind, Popplet, Swey and Coggle. As bibliographic managers: EndNote, Zotero, Words, Citeulike, JabRef, Reference Manager, RefWorks, Labmeeting, Connotea and Mendeley.

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For research and platforms for data collection: INEGI, Scopus, PNAS, Java, public statistics, Google / Office Forms, etc. Typeform, QuestionPro, Survey Monkey, Qualtrics, Encuesta.com and Survio. For distribution and publication of data; Facebook, What's app, For statistical treatment: Statistica, NCSS, IBM SPSS, Excel, SAS and Puthon. Online emails, Twitter, Instagram, Linkedin, etc. For exams and surveys: Google / Office Forms, Survey Monkey and Kahoot. For market analysis and qualitative research: Atlas.it, Google Analytics, Google Triends, QDA Miner, Wordstat, Maxqda and NVIVO. To present projects and work results: Power point, Office 365 Sway, Prezi, Emaze, Knovia, Google Sides, Swipe, etc. To send and save documentation: Adobe Acrobat, Onenote, Onedrive, Share point, Wondershare, What's app, CS and Uniconverter. To share, manage and collaborate: Share point, Flipgrid (Educational Tic-Toc), Automate and Teams. Drawings and structures in Autocar and Corel draw.

These virtual tools are studied and some of them used by current teachers in a hybrid learning model where synchronous and asynchronous classes are combined with videos, recordings, group work in Breakout roms, virtual whiteboards such as Whiteboard, subgroups of topics or teams in Teams channels, etc. The new techniques of Gamification (Escape Rooms) and ludic virtual laboratories, to program and elaborate interactive and collaborative virtual material for online classes. Online tools are being created to detect student emotions such as Office 365 Reflect.

The programming and didactic direction of motivating online learning requires dynamic classrooms, with virtual recreational resources and teaching support, a digital space that is designated for learning with diverse and motivating mathematical didactic methodologies such as: flipped classroom, case method, resolution of real problems, spaces for collaboration and simultaneous exchange, with debates, analysis, propositional critiques, carrying out projects in synchronous collaboration, academic talks and reflections, tutorials, emotional support and accompaniment. Do not forget the importance of the teacher now as a support and guide in the different forms of learning.

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Application of the CSA incremental process in the development of an academic advisory system

Aplicación del proceso incremental CSA en el desarrollo de un sistema de asesorías académicas

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Abstract

This article shows the development of an academic advising software under the premise of an agile development model that is generally considered as a cooperative, simple and adaptive incremental process, particularly referred to in this project as the CSA incremental process. The result achieved, considering that currently the counseling process is done manually in Excel formats, is the automation of the process through the use of software development and information storage tools such as SQL Server Management Studio, Visual Code, Visual Studio 2019 and Angular, contributing to the operation of an information system that allows the optimization of the request for advice, the registration of advisers, the evaluation of the advice provided and the generation of reliable and timely information for decision-making, seeking to improve the institutional indicators that apply to it. Finally, it is important to mention that this document presents the second phase of a technological development project.

Incremental Process, Software, Academic Advising

Resumen

El presente artículo muestra el desarrollo de un software de asesorías académicas realizado bajo la premisa de un modelo de desarrollo ágil que generalmente es considerado como un proceso incremental cooperativo, sencillo y finalmente adaptativo, denominado particularmente en este proyecto como proceso incremental CSA. El resultado logrado, considerando que actualmente el proceso de asesorías se realiza de forma manual en formatos de Excel , es la automatización del proceso mediante el uso de herramientas de desarrollo y almacenamiento de información como SQL Server Management Studio, Visual Code, Visual Studio 2019 y Angular, contribuyendo este software en la operación de un sistemas de información que permita optimizar la solicitud de asesorías, el registro de asesores, la evaluación de las asesorías impartidas y la generación de información fiable y oportuna para la toma de decisiones, buscando mejorar los indicadores institucionales que le competen. Para finalizar, es importante mencionar, que este documento presenta la segunda fase de un proyecto de desarrollo tecnológico.

Proceso incremental, Software, Asesoría Académica

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Introduction

In 2001, the National Association of Universities and Institutions of Higher Education (ANUIES) published that "one of the biggest problems at the undergraduate level in the first semesters are: student failure, dropout rate, low academic performance, and low terminal efficiency" (Chávez & Vargas, 2007). In response to these problems, new proposals for tutoring and advising programs emerge to address these indicators, being tutoring and advising programs one of the main efforts that should work to abate the problems that occur in higher education institutions.

As mentioned by Alvarez (2013), "In the educational model of the European Higher Education Area (EHEA), tutoring is considered as a task contemplated in the responsibilities of a teacher, and one which involves a more personalized interaction between the teacher and the student and in addition to this, it is important to monitor the acquisition of basic skills and guide his or her learning process throughout the degree, thereby guaranteeing adequate academic and professional development".

The 1990s saw the greatest worldwide surge of interest in tutoring. Thus, international and national organizations such as the National Association of Universities and Institutions of Higher Education (ANUIES), and the General Management of Technological and Polytechnic Universities (DGUTyP), have included in their menu of recommendations or in their "strategic lines of development", both in the medium and long term, tutoring as a mechanism to "raise the quality of higher education", based on a more individualized accompaniment to students, within a general framework derived from the idea of making the student the center of learning. (Aguilar, 2012).

According to Romo (2011), "the innovative and quality improvement strategy granted to tutoring is to see it, then, as a viable alternative to help reduce dropout rates and backwardness in higher education. Certainly, it does not actually refer to a new practice, but what is important to consider is that its operation and impact from an innovative perspective, depends on the ways in which it is implemented and organized in an institution".

Since 2016, the Technological University of Southern Sonora (UTS) has implemented an Institutional Program of Academic Advising, considering it, as mentioned by the National Autonomous University of Mexico (UNAM), a support activity that a teacher provides to students, outside their class schedule, in order to overcome academic difficulties in the different subjects they take, or to reinforce their school education (UNAM, 2016). This has triggered the need to automate the academic advisory process through the creation and implementation of a web application that allows managing the advisory request made by the student, the registration of the advisory, the registration of advisors, the assignment of an advisor which may be a student or a teacher, depending on the availability of time and experience in the subject requested to advise. Likewise, to generate reports that provide reliable, accurate and timely information on the advisory services provided and not provided, the evaluation of the advisor on the service provided and the consultation of pending advisory services, thus seeking better decision making and to know their effectiveness. To date, the records on the academic advisory service are carried out manually, using electronic spreadsheets and through the use of online forms as an emergency measure when the COVID-19 pandemic occurred. It is important to mention that since the beginning of this program, the reports generated by the person in charge of it have only been quantitative, in general terms, the reports included the total of advisory services provided in a period, by Educational Program, but not their effectiveness nor if there was any change, favorable or unfavorable, in the academic performance, dropout and failure rates, when the student received the service.

Reaffirming that the objective of the Advisory Program at UTS is to provide timely academic support in the different subjects taken by the students of the different educational programs, so that they reaffirm their knowledge, solve their doubts and develop the habit of being self-taught, which translates into better academic performance, it is also "known that the lack of reliable and valid information hinders actions and analyses that limit the evaluation and confuse the purpose of the programs" (Islas, Baltazar, & Arriaga, 2010).

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The purpose of this research work is to offer academic and technological services in a more efficient and effective way, that support the student community and contribute to the improvement of institutional indicators, as well as to implement an information system to manage and generate reliable information, in a timely and effective way, for decision making.

Problem statement

The National Association of Universities and Institutions of Higher Education (ANUIES), as regulator of public Institutions of Higher Education (IES) in Mexico, points out that in order to fulfill the purposes of the university, it is necessary for each IES to design strategies and implement actions to increase the quality of the integral formative process of students, increase their academic performance, reduce failure and dropout rates, and contribute to the achievement of higher grade average and terminal efficiency rates.

Academic advising in some universities has been implemented as part of the Institutional Tutoring Program, with the purpose of accompanying students academically during their education; however, this service is regularly requested by a very low percentage of students or when the student has already failed.

On the other hand, there is the accelerated development and growth of Information Technology (IT), the administration of educational institutions tends to evolve; however, at present, most of these institutions do not have the vision or the resources to systematize, through the use of IT, the services that are required daily by students, teachers, administrators and the community in general. That is, useful information such as statistics, reports, and indicators that support decision making.

Currently, early actions are being carried out to have a positive impact on the institutional indicators; it is also important to work with the motivating factor in order to achieve a better performance of the participants in this type of programs. However, the process is not controlled, generating a lack of information for decision making and for the successful attention of students.

Considering the above, it is essential for educational institutions to record and monitor, through the use of computer systems, the follow-up and control of academic advisory services, in such a way, that allows them to carry out the analysis of information for the definition of the strategies required to achieve the institutional academic objectives. Likewise, in this sense, the problem could lie in the low grade average that the student community may present on the topics that are taught in the subjects where they present greater difficulties.

Therefore, the lack of computer systems that allow a more accurate and timely measurement of the substantive processes of academic work, gives rise to what Islas, Baltazar, & Arriaga (2010) mention, "This problem is due to the lack of reliable and valid information that hinders actions and hinders analyses that limit evaluation and confuse the purpose of the programs".

Otherwise, having information systems adequate to the needs of any institution would at least allow:

- To offer more efficient and effective academic and technological services that would allow optimizing the advisory process by improving the overall quality of the service to be granted.

- To operate information systems that allow to manage and obtain information with reliable statistics, for decision making and improvement of institutional indicators that concern this process.

Since 2016, at UTS, an academic advisory program has been implemented in which students can request an academic advisory session, through their tutor or directly with the teacher, on the subjects they are taking or on a specific topic. Academic advising is provided to students in teams, individually, in pairs or in groups, normally outside their class schedule.

In order to carry out the implementation of this program, a professor responsible for the academic advisory program was appointed, keeping the records of the sessions manually in an electronic spreadsheets.

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The information required to generate the reports of the teachers with advisory services given, has to be obtained from the submissions made by each teacher, and by doing so, there is information that is usually not recorded or lost and not considered in the quarterly report also, if by the time the registration forms are delivered, the person responsible of the process has already entered the information, these advisory sessions are not considered, even if these were carried out by a teacher. In addition, no statistical reports are generated, only informative ones, which would allow for a more timely follow-up and informed decision making, since the information is not regularly complete or measured. Therefore, senior management or academies cannot make decisions that lead to the improvement of this process. Therefore, because the current process is completely handmade, it is easy to make mistakes in filling out forms, obtaining information and follow-up control, leading to poorly informed or statistically uninformed decisions, resulting in incomplete reports.

Consequently, the current needs can be met by automating the process, through the development of a software that allows improving the academic advisory service and obtaining the pertinent information on time so it can be used for decision making and the improvement of the collection of institutional indicators.

Methodology

According to Maida, EG, Pacienzia, J (2015), the methodology is one of the specific stages of a work or project that starts from a theoretical position and involves a selection of specific techniques or methods about the procedure for the fulfillment of the objectives, likewise, it determines the steps to follow and how to perform them to complete a task. Taking into account the way in which this project was carried out in this second phase and its characteristics, it was decided to use an incremental process, generally used in agile software development methodologies, which was adapted and named, for this project, as CSA Incremental Process, defined in the order in which the acronym is presented, as Cooperative, Simple and Adaptive, given that it is theoretically composed of frequent deliveries with fast cycles, as mentioned by Maida, EG, Pacienzia, J (2015). Figure 1 shows the structure of the CSA incremental process, followed by a description of each of the aspects that comprise it.

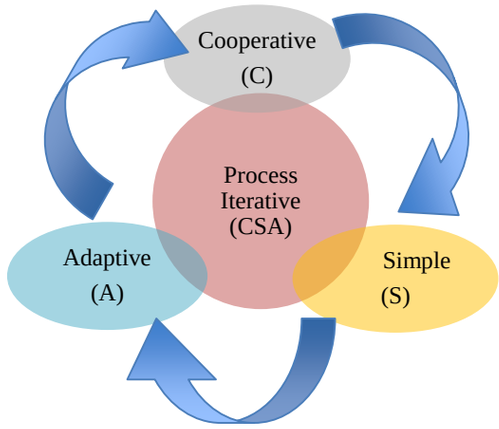

Figure 1 CSA Iterative Process
Source: Author's own (Theoretically based from Maida, EG, Pacienzia, J (2015).)

- Cooperative(C): customers and developers work constantly with very fine and constant communication.

- Simple(S): the method is easy to learn and modify for the team and finally

- Adaptive (A): the ability and flexibility to allow last-minute changes.

The following is a description of how each aspect of the CSA incremental process was applied during the second phase of development of this project:

Aspect 1. Cooperative(C):

In this aspect, both customers and developers held several meetings, first face-to-face and then, due to COVID-19 pandemic issues, through Google Meet. The meetings were held as follows: first, contact was established with those involved before starting the development of the project and the generalities of the project were presented, the requirements that the client had for it, the class diagram currently implemented in the integral system in which the developed software is to be integrated and to finish with the opening meeting, the assignment of roles and activities of each member of the work team was carried out. Communication was also maintained through the use of instant messaging and email to address doubts about the requirements. Following this, the pandemic began and the work team had to adapt to the new way of working, especially the activities that were face-to-face, such as advisory services and/or visits with the client in their work cubicles.

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In compliance with the contingency protocols, meetings continued to be held by Google Meet and with the channels of communication that were established to work and be in contact with those involved in the project. As for the presentation of the project progress, these were done using Google Meet and for very specific and brief points where a synchronous meeting was not necessary, social networks were used. To finalize this aspect, communication was established with some students and teachers of the Software Development area to perform some functionality tests of the system and to verify the existence of possible failures and/or defects that should be addressed in order to have a system operating optimally at the time of its implementation. A very important bond was created between clients and developers.

Aspect 2. Simple(S):

This project is conceived in phase 1 of its development to be worked under the prototyping model and it was possible to finish with that methodology, obtaining, as a result, the publication of a computing prototype and a series of modeling diagrams derived from the client's requirements, all this was done in person, at the university, in face-to-face meetings. The technological tools used for the development were StarUML, Visual Studio 2019, and Microsoft SQL, these technologies were used for the front end and database (DB). Likewise, for the development and administration of the system, the resources used were 5 desktop and 4 laptop computers located in the Office of Innovation and Technology Transfer in Information Technology and Applied Informatics (OITTTIA). Following this, the project continues, but already in phase 2, the development phase, still thinking in the same model and the use of more tools since it would go from being a prototype to a functional software, for that reason new tools were added, such as Microsoft SQL, SQL Server Management Studio, Visual Code, Visual Studio 2019, Microsoft Visio and Angular, without considering yet that the front end would require to be changed and new tools would be added, derived from the situation that was approaching at that time.

This aspect begins to be present, once the pandemic arrived, since it was necessary to add, as part of materials and tools, the remote access of the teams to the DB server from home to be able to continue with the development of the project. Therefore, everything changed for the development team due to the control and prevention measures for Covid and also the lack of access to the University facilities, and the lack of physical contact with the team. This is where other means were established to continue working with the project, technologically speaking and for specific follow-up with the client and its needs, since the infrastructure and materials such as connectivity, software, and human resources were no longer available at the university. Both the scenario and the method were adapted to continue with the development of this project, emphasizing the use of incremental processes and the aspects of Cooperative, Simple and Adaptive, as generally used in agile methodologies, would be the most adaptable method to continue this project, since they are mainly light and enjoyable for people who are constantly communicating with the client and who are not entirely accustomed to following processes, much less in the present situation.

In addition to the above, virtual training of HTML, CSS, and Bootstrap were carried out from home, using platforms where UTS has free subscriptions such as Edx, Académica, and Udemy, in a particular way with its own resources, in order to address some aspects of the development of the project and to make the necessary adjustments in the planning and management of resources such as the loan of computer equipment in support of the pandemic situation present at that time. The class courses, even in a non-pandemic situation, were on the Angular framework used to develop the system, this training took approximately 3 weeks.

Aspect 3. Adaptive (A):

This aspect was applied once the training was carried out and the developers were already trained to deal with changes without the daily presence of the clients and to solve any problem that arose.

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Once the client had been presented with the progress of each of the modules of the advisory system, in terms of design and functionality of the software under development, several adjustments were made to the modules because those responsible for the advisory process were discovering the need to adapt new functionalities, also, through the process of validation and verification of the software requirements, in one of the meetings, it was detected that some elements did not exist and that it was necessary to have them in order to make its operation more optimal and the information it generated, more accurate and timely. During the last period the team continued with the development of the web API (Application Programming Interface) for each of the assigned modules, these APIs were developed in C# and ASP.NET. Some changes were made to the web API since another database was added to complement the system, with this there were already 2 databases.

Once the web API was finished, the team continued with the development of the components that had been incomplete in the Front End, some adjustments were made in terms of system design, code was optimized, the requested changes were made in the last presentation of the modules mentioned, to adapt them to the new changes that were made in the web API and leave the system finished and functional to later use the corresponding testing process. In addition, the current class diagram of the integral system was integrated with the class diagram resulting from the changes requested by the client, since they could not, in the first instance, be fully integrated due to the diversity of changes that were applied at the last moment to the academic advisory system developed.

The system access data was shared with the program coordinator so that he could test and evaluate the advisory system to be implemented in order to improve the service and information management. Likewise, other users played the role of students, teachers, advisors, and tutors.

It is important to mention that due to the confinement, the project has not been able to be implemented, because there is still no access to the university facilities to make the necessary configurations in the server where this software will be hosted. However, remote access was enabled in order to test with a copy of the database.

The system is complete, according to the requirements and with the database tables that were provided.

The third phase of this project will be the implementation and evaluation of the software to measure the impact on some of the institutional indicators such as: academic performance, dropout and student failure rate, student retention, graduation, and graduation rate of those students who received advisory services versus those who did not. Also, some of the variables to be considered are: immediate academic performance through the passing of exams or the improvement in test performance, the increase in their grade, the understanding of the topics, improvement in overall grade point average, and increase of graduated students.

Results

The results that have been obtained so far in the second phase of this project is the redesign and coding of the interfaces of the academic advisory software whose general objective is to offer academic and technological services in a more efficient and effective way that supports the student community and allows an improvement in institutional indicators. Each of the interfaces that make up the developed software is presented and described below, showing the basic process that must be followed to request an academic advisory, execute the advisory, evaluate the advisory and obtain the report of the status of the service received.

In Figure 2, the Login interface, the user with registration and password assigned at the beginning of his studies will be able to log in to the system.

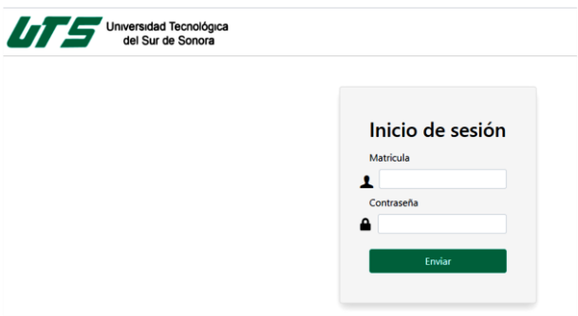

Figure 2 Login Interface
Source: Own elaboration

Following this, in Figure 3. The options menu, the users (advisor, student, teacher, coordinator) can access the options, according to the level of access they have, to request the advisory service, register advisors, evaluate the advice received and register the advice, the user must be logged in beforehand.

Figure 3 Option menu
Source: Own elaboration

On the other hand, in order to start the advisory process, it is necessary to register the advisors and enter the data shown in Figure 4.

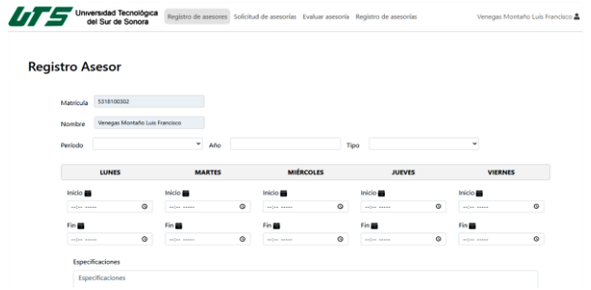

Figure 4 Advisor registration
Source: Own elaboration

Figure 5. Shows the counseling request that the student must make in order to receive the service from an advisor who has the availability and knowledge of the topic requested by the student.

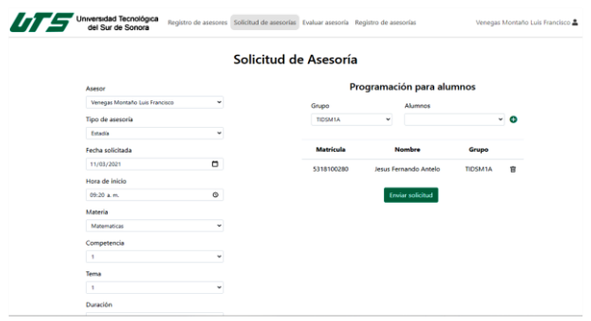

Figure 5 Request for advice
Source: Own elaboration

In Figure 6. Advisory Registration, the advisor, once the advisory is given, proceeds to register it and specify whether the student attended or not in order to give him/her a grade. The student must evaluate the advisory.

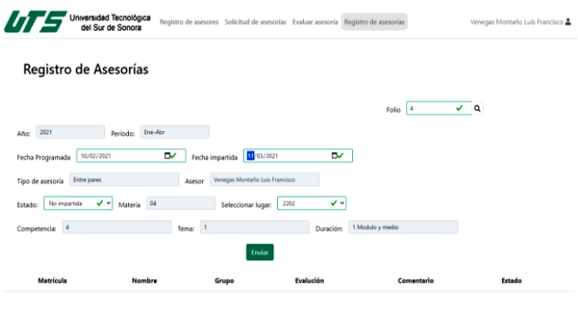

Figure 6 Advisory record
Source: Own elaboration

In Figure 7. Evaluate Advising, once the requested advising has been given, in the end, the student will have to evaluate the advisor and/or the advising in general.

Figure 7 Evaluate advisory
Source: Own elaboration

In Figure 8. To generate reports, the advisory coordinator will be able to generate reports of the recorded advisories, whether they have been given, not given, or in process.

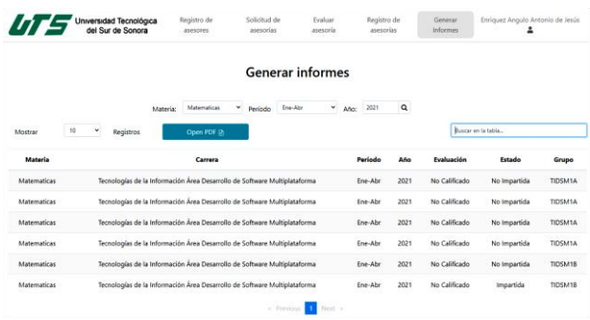

Figure 8 Generate reports
Source: Own elaboration

Figure 9. Report of advisory services given and not given shows a sample of those advisory services that have not yet been given to the student who requested them.

Materia	Carrera	Periodo	Año	Evaluación	Estado	Grupo
Matematicas	Tecnologías de la Información Área Desarrollo de Software Multiplataforma	Ene-Abr	2021	No Calificado	No Impartida	TIDSM1A
Matematicas	Tecnologías de la Información Área Desarrollo de Software Multiplataforma	Ene-Abr	2021	No Calificado	No Impartida	TIDSM1A
Matematicas	Tecnologías de la Información Área Desarrollo de Software Multiplataforma	Ene-Abr	2021	No Calificado	No Impartida	TIDSM1A
Matematicas	Tecnologías de la Información Área Desarrollo de Software Multiplataforma	Ene-Abr	2021	No Calificado	No Impartida	TIDSM1A
Matematicas	Tecnologías de la Información Área Desarrollo de Software Multiplataforma	Ene-Abr	2021	No Calificado	No Impartida	TIDSM1B
Matematicas	Tecnologías de la Información Área Desarrollo de Software Multiplataforma	Ene-Abr	2021	Muy Buena	Impartida	TIDSM1B
Matematicas	Tecnologías de la Información Área Desarrollo de Software Multiplataforma	Ene-Abr	2021	No Calificado	No Impartida	TIDSM1A
Matematicas	Tecnologías de la Información Área Desarrollo de Software Multiplataforma	Ene-Abr	2021	No Calificado	No Impartida	TIDSM1A

Figure 9 Report of advice given and not given
Source: Own elaboration

Figure 10. Evaluation of advisory given, the evaluation made by a student on the advisory he/she received is shown.

Materia	Carrera	Periodo	Año	Evaluación	Estado	Grupo
Matematicas	Tecnologías de la Información Área Desarrollo de Software Multiplataforma	Ene-Abr	2021	Muy Buena	Impartida	TIDSM1B

Figure 10 Assessment of advice given
Source: Own elaboration

Before concluding this section, it is important to mention that as part of the results of this project, the integration of a domain model was obtained, in which the different entities and relationships are described, as well as the restrictions that will have to govern the integral information system of the university due to the different modifications requested by the client. See Figure 11. Integral domain model

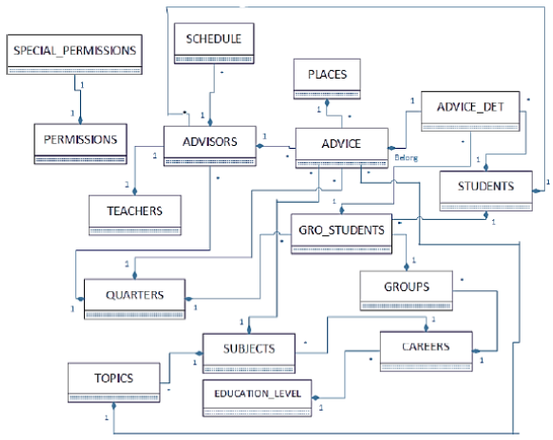

Figure 11 System domain model
Source: Own elaboration

Acknowledgments

To the Technological University of Southern Sonora and especially to the members of the Center for the Development and Application of Information and Communication Technologies (CADTIC) and collaborators, for their support in the development of the project.

Conclusions

What has been exposed throughout this work allows reaffirming the importance of the academic advisory process in educational institutions, especially in the Technological University of Southern Sonora (UTS), it also expresses the importance of having this process automated, but not only for its control and continuous improvement but also as a source of reliable information for the formulation of strategies aimed at reducing the indicators of student failure and dropout rate. It is worth mentioning that these indicators were increased as of May 2020, the date on which the educational service at UTS changed from face-to-face to virtual.

The methodology exposed throughout this document and used for the development of this project allowed the constant adaptation of the requirements as they were changing as a consequence of the confinement derived from the pandemic, it is also important to mention that communication was key for the collaboration between the different actors and this allowed to identify deficiencies in the current process that, if not addressed, would have been inherited to the automated process.

To conclude, it is important to mention that the software developed increases the availability, control, and overall quality of the academic advisory service at UTS; however, it is still necessary to determine to what extent this increment occurs, i.e., what is the impact of the software on the Advisory Program, and furthermore, it is necessary to define how the direct impact of the advisory services on the student failure and dropout rate will be measured.

The subjects involved in the development of this advisory software and the documentation generated from it are mainly the members of the Center for Development and Application of Information and Communication Technologies (CADTIC), being the research group responsible for monitoring compliance with the functional requirements of the system and the relevant management in each of the tasks to be performed, the Coordinator of the Academic Advisory Program and two students with the function of research assistants, all actors belong to the Technological University of Southern Sonora.

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Finally, it is necessary to point out that in each of the aspects of the CSA iterative process, the necessary inputs for the development of the project are mentioned.

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Migrating the *dilo con señas* mobile app to a local web environment

Migración de la aplicación móvil dilo con señas a un entorno web local

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Abstract

This project documents the migration of the mobile application "Dilo con señas" to a local web environment using IWEB technology to contribute to the improvement of mexican sign language (LMS) learning, expanding the opportunities for inclusion and autonomy of people with hearing loss, hearing impaired or aphonia of CAM No.8 According to the results of the National Survey of Demographic Dynamics of 2018, 7,877,805 people, have some disability, which represents 6.3% of the total population of the country, of that universe 28% manifests some disability of hearing loss, hearing loss or aphonia (INEGI, 2018). The methodology was IWEB (Solis, 2015) which consists of the following phases: formulation, planning, analysis, engineering, page generation and customer testing and evaluation. As a result, a web application was obtained which consists of the categories; alphabet, animals, house, colors, days of the week, school, family, toys, months and numbers, implemented images of ideograms and dactylologies, the purpose is to offer an option to improve communication and boost the autonomy of the children of CAM No. 8 with their family and school environment, because it is clear that if they work together a positive and inclusive environment can be created.

Inclusion, Hearing Loss, Signs, Aphonia

Resumen

El presente proyecto documenta la migración de la aplicación móvil “Dilo con señas” a un entorno web local empleando la tecnología IWEB para contribuir en lamejora del aprendizaje del Lenguaje Mexicano de Señas (LMS), ampliando así las oportunidades de inclusión y autonomía de las personas con hipoacusia, débiles auditivos o afonía del CAM No.8. De acuerdo con los resultados de la Encuesta Nacional de la Dinámica Demográfica de 2018, 7,877,805 personas, presentan alguna discapacidad, lo que representa el 6.3% de la población total del país, de ese universo el 28% manifiesta alguna discapacidad de hipoacusia, débiles auditivos o afonía (INEGI, 2018). La metodología fue IWEB (Solís Ramos, 2016) que consta de las fases: formulación, planificación, análisis, ingeniería, generación de páginas y pruebas y evaluación del cliente. Se obtuvo una aplicación web con las categorías; abecedario, animales, casa, colores, días de la semana, escuela, familia, juguetes, meses y números, implementado imágenes de ideogramas y dactilologías, el propósito es ofrecer una opción para mejorar la comunicación e impulsar la autonomía de los niños del CAM No. 8 con su entorno familiar y escolar.

Inclusión, Hipoacusia, Señas, Afonía

Citation: FELIPE-REDONDO, Ana María, DEL CARMEN-MORALES, Heidi, SALAZAR-CASANOVA, Hermes and HERNÁNDEZ-LARA, Florencio. Migrating the *dilo con señas* mobile app to a local web environment. Journal of Information Technologies and Communications. 2021. 5-14:22-28.

† Researcher contributed as first author.

Introduction

The Multiple Attention Center No. 8 (CAM No. 8), offers basic education and job training for children and young people, these centers seek the integration of minors to regular educational services, through the development of autonomy, self-care and learning basic school concepts.

One of the situations that this sector faces is the little or no access to technological resources by the educational community, made up of the vast majority of people with limited economic resources, of indigenous extraction, whose parents have no training. that allows them to support them.

In the various visits that were made to the facilities, the staff mentioned that the sector that could benefit the most from the use of IT in their training, are precisely children with hearing loss and / or aphonia, given that their mental capacities are whole; However, there are no didactic resources or internet services to access various training resources, so the alternative is to offer a website through an intranet that offers an interactive and intuitive experience in the Mexican Sign Language (LMS).

Theoretical framework

Disability is understood as the interaction between people who have a health problem (WHO, 2021), for example, cerebral palsy, Down syndrome and depression, as well as personal and environmental factors (for example, negative attitudes, transport and public buildings inaccessible and limited social support).

Types of disability

- Physical disability: It consists of lack, deterioration or functional alteration of one or more parts of the body, and that causes immobility or decreased mobility.

- Sensory disability: It is divided into hearing impairment and visual impairment.

- Hearing disability: It consists of the deterioration or lack of the sensory function of hearing (partial or total deafness, difficulties in speaking).

- Visual impairment: It consists of the deterioration or lack of the sensory function of seeing (decreased vision, blindness).

- Intellectual disability: Consists of significant limitations in intellectual functioning and adaptive behavior, which is manifested in conceptual, social and practical adaptive skills.

- Mental disability: It consists of alterations or deficiencies in mental functions, specifically in thinking, feeling and relating. It is also known under the term "Psychosocial Disability". (Fundación Integralia, s.f.)

In Mexico, according to the 2018 census, the percentages of each activity with disabilities are walking 52.7%, seeing 39.0%, moving 17.8%, learning 19.1%, listening 18.4%, bathing 13.8%, speaking 10.5%. disability the activity of walking, going up or down using your legs. As shown in Table 1.

Activity with difficulty	2014 (%)	2018 (%)
Walk. Raise or lower using your legs	50.2	52.7
See (even if I wear glasses)	39.2	39.0
Moving or using arms or hands	17.0	17.8
Learn, remember or focus	19.0	19.1
Listen (even if you wear a hearing aid	19.0	18.4
Bathing, dressing, or eating	14.0	13.8
Talk or communicate	11.4	10.5
Emotional or mental problems	11.7	11.9

Table 1 Percentage of the population with disabilities, by activity with difficulty, 2014 and 2018
Source INEGI

According to the results of the ENADID (INEGI, 2018), of the 124.9 million people in the country, different types of disabilities are shown, of which 39.0% their problem is seeing (even if they wear glasses), 17.8% are move or use arms or hands, 19.1% is learning, remembering or concentrating, 18.4% is listening (even if they use a hearing aid) and 10.5% their difficulty is speaking or communicating, as shown in Figure 1.

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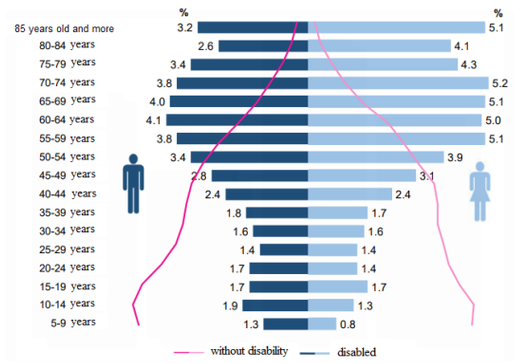

Figure 1 Structure by age and sex of the population with disabilities and those without disabilities according to ENADID
Source: INEGI

Language acquisition: sign language, written language and reading.

Language is one of the inherent qualities of the human being and as already mentioned, it constitutes a right; however, the criteria for defining the concept of language are varied since they depend on its number and scope. (Sacoto Macias, 2017) The basic characteristics of this, as alluded to by Roger Brown are:

- Productivity, that is, the ability to create new statements, combine them and even expand them to build new things. This characteristic has other names according to the author, for example: recombination, recursion or generative capacity.

- Symbolism or semanticity, this refers to the symbolic way in which ideas, events and objects are represented.

- Displacement, that is, the messages do not have the need to relate to the immediate context. (Brown, 1973)

The acquisition of language, then, is framed as a process that has attracted the attention of several scholars for decades, starting from the philological perspective, moving to the Boasian study until reaching the paradigm reasoned by Noam Chomsky (Chomsky, 1957) where it was established by the first time that the rules of grammar and language must be innate in the brain, this; due to the complexity that implies that a child learns the linguistic structure of a language from what he hears.

Thus, language can be understood as a system of symbols used to carry out cultural activities of a specific group. (Trager, Smith, & L., 1957) in this way, a postulate that opposes universal grammar is theorized (Stokoe, 2004)

Reading is a complex process, which also raises a perceptual drawback that psychologists call the problem of invariance¸ that is, we must be able to identify words, no matter how they appear, regardless of their size, typology or shape. In this sense, one of the first steps for reading is to learn the immense variety between these superficial forms, and then to be able to move on to understanding and meaning. Although the fovea absorbs visual information, not all of it has the same precision because as the reader moves away from the center of attention, the visual relays of the thalamus and the cortex gradually decrease the number of cells assigned to it; which generates a gradual decrease in visual precision.

Ideograms

Ideograms represent a word with a single hand configuration. (CONAPRED, 2011)

Dactylology

Sign language is the manual representation of each of the letters that make up the alphabet (Vilches Vilela, 2005). Through it, any word that you want to communicate can be transmitted to the deaf person, however complicated it may be.

Spelling is an important part of the communication system of deaf people. It is simply the writing of the Castilian alphabet executed in the air instead of on paper.

There are twenty-nine positions with their variations of hand movement, some of which are the exact representation of the letter. Fingerspelling is used in combination with sign language for nouns, proper names, addresses and words for which there is no ideogram or sign created or is little known by the signatory community, as occurs with recently created signs (neologisms). or unusual words. Its importance cannot be underestimated; It is therefore essential for the newcomer to sign language to concentrate on developing both receptive and expressive skills in order to gain experience.

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The dominant hand is used (right for right-handed and left for left-handed) to carry out sign language. It is executed mainly at the level of the chin. Its implementation is complemented by the oral articulation, so it is necessary that the face and mouth are visible, as shown in Figure 2.

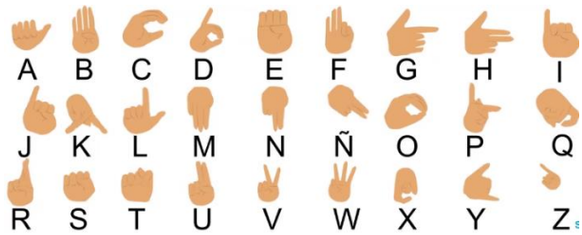

Figure 2 Representative alphabet with sign language
Source: National Pedagogical University UPN

Problem Statement

Currently the teachers of CAM No. 8 communicate with people who have hearing loss, deafness or hearing impairment through nonverbal expressions, facial expressions and gestures using the hands based on the Mexican Sign Language, but relatives, psychologists and some educators are not related to this form of information transmission.

Within the student population there are students with hearing loss, deafness or hearing impairment, educators establish a communication channel through nonverbal expressions, facial expressions and gestures using the hands based on the LMS, but in their environment the transmission of information is difficult since relatives and even the staff of the same institution are unaware of this means of communication.

For these reasons it is that the Academic Body of Information Technologies makes the decision to work with a mobile version of the Dilo project with signs, which after having carried out usability tests (experience in mobile applications, identity, content, navigation, graphic environment, searches, feedback and utility) aimed at the teaching staff and students of the institution that resulted in the need to implement a web environment because the institution does not have the necessary infrastructure to offer connectivity or mobile devices to its students, for For this reason, it is determined to implement the migration of said application to a local web environment that allows making use of the contents of "Say it with signs within a computer laboratory".

Method

In the project named Migration of the Web Application Dilo con Señas for the Multiple Attention Center Number 8, Huejutla, Hgo, the Web Engineering methodology was used (Solís Ramos, 2016), which is a methodological proposal that works with the World Wide Web and the Internet.

This methodology consists of six stages that handle an incremental and evolutionary process, which makes it an efficient model for the development of web systems. The following sections provide a detailed description of each stage, as seen in Figure 3.

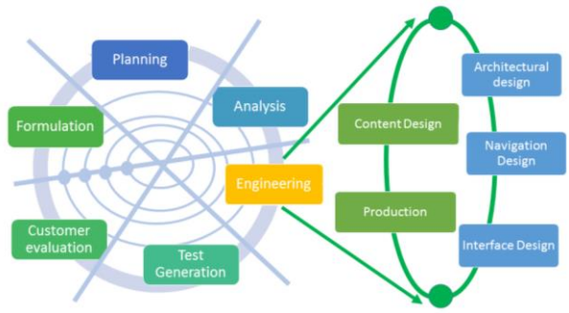

Figure 3 WEB Engineering Methodology (IWEB)
Source: Own elaboration, Solis 2015

Results

Formulation, in this phase the objectives and user profiles that the application will contain were identified, leaving the following:

- Administrator, this can create categories within the application, add content, add new users and login.

- User (Students, Parents and staff), could log in and consume the contents of the application.

In the planning stage, it was determined to carry out an analysis of the technical hardware and software requirements for the development of the project that allow to identify the feasibility of the web application (technical, economic and legal).

In the Analysis process, CAM staff and the academic body came to the conclusion of creating two main categories of content within the application illustrated in Table 2.

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Category: Alphabet	
Content	Justification
Letters	Static and dynamic images were implemented, using the complete alphabet. A, B, C, D, E, F, G, H, I, J, K, L, M, N, Ñ, O, P, Q, R, S, T, U, V, W, X, AND Z.
Category: Learn	
▪ Family ▪ Colors ▪ Numbers ▪ Fruit ▪ Toys ▪ Animals ▪ House ▪ School ▪ Weekday ▪ Months	The Learn category is made up of subcategories that are mentioned in the content section, each content has its respective static image.

Table 2 Categories that make up the source web page Academic Body in Information Technology

In this same phase, the modeling of the database is created taking into account the categorization of the contents, as well as the use case diagrams that represent the interaction processes of the users with the application.

The engineering phase includes the design of content (static and dynamic) that will form part of the project, the site navigation map and the production of the graphic interface design that is illustrated in the following image of Figure 4.

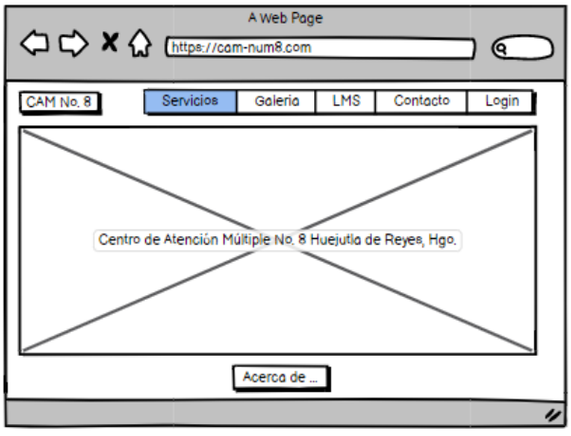

Figure 4 Initial interface design, Home screen representation
Source: Academic Body in Information Technologies

The web application displays static images of the symbols, as seen in Figure 5.

Figure 5 Still images, examples of the alphabet, animal, color, day of the week, number and fruit
Source: Academic Body in Information Technologies

On the other hand, the web application shows dynamic images of the symbols through videos, as seen in Figure 6

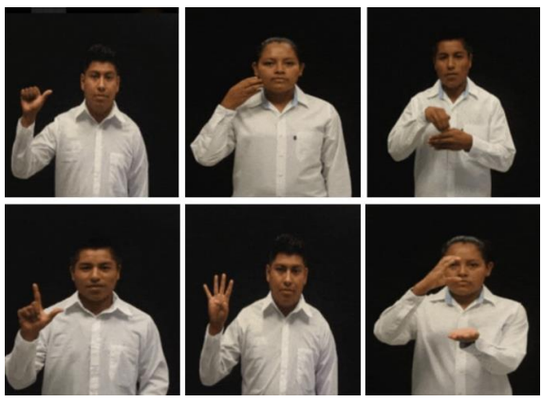

Figure 6 Dynamic images. Examples of alphabet, animal, color, day of the week, number and fruit. Source Academic Body in Information Technologies

The page generation and testing phase served for the development as such of the web application in which various web development technologies were used (MySQL, HTML5, CSS, JS, REAC JS) that were implemented to generate the user interface of the application, as seen in Figure 7.

Figure 7 Capture of the home screen of the web page
Source: Academic Body in Information Technologies

In the test section, various questionnaires were applied (experience in web applications, identity, content, navigation, graphic environment, searches, feedback and usefulness) that allowed to determine the usability of the project before the possible end users of the application.

In this project, the expected objective was achieved, the purpose of which was to develop a web application through the IWEB methodology that allows contributing to improve the learning of the Mexican Sign Language in order to expand the opportunities for inclusion and autonomy of people with hearing loss. hearing loss or aphonia of CAM No.8.

The objectives and goals of the system were identified, considering the results of the usability tests in terms of experience in web applications, identity, content, navigation, graphic environment, searches, feedback and usefulness for development for migration to the web application.

The technical, economic, operational and legal analyzes were carried out to determine the viability of the project, as well as to establish the sketches based on the requirements for the development of the web page modules, specifying as a goal to elaborate the interface and navigation designs.

A web application was built using the react js framework that allowed the development of dynamic web applications, establishing the goal of building the website by creating the categories of: alphabet books, learn, practice, toy, numbers, family, animals, using fingerprint and ideograms. As a result, the web portal was started with its respective modules and the dynamic and static images were selected.

A usability testing protocol was applied again, aimed at staff, students, and school environment.

After concluding the project, it is intended to deliver the web application called web application development say it with signs, for the Multiple Attention Center (CAM) number 8, Huejutla de Reyes, Hgo; This will allow many people and parents to have a tool that serves as support material to strengthen the knowledge of students with deafness, hearing impairment or hearing loss and in this way they can obtain better communication through Mexican sign language.

Conclusions

The project was born out of the need to support people with deafness, hearing impairment or hearing loss, since there is a high percentage of disabled people in the country. Its purpose was to carry out the migration of the mobile application “Dilo con señas” o a local web environment using IWEB technology to contribute to the improvement of the learning of the Mexican sign language, thus expanding the opportunities for inclusion and autonomy of people with hearing loss, hearing loss or aphonia of CAM No.8.

The methodology used for this project was Web Engineering, which allowed keeping a chronological order for the creation of the project, as well as optimizing errors and times that occurred during its development.

This project benefits the community that make up the Multiple Attention Center (CAM) number 8, Huejutla de Reyes Hidalgo. This application helped CAM students to have ease of acquiring knowledge through the use of the alphabet categories and learn, since in each image the sign language and ideogram are represented.

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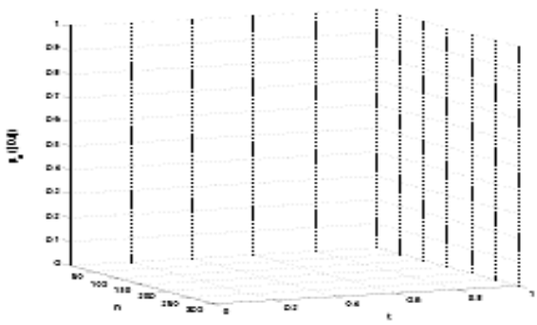

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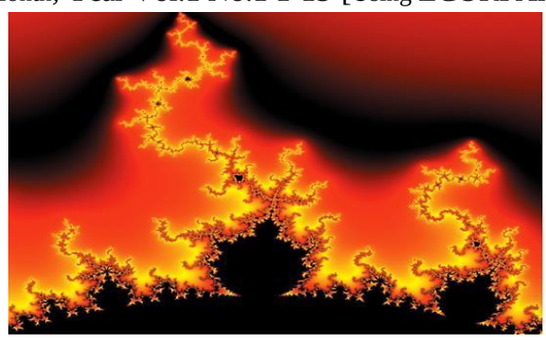

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