Digitalization, as focal tactical strategy, within collaborative learning; case study: Mathematics

La digitalización, como estrategia táctica focal, dentro del aprendizaje colaborativo; caso de estudio: La Matemática

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Abstract

Initially, it is necessary to infer the way in which teachers contribute knowledge to the smart classroom. To this end, the objective of this study, as the basis of the educational environment and within digital pedagogy, manifests the didactic ability as a technicality of instruction. However, this research is based on the prism methodology and the bibliography admits technology as a bastion of ubiquity in resulting edges. Thus, digital connection is considered as the driving force of learning and its competencies are focus strategies. As much as these serve as educational tools in the digital age, they promote knowledge and expose, as derivation, cognitive thinking; safeguarding, in the classroom universe, competencies as a standard and establishing digitalization as the foundation of learning. Finally, in their search, technological instruments and computational certainty supported a practical assumption; case of Mathematics in an Ecuadorian University.

Keywords: Mathematics, learning, digitalization, education, internet

Resumen

Inicialmente, es necesario inferir la forma en que los docentes aportamos conocimientos al aula inteligente. Para ello, el objetivo de este estudio, como base del entorno educativo y dentro de la pedagogía digital, manifiesta la habilidad didáctica como tecnicidad de la instrucción. Empero, esta investigación se apoya en la metodología prisma y la bibliografía admite la tecnología como reducto de la ubicuidad en aristas resultantes. De esta manera, se tenga a la conexión digital como motor del aprendizaje y sus competencias sean estrategias de enfoque. Tanto cuanto, éstas, sirvan como herramientas educativas en la era digital, propendan al conocimiento y expongan, como derivación, al pensamiento cognitivo; resguardando, en el mundo áulico, las competencias como estandarte y estableciendo la digitalización como fundamento del aprendizaje. Finalmente, en su búsqueda, los instrumentos tecnológicos y la certeza computacional dieron sustento a un supuesto práctico; caso de la Matemática en una Universidad ecuatoriana.

Palabras clave: Matemática, aprendizaje, digitalización, educación, internet

Introduction

Considering the didactic strategies and reflecting on the teaching-learning processes, we cannot alienate the current of the social environment that contains doubt in the way we teach. Therefore, it is necessary to question ourselves in the way we produce knowledge and what we exhibit in the face of the ideological neutrality of the University; in order to eliminate escape points within the educational environment. So, no higher education center should interfere with established points in the social environment when it comes to digital factors.

Thus, as an objective, we must conjecture whether current devices are in line with the smart classroom and whether they are suitable for the development of collaborative work; such is the case of mobile technology. Therefore, "…it is possible to establish archetypes of the educational events to be carried out; much more so, if the Universities are objectives to be fulfilled. Visibly, to achieve this, it is necessary to set propose new knowledge" (O'Connor et al., 2020, p. 11).

Consequently, we can deduce that the feasibility of knowledge production integrates the student; but at an age according to his capacity. That is to say, that teachers must adapt to the fundamental principles that a young person has within himself, for autonomous learning and, therefore, it is when it is argued that there is no commitment to classroom culture. But also, that the student society must be the architect to achieve an influence, not dominant, in the formulation of innovative pedagogical practices. However, this must be guaranteed by formative expressions as a reformulation of the social problems presented; arguing, equality in the development of creativity. Though, said creativity must be forceful in supporting knowledge and, at the same time, be considered as a transversal appendix within ubiquitous learning (Arul et al., 2024; Saif et al., 2024).

Development

Interaction with the student must be collaborative within the university environment and this implies the consummation of pedagogical skills as expressive tendencies. Thus, professional skill must become an activity that enables the culmination of the ideal educational process.

Noting that these skills must be based on the idealization of concepts and established goals. That is, that the assigned qualities distinguish the teaching staff as drivers of rationality in the cognitive development of a human being in training. Likewise, taking into consideration the subject matter to be taught and that it is transformed into communicative skills, the teacher is a transmitter of motivational erudition.

At this moment, the empathetic aspect must provide optimal sections in the confidence of learning and that classroom tedium is expelled; much more, if creativity is the prelude and ubiquity reacts positively. Above all, if we have Information and Communication Technologies (ICT) as tools to share modern content and these are a sign of good teaching. In addition, the emotional relationship with a student is strengthened and can be effective with attention; also, with the absorption of the content taught. Then, the methodology used, for the sake of learning, is something notable in favor of continuity and the smart classroom; together with the ubiquitous aspect as a mainstay.

The digital connection between higher education and its skills

It is logical to point out that the University of the future is a manifesto of the philosophy of 'Good Living'. Since, living with nomothetic thinking is the basis of a promising educational future and because of this, it is unavoidable to specify a digital point of view; when considering the pedagogy of the new millennium as an intrinsically effective section. Then, "...the new didactic strategies foresee a highly competitive market within globalization and the social political aspect; depending on each country, they will take a direction" (Hossein-Mohand et al., 2021, p. 10). Nor should we forget educational integrality. More than anything, in the formation of social entities capable of being critical, their connection becomes a predominant sociocultural context and ethical conditions exist. However, the problem does not lie only in the educational environment that we have in Ecuador. Since it is more important to radicalize the academic universe within the particular educational model and be able to fragment it into subjects that contemplate the technological study imparted by Universities. Obviously, being aware that knowledge incites action and knowledge competencies encourages the announcement of multiple intelligences. Reasonably, it is then essential to opt for a new model of transformation in the context of technological humanism; but assuming responsibility for the consequences (Wilson et al., 2024; Davy Tsz Kit et al., 2022; Sistermans, 2020). Highlighting, that entrepreneurship will emphasize knowledge and its transformation, giving importance to predefined contexts; both declarative and procedural. Thus, absorbing the intention of thought as non-static dimensions and that these become the pedagogy of knowledge as declarative of the harmonious context of the student. Therefore, by integrating within a competence acquired by the student, "...he becomes a participant in academic integration and in this, there are competencies that make up the teacher's declaration of conduct" (Boichuk et al., 2023, p. 42). The same, which is very valuable within the field of education and it is from here that the concept arises that, "...the development of cognitive competencies is a strategy to improve the quality of learning and also, that its potential is the capacity that people have to think and develop insightful behaviors" (Buckingham Shum et al., 2023, p. 26). But, in the Ecuadorian context, it should be noted that, for more than two decades, the application of digital technological skills has expanded as educational reforms have been adopted aimed at control entities; case of the Secretaría Nacional de Educación Superior, Ciencia, Tecnología

Educación y sociedad
ISSN: 1811-9034 RNPS: 2073
Vol. 23, No. 1, enero-abril (2025)

e Innovación. (SENESCYT).

Focal tactic of technological tools affirmed in the digital age

There is no need to debate the current moment that society is experiencing. So much so that, decisively, we must address the issue of digital education and the tools that it entails. Thus, "…inevitably, we must address cloud education and in this, we must necessarily recognize multimedia technology; the case of smart tutorials" (Hobbs & Donnelly, 2020, p. 137). Thus, this is how an intelligent multimedia tutorial is shown and this, being a communicative software, refers to digital education as a pedagogical pastime. So much so that motivation in the classroom is a canon within Latin American education; defining concepts of educational value such as the emergence of a developing country. It turns out, then, that projecting research on the participation of university students within technological exclusivity is ideal.

Consequently, the existence of technological devices encourages the student to have common links with cybernetics. That is to say, if we relate our interior with personality, we must agree with the existence of new concepts. The same ones, which are presented and disseminated within the wisdom of each student; as modelers of ideas and conditioners of cognition. It is in this, that Ecuadorian society, through the higher education institutions it has, must determine socializing instances. Which, "…establishes situations in the student's performance; but being consistent with their emotional stability. At the same time, the changes generated in the digital age must formulate a correct interrelationship between people of the same age" (Watkins et al., 2021, p. 262); in this case, Ecuadorian students within the range of [18;24] years. With this, carry out communicative dynamics and with the support of the teaching staff, turn it into knowledge. That is to say, this material must be deposited in the cloud and be a precursor to a correct academic training. In such a way, that it facilitates the assimilation of knowledge and attitudes conducive to self-learning and the acquired way of thinking, entails dispositions in the motor concentration of the classroom; such that, these attitudes are a reference for continuous improvement in education. Likewise, it should be noted that academic performance must grow exponentially and learning conflicts must decrease. But multimedia work in the classroom must be consistent with groups; more than anything, in collaborative training. Then, "...as long as the study techniques applied are in accordance

Educación y sociedad
ISSN: 1811-9034 RNPS: 2073
Vol. 23, No. 1, enero-abril (2025)

with the environment in which the student lives and the weakness of the previous academic preparation is considered" (Trabelsi et al., 2023, p. 6-7).

However, it is essential to be clear about the changes that this nation has experienced in recent decades; especially since the beginning of the century. So much so that, at that time, when accepting technological challenges, educational implications were not taken into account; much less, by not considering globalization. This is therefore where risk becomes a major issue and opportunities for progress are limited.

Teaching skills as a pillar of cooperative learning

In this reflective paradigm, "...it is possible to insert competencies into autonomous learning and admit technological education as a strength of the smart classroom. Even along with this, the strengthening process must be directed towards the paradigm of ubiquity" (Welcomer et al., 2022, p. 291); likewise, the categorization of the curriculum. In such a way, that good learning is inserted within the University and teaching as a tool.

But this only happens when a student needs norms that promote similar behaviors within their academic training. As long as compliance with these norms is consolidated as the establishment of institutionality and its imposition does not segregate the psychological development of a mentality in formation. It is then that, when talking about behavior, peers are impartial. Emphasizing the actions of students and the knowledge acquired for the good of the educational community to which they belong; which encourages maintaining the literality of the commitment.

Then, "...this is the way teachers have to infuse the social entities that participate in the institutions. Bordering on personal benefit and educational practice as satisfaction of collaborative work" (Sommerville, 2021, p. 160). All of which refers to the information stored in the student's possession; this being the academic project shows. Subsequently, cognitive utility and creation must be the beginning of intellectual reach and collaborative work, of the adoption of dynamic processes; case of gamification and recreational mathematics. However, this includes the intensity of reflective work; which denotes complications in the student's actions. So, social practice is an undeniable fact that contains demonstrable characteristics; case of responsibility.

Therefore, first of all, we must reflect on the emotionality that students have for their mental functions. Thus, that these are binding with teaching and have the projection of personal improvement; together with not being bored in the classroom. As a second literal, we put, as an apocope of dogmatic sociability, the metacognitive functional priority of the brain and the human personality. That is, it is essential to carry out dynamic stimulation processes within a socio-educational context; thus, the fact that a University is integrated with the social environment is gratifying. Consequently, according to the philosophy that transposes the university environment, as a valid concept, we must consider its conceptual assimilation as canon and consequently, depriving the smart classroom of knowledge is something negative. Since in this way it is possible to obtain a constructive criticism in favor of the new academicism; accepting equity and equality among peers. Where these two, "...are the educational and constructive values of a committed acquisition. Meanwhile, the cognitive and emotional aspects are contagious in the middle of work" (Pokrovskaia et al., 2021, p. 7). That is, the rational value of the individual, both collective and social, must be the basis of moral conscience. Therefore, the idea of having the universal manifesto of education in values at hand is plausible and it is here, when the importance of humanity is magnified. Likewise, respect for the classroom is a common denominator in the construction of modern sociocultural bases. Demonstrating that in this way, at any educational level, there is a tendency to detect the problems that may arise in personal development. But to do so, it is necessary to focus on emotional conditions and carry out appropriate didactic therapies; ensuring that students, contained in the interval [18;24] years, are not recipients of classroom boredom. Demonstrating that, in practice, numerical gamification can be counted on; but in an analytical and judicious way. In addition, the fact of having the involvement of students in activities, recreation is proven as pedagogical accompaniment. Remembering that this tends to improve the mental structure and encourages recognizing the evolution of student thinking; in this way, the mathematical content is more attractive. Thus, "...the construction of meanings is the section to be directed towards interculturality and when it is applied, the interrelation of the dialogue is consistent with the emergence of terms" (Sanzana et al., 2024, p. 103-104).

Ubiquitous learning, in Mathematics, as a metaphorical burden on the University

We must recognize that ubiquitous learning is in its early stages in Ecuador. Since it is not considered among the paradigms of numerical skills. So much so, that no higher institution has it as a priority and, nevertheless, the necessary devices are within reach of the students; therein lies the contradiction. Therefore, the university higher education system in this country does not tend to comply with formality. As much as the skills of teaching are not applicable to the environment; much less, if they are not considered as a burden to obtain positive results. That is to say, none of this is aimed at the good of university education and even worse, within digital literacy. So, in relation to mathematical teaching, the ubiquitous subject does not invite scientific research. So much so, that the same computer material identifies this methodology as not viable; above all, due to the lack of knowledge of the importance of this paradigm.

Noting, that this system should invite to update. Since the technological changes in the current world, not to mention in the student world, are more than noticeable. So much so that, the exact sciences are drivers of virtual information; exemplifying with the MATLAB[1] and GNU Octave[2]. Even within this type of teaching, knowledge is treasured by the student. Since, in a certain way, it strengthens their student life and encourages ideal u-learning[3]. Much more so if it is closely related to academic achievement and its teaching, as a possibility of globalization within the educational universe; which is plausible. Subsequently, ubiquity provides virtual and prepared classrooms, just as in Figure 1, which will always be available to students at any

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[1] MATrix LABoratory (MATLAB) is a paid software and web platform designed for Exact Sciences. These support Scientific Research in the management of Computational Mathematics and Numerical Programming for Engineering. In addition, it has a type language (.M) that operates with object orientation and is executed based on scripts. Therefore, it provides advanced functions for the visualization and rendering of 3D graphics in Simulink.

[2] Operational Critical, Threat, Asset and Vulnerability Evaluation (OCTAVE) is an application and portal, licence GNU's Not Unix (GNU), that facilitates mathematical calculations. Therefore, as it is a free project, it is equivalent to MATLAB and through its online platform, university learning is guaranteed. Thus, it is coded in C++, works with Data Structures and is executed in batches; likewise, its sentences and graphs are dynamic. However, its Graphical User Interface (GUI) is not stable.

[3] It is then that the importance of ubiquitous learning arises as an appendix to its use of the cloud. Since, acting as a base repository, it becomes a guarantee for learning at home. Pointing out that the impact caused by teleworking validates the focal strategy. So much so that the ubiquitous paradigm becomes part of the Information Society (IS) and the Knowledge Society (KS). It is at this moment, that Information and Communication Technologies (ICT) predict success for the coming years, its functional characteristics project verticality of information and guarantee instantaneousness of technology; applying virtual access to the educational universe and acting as a pedagogical edge.

Educación y sociedad
ISSN: 1811-9034 RNPS: 2073
Vol. 23, No. 1, enero-abril (2025)

time and place; regardless of their abilities. In addition, platforms intended for ubiquitous learning provide adequate material in accordance with current events. Complementing this, with the idea that ubiquitous education offers the student significant potential; much more so if the latest generation of manual devices are available.

Practical case of collaborative mathematical learning among peers

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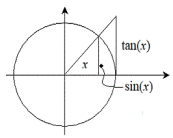
Guayaquil/Ecuador

Mathematics Didactics
Final Test

Postgraduate Studies Faculty
Williams Basantes Valverde
Responsible Teacher
2022
60 Minutes

Question (10 Pts.)

Based on the graph, using deductive reasoning techniques and thinking skills,

$$\lim_{x \to 0} \frac{\sin(x)}{x} = 1$$

¿What would be the ideal way to explain, the following solved problem, to your students?

Table 1

Solution to the Limit of the function as x→0

Step	Solution	Step	Solution
1	$\sin(x) < x < \tan(x)$	6	$\cos(x) < \dfrac{\sin(x)}{x} < 1$
2	$\dfrac{\sin(x)}{\sin(x)} < \dfrac{x}{\sin(x)} < \dfrac{\tan(x)}{\sin(x)}$	7	Accumulation point: $x_0 = 0$
3	$1 < \dfrac{x}{\sin(x)} < \dfrac{\sin(x)}{\sin(x)\cos(x)}$	8	$\lim_{x \to 0}\cos(x) < \lim_{x \to 0}\dfrac{\sin(x)}{x} < \lim_{x \to 0}1$
4	$1 < \dfrac{x}{\sin(x)} < \dfrac{1}{\cos(x)}$	9	Sandwich theorem: $1 \le \lim_{x \to 0}\dfrac{\sin(x)}{x} \le 1$
5	$1 > \dfrac{\sin(x)}{x} > \cos(x)$	10	Then: $\lim_{x \to 0}\dfrac{\sin(x)}{x} = 1$

Name_1: _____

Name_2: _____

Figure 1

Cognitive aspects of mathematical thinking

Digitalized solution on the MATLAB online platform

The digitalization process must be understood as the transformation of analog techniques into digital ones and structured programming, Figure 2 case, as a methodological contribution within the universe of learning; much more, seeing that it is a technological reference of Computational Mathematics. But there are various reasons to assimilate virtuality as an appendix of ubiquity and for modern academic society to reach an unquestionable digital future. So much so, that digital transformation provides dynamic structures for access from any electronic device. This facilitates data sharing, but categorizing the collaborative format in a secure manner. Likewise, confidence in the resolution of the problem posed is a support and cybernetics contributes to its feasibility. At this point, it is necessary to take into account the availability of information, the e-learning modality chosen for teaching and ubiquity, as a unique study technique, by maintaining the speed of consultation; while this is an indicator.
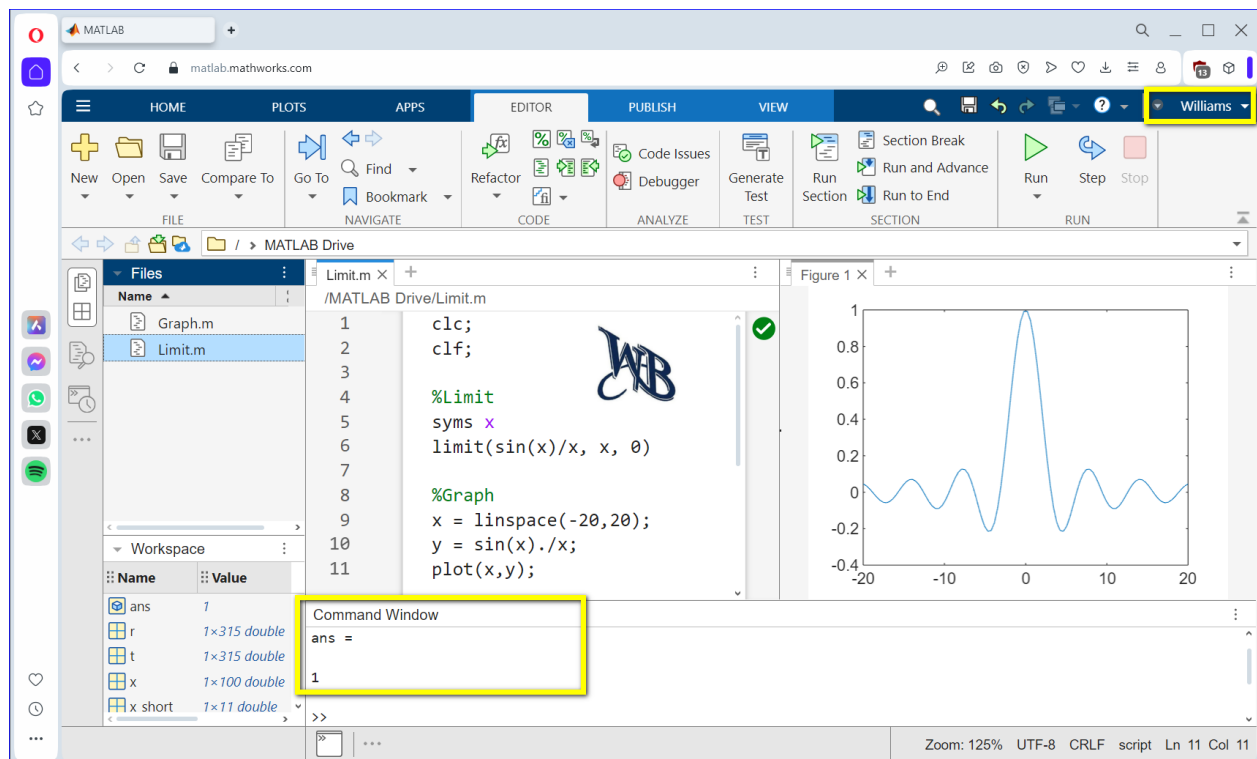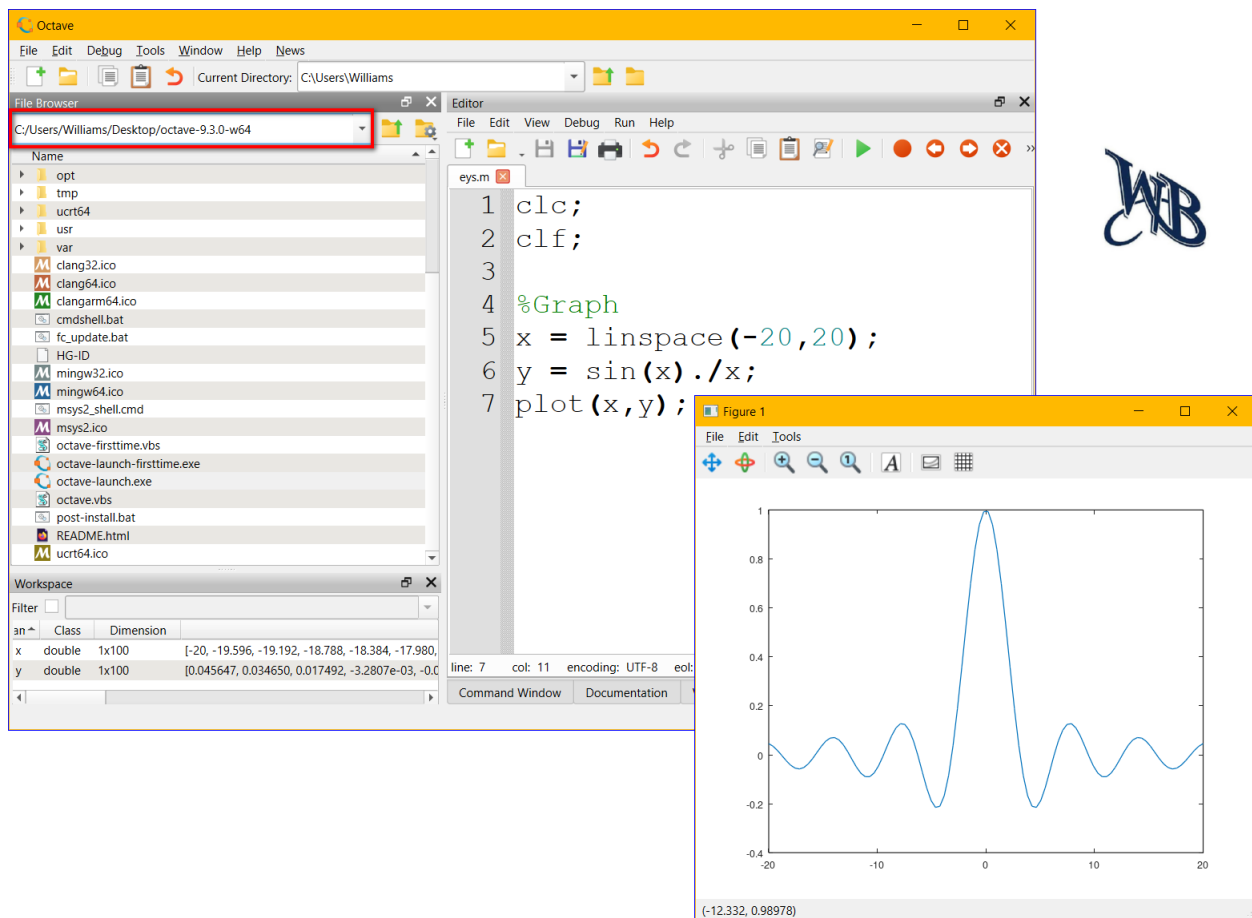

Figure 2

Computational Mathematics Activity on the MATLAB Web Portal

Focusing the graphical solution on GNU Octave software

The approach is a process that is basically encompassed in efficiency and is projected, in potential guidelines, within all intelligent software for graphical visualization; Figure 3 case. So, the user wins; above all, in attitudes towards the challenge of acquiring knowledge. In this case, as a great support, GNU Octave prepares the student to understand mathematical innovation. In this way, the trend of his study is framed, with polyvalence, within a complex system and, in this way, the exchanges support the changes in the pedagogy of the new millennium; abandoning the celebrated master class, classroom desertion and opting for the Socratic Method as a benefactor of self-learning.

Figure 3

Collaborative event, on visualization, using the free software GNU Octave

Educación y sociedad
ISSN: 1811-9034 RNPS: 2073
Vol. 23, No. 1, enero-abril (2025)

Conclusions

The processes of dynamization, together with the teaching staff, project conjectures in an integral communication; strengthening the digitalization of the student body. Pointing out that the environment itself emits characteristics of a changing modern world and considering creative thinking as a reflexive current. In this way, the latter is considered as an ideal image and assessment of its task. So much so that, being focus strategies, they are fundamental in the evaluation of the student. Consequently, there are somewhat obsolete currents, such as [Piaget], that do not visualize intellects capable of overcoming the paths of knowledge and reasonably so, they do not try to make them more bearable either; generating negative endowments in the subject of virtual training. Before, teaching in the cloud becomes a permissive approach to the management of educational Big Data and as this is an inciting instrument of cloud pedagogy; it is activated as an academic activity. For this reason, said virtual education encompasses knowledge of teaching and dynamic participation of the student body; linked to digital environments and electronic devices, iPhone case. In other words, technological resources support digitalization by interrelating with attendees, providing feedback on knowledge and saving money on face-to-face education; also, can be defined as the technological transformation of every pedagogical process through the automation of each teaching activity.

To reach the result of this research, strategic planning was applied within collaborative learning and, as this is an important axis, it gave way to the formulation of comprehension tactics; also, a practical assumption in the subject of Mathematics. To this end, in this planning, success stories were applied with the processes of linking the smart classroom and the numerical environments. Likewise, the evidence supported the expectations raised in the relationship of lateral thinking and attracted the principles of continuous improvement within Ecuadorian technological education; along with creative solutions, generation of personal and professional challenges. Correspondingly, from this perspective, changes were proposed in University Higher Education, when addressing unconventional problems, in a country prone to the scarcity of scientific research and the canons expressed were binding with its inhabitants and the overcoming of difficulties; together with their social interrelation and their application.

Thus, in Ecuador, the University is capable of promoting the development of strategic plans in search of e-learning communication; the same one that, since the beginning of the century, has shown its advances. Therefore, ubiquitous learning is prone to human-machine interaction and because of this, it is schematized within the modern computing experience; much more, if it is understood as evidence of non-temporal learning. Understandably, this is the ideal way to expel an obsolete technology. Above all, knowing the primacies that electronic devices offer within the u-learning universe; but considering the immediacy of their handling. So much so, that techno-educational activities are nuanced in terms of the adaptability and technological implication that they offer advantages; granting regulations in mobile technology. Much more, if the future supports the field of the Cloud, it makes its interaction with the daily argument notorious and virtuality standardizes smart terminals. Subsequently, Artificial Intelligence (AI) brings knowledge to science and reasoning predominates over techno-social expectations. But this technology is the pinnacle of humanity, providing interpolation in online communication and exemplified by Python as an instrument of the Knowledge Society (KS).

Finally, in order to achieve a consensual outcome, induction, analysis and synthesis were chosen as instruments. However, all of these helped for a future diagnosis and qualitative parameters for observation were proposed; in addition to a projection.

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