Educación y sociedad
ISSN: 1811-9034 RNPS: 2073
Vol. 22, No. 2, mayo-agosto (2024)

Lateral thinking, as a non-accessory characteristic, within the implicit learning of the Exact Sciences

El pensamiento lateral, como característica no accesoria, dentro del aprendizaje implícito de las Ciencias Exactas

Williams Basantes-Valverde*
wbasantes2@alumno.uned.es
https://orcid.org/0000-0002-7352-6455
Katherine Tixi-Gallegos**
katherine.tixi@espoch.edu.ec
https://orcid.org/0000-0002-7545-9671
Norma Isabel Allauca-Sandoval***
normaisabel.allauca@unach.edu.ec
https://orcid.org/0000-0003-0269-8417
*Universidad Nacional de Educación a Distancia, Spain.
**Escuela Superior Politécnica de Chimborazo, Ecuador.
***Universidad Nacional de Chimborazo, Ecuador.

Abstract

Lateral thinking is the ideal way to achieve creativity within the student mentality; but to do so, it is essential to look at this challenge from another perspective. Reasoning skills are not only available thanks to advances in educational technology and rather, the solution to this dilemma must be based on the digital age; just like in the Knowledge Society. Therefore, this is how unconventional thinking will emerge as a social approach capable of allowing the independence of the Sciences and it is in this case that challenges, of Higher Education, will germinate by proposing permanent learning environments. Making every student work, collaboratively, in obtaining knowledge of the Exact Sciences and exemplifying with online courses that promote learning spaces; as long as intelligent software is the tool to interact.

Keywords: University, knowledge, education, math, thought

Systematization article derived from educational practice.
Recibido: 30/01/2024 – Aceptado: 17/05/2024 – Publicado: 26/05/2024

Resumen

El pensamiento lateral es la manera ideal para lograr creatividad dentro de la mentalidad estudiantil; pero para ello, es sustancial mirar este desafío desde otra perspectiva. Motivo de que las habilidades de razonamiento no solo están disponibles gracias a los avances de la tecnología educativa y más bien, la solución a este dilema debe basarse en la era digital; al igual que en la Sociedad del Conocimiento. Por lo tanto, es así como el pensamiento no convencional surgirá como un enfoque social capaz de permitir la independencia de las Ciencias y es en este caso, que germinarán desafíos, en la Educación Superior, al proponer ambientes de aprendizaje permanentes. Haciendo que todo estudiante trabaje, de manera colaborativa, en la obtención de conocimiento de las Ciencias Exactas y ejemplificando con cursos online que promuevan a los espacios de aprendizaje; tanto cuanto, el software inteligente sea la herramienta para interactuar.

Palabras clave: Universidad, conocimiento, educación, matemática, pensamiento

Introduction

Since the beginning of human history, two arguments have been taken for granted: Thought and reason. We have proof of Homo sapiens evolution and adaptation to the planet's ecosystem ever since their inception. Thus, this is what made it possible for the development of ancient hunting tools. They also served as the forerunners of control, eventually choosing metallurgical foundries. As a result, it was the period for creating the instruments required to survive in a foreign environment, refining agriculture and minimizing animal migration. Consequently, the knowledge of intelligent development and adaptation to the dominant ecosystem then starts to build intelligence as a precursor to survival; highlighting the treatises of [Charles Darwin] and connecting it to the current millennium in scientific advancement.

So, "…judging by a timeline, digitalization has created generations whose technological development is in line with modernity and the digital divide has not slowed down their development" (Phang et al., 2023, p. 16); regardless of age level. Because of this, it is when the cognitive aspects come to the aid of the individual; making memory more flexible and facing diffuse moments. Therefore, today, a human being must be a member of the digital world and become a social entity capable of technological progress. Thus, in a changing

world, it is closely related to globalization and the entire world; especially in Third World countries. Considering that since 2000 there has been development in improving university education; unfortunately, this still does not match the quality. So much so, that the linearity of thought is a retrograde episode, within the teaching-learning process, which results in the poor development of spiritual skills. But it must be remembered that technology shows its expiration date and, consequently, inflexible educational calibration produces negative spaces in classrooms; refuting didactic evolution, declining current educational models and hiding the new.

That is why, "…the educational system must promote the development of attitudes such as formal learning and foster relationships in adaptive environments; but, participating the competencies of the teaching staff" (Wang & Ge, 2023, p. 163).

Development

Promotion and abstraction of Educational Technology

It is well known that the development of technology in education requires innovative regulations. Therefore, its integration gives meaning to the normativity of scientific research; what is important in precise terms. Consequently, its resistance provides disadvantages; especially, if there is no evidence of indexed journals and international conferences as thermometers. But adequate teaching of Information and Communication Technologies (ICT) requires updated materials; starting with multimedia tools. In other words, pedagogical optimization should be used to aid in the continuous improvement of education. But counting on ideals that remove outdated material; blackboard case. So current events influence mobile technology as support for Holography, World Wide Web (WWW) and Artificial Intelligence (AI).

Consequently, every teacher must modernize their methods for better absorption of knowledge by students; but preserving motivation as a stimulus. However, seen from another perspective, technology does not have to support linear learning; but that must be coherent with the horizontality of thought. Arguing that, "…this pattern of behavior must be predicted, treating learning as a non-random process rather than a linear progression; but at the same time, as a revelation of the Socratic method of self-study" (Ho et al., 2023, p. 12). Also, the projection curve exponentially increases the student's difficulty in acquiring knowledge. Expressing that

some time ago paper printing was used as a basis for learning and in exchange, currently multimedia integrative material is the preamble to a new pedagogical training. In this, the sciences of behavioral psychology, together with the virtual world, have excluded rote culture; at the same time, they have categorized constructivist processes. Advantageously, systemic guidelines dedicated to online educational technology have been conceived; alleging flexible positions, projecting experience in the didactic field and its radicalization.

But to do this, "…we must consider, as a criterion, the distribution of the variables that intervene in the learning of sciences. However, this will only be possible if the hypothesis of programming as innovative technology is supported; reducing school dropouts and enabling educational efficiency" (Tolba & Youssefm, 2022, p. 1283).

Thus, knowledge is the driving force of the university environment and interest expresses achievable goals in the short term. Such that its influence reaches advanced perspectives and the mechanistic model, does not support biased personalities as interpreters of unreality; preventing learning from being the pinnacle of innovation and the behavioral pedagogical classroom standard. That is, there are provisions that are created at the time of instructional design and project realities as situational representations.

Noting that,

> "…cooperation is a broad letter, within the context of meaningful learning, such as the acquisition of knowledge. At the same time, it must be interpreted from different areas; above all, based on competencies. It is in this context that the teacher becomes a social entity capable of supporting the teaching processes; evoking its pedagogical beginning" (Liaw et al., 2023, p. 69).

Remembering that the rote criterion does not provide investigative connections such as reflective practices of analysis and Information and Communication Technologies (ICT) nor do they provide content within autonomous learning. But a setback, in an erroneous self-assessment, will lead to a reversal of results. So, it is at that moment when educational technology must support cooperative work; but assuming methodological changes and emphasizing that limiting educational technology will never be possible if there is action.

Once,

> "...innovative curricular models have already been developed to address the speculations of communicative pedagogy; while they point to technology as an intelligent way to understand the society in which we live. Integrating pioneering curricular models in Higher Education and without containing uncertainty, when designing innovative educational systems" (Weisberg & Dawson, 2023, p. 337).

But for this postulate to become a realistic current, with deep meaning, the teaching and learning process must be evaluated; considering humanistic and technical models as harmonious sections. More than obvious, considering Information and Communications Technologies (ICT) as part of university centers; these being innovative. Obviously, if this procedure is applied within the curricular integration as a pedagogical project binding to the strategy and therefore, digitalization is recognized as a contribution to collaborative work and virtual media; above all, 2.0 as components that facilitate direct communication between individuals.

Dual relationship between the Information Age and the Knowledge Society

Big Data is the result and the first consequence generated by the technological revolution; access and storage. Where social processes have converted information into capital and production models have been updated in favor of mercantilist thinking. Therefore, the information age has as its canon the speed and circulation of data on the Internet. In this, the information highway is a section to consider; also, the affected areas in which the company operates. What defines this relationship as, "…the creation of knowledge that is characterized by adaptation, branching and feedback; apart from innovation and its frequent use. This leads to a vicious cycle between data evaluation and knowledge creation" (Sahoo et al., 2023, p. 564).

Therefore, this affinity provides novel thoughts about the technological environment in which we live; by turning technology into an integrator of branches of knowledge. But the effects are immediate, if they offer development in the educational field. In such a way, this convergence adds added value to the new pedagogy and the potential that it entails. As an advantage, multimedia takes advantage of the technological means of information and communication by providing state-of-the-art devices; smartphone case. Pointing out then that, in the

extreme case, students have a development in line with recreational activities and integrative learning. But for this it is necessary to provide it with ubiquitous models, which express social environments within the cultural environment and are considered as training activities.

Then,

> "…the effective use of technology arises from the specific capabilities that are part of the Knowledge Society (KS). Consequently, what happens in the technological world has to do with academic quality; especially when solving problems in the classroom. Contributing, in this case, to the curricular design of technologies becoming the formal method of learning free software; case ChromeOS, GNU/Linux and BSD distributions" (Al-Said et al., 2023, p. 13707).

So, the exclusive is discarded and standardization is valued as a support for the material promoted by a well-directed technology; choosing to exclude old models. So, it is thus that the student will absorb active principles of multiple collaborative work; highlighting the appropriation of autonomous concepts. Along with this, the revolution in the educational field is digital culture; also, the direction of social impact. It is at that moment when technology provides unidirectionality so that its effects are not reproduced automatically with productivity within human activities. Nonetheless, "…technological determinism reflects the impact of Information and Communication Technologies (ICT) in the digital age; creating addictions in a robotic society and designing open mental reflections with current technology" (Vesić et al., 2023, p. 6).

Disputes between the autonomy of science and technological development

The importance of science, within society, is progressive in its contextualization and technology, in turn, is the space where educational innovation is socially argued. If this proposal projects technological literacy and is based on training. Without forgetting that the environment, in anticipation, influences the incremental curve of scientific research. So much so that scientific research is essential in the development of classrooms and with its technology, social constructivism can be achieved. In this, teaching, as a trainer, must have responsibility for the future professionalism of the student body; proposing smart classroom spaces that address real identities and social issues within the academic environment. Similarly, difficulty in acquiring

knowledge portends inclusion. Offering, after the fact, answers and for the classroom group to obtain solutions to any questions; also, as critical reflections with the analysis of ideas.

But, "…encouraging the search for answers is the way for students to obtain cooperative reasoning immersed in dynamic work and consequently, the traditional perspective of science and technology, as distant fields, is considered an archaic orientation; demanding social contextualization" (Lavrentiev *et al.*, 2022, p. 66).

This is how obtaining knowledge favors the growth of the attitude and aptitude of critical students. Arguing that this pair has effects concerning values and said environment, it necessarily must respect techno-scientific development. Then, reality reveals the follies of science and technology in the educational stage of university students; looking for a favorable solution in updating the curricular framework.

Pointing out that, if there is a departure from this precept, various integrative perspectives oriented towards contemporary constructivism must be chosen. Obviously, sustainability, in terms of academic training, must be the foundation of scientific activity; more than anything, provoking the promotion of thought as a contribution within the topics involved in the academic world. This happens, when consideration becomes a quality that emerges from social development, the importance of techno-sociality in academic training and the unexplored field in techno-humanism. These three are major barriers to digital literacy as a solution to the challenges of the cloud.

The acquisition of knowledge as an academic-scientific challenge

The greatest desire that the Internet user has is to ensure that literacy, in science and technology, is a commitment to the application of personalized environments. That is, by assuming this ideal, the fact that scientific knowledge is a social objective and includes ethical values is radicalized. So much so, that good orientation will result in the succession of concepts such as positive reaction attitudes and these will crystallize in academic activities. But if the difficulty that comes with learning science is discarded; case of mathematics. However, the fulfillment of the objectives is fundamental in the stimulation of the student and, however, the prevailing crisis in Third World countries prevents improvement in the adequate development of scientific research; Ecuador case. Since the disastrous economy that

preserves this geographical latitude reduces the expectations of innovation that every society longs for. In such a way that the brain drain is present with the migration of any professional who appreciates himself.

Consequently, we must understand the contribution that society makes to science and technology; by promoting ethics as active thinking. Emphasizing that this attenuates participation; especially with learning. That is why the educational argument contrasts distinct aspects of judgment. So that in this way, decision making can be encouraged when problems arise; but having capacity as guarantor of the assumed risks. Along with this, it is necessary that the practice encompasses scientific education, excludes confrontation and collaborative work is progressive in obtaining common experiences in the modern university environment.

Though,

> "…noting that this is the ideal way to promote the work of teachers; by having flexibility and participation in the classroom environment. To achieve this, we must teach the reason for science and whatever quality the student possesses must involve verifiable action; especially, if the scientific knowledge acquired is absolute and verifiable supported by evidence" (Grindell *et al.*, 2022, p. 23).

In conjunction with this, if we refer to international institutions, we can cite the Trends in International Mathematics and Sciences Study (TIMSS). The same, which aims to disseminate the international evaluation of the Exact Sciences and defines technological literacy as "...the creation of methods and techniques so that people understand the nature of intelligence. But considering a cumulative research program as a commitment to American culture" (Bailey & Woodall-Greene, 2022, p. 1961).

It is from here then, consequently, that the innate precept of the will to learn and attend to topics related to sciences is obtained. Therefore, it is when social constructivism is established, the importance of student attitude and values in personal improvement; which generates an improvement in education. Nevertheless, we must recognize that the environment is responsible for digital literacy and the student community is responsible for obtaining new knowledge; applying skills in the classroom by becoming research managers and opting for

communication skills.

Internet, as a learning environment, within collaborative work

The paradigm of the new Web 2.0 makes the establishment of online meetings viable. That is, virtuality between users allows materials to be shared collaboratively; that is when creativity expresses relationships with Social Networks. If the generation of content is the introduction to the educational process and the advantages offered by the World Wide Web are taken advantage of as projective edges of the innovative education. Observing, furthermore, that the advantages offered by the information highway are transformative currents that tend towards the exuberance and goodness of multimedia information; especially in virtual education.

However, this exchange does not always define literals in favor of research; since leisure is the initial section to not formalize this canon. But "…Big Data is something that must be resolved through information processing and that is when educational opportunities are made more flexible; combining characteristics of the Socratic Model when acquiring skills in favor of daily interaction" (Bourechak et al., 2023, p. 20).

Though, the protagonist of this plot, at least currently, is the teachers with their attitude. This is how the new educational paradigm that encompasses formal learning is seen; boasting peculiarities that each member has. Noting, also, that the practice obtained during its development provides threatening obstacles in the personalization of learning; jointly, that these practices do not lead to uniformity of thought. In such a way, that "…the student approach is tailored and personalized to the individual. However, the e-learning paradigm supports the non-abstract concept of hypermedia systems; both personal and freelance" (Moorhouse et al., 2023, p. 121).

More than anything, if classroom management gets tools; case of horizontality of thought and lines of research that tend towards online platforms, such as DokeOS. Pointing out that teaching itineraries must become a methodology consistent with the classroom environment, observing their weaknesses and progress. Advantageously, in the special case of DokeOS and lateral learning tracking, the customized nonlinear thinking model is applied; simplifying technological variability and preserving educational development. So, this makes it possible to learn science in the virtual environment and involves minimal effort time with teachers

and students. Establishing that the tests of the proposed model extract interesting and, in this case, exact results. Because numerical methods program sharp mentalities in individuals in training. Therefore, "...the learning of mathematical intelligence is programmed as an educational phenomenon and is used for motivation to learn scientific knowledge" (Song & Su, 2022, p. 137).

Practical case in the Exact Sciences: Online course Mathematical Analysis

Activity 1. Predictive Analysis Plan

Data mining, in the world of the virtual classroom, allows predicting pattern trends for the visualization of the proposed syllabus; in addition to extracting numerical knowledge. Therefore, predictive analysis will bring together a variety of statistical models and learning techniques. Therefore, this online course will be created based on a sequence of objectives. The ones that will facilitate the search for Key Performance Indicators (KPI) and will become essential appendices to integrate the analysis process; but, with feasible results. However, to do so, the nomenclature must consider its own terminologies such as abbreviations.

Activity 2. Functional Scheme Approach

As a foundation, educational technology will be projected with objectives; along with its implementation in the university environment and the interest in achieving goals. But the purposes of this project must be considered as strategic planning. Since they will guide the collaborative work in search of the proposed competencies and based on this, the objectives of the pilot course, their indicators are shown in Table 1.

Table 1

KPI evaluation stages and indicators

Goals	Itinerary
Phase 1: Preliminaries	
• Provide surveillance to the student group that will enroll (satisfying curiosities and needs)	• Linear tracking of personal achievements • Support participation for students who require

Goals	Itinerary
• Prevent abandonment	• Provoke critical attitudes related to the proposed topic
• Provide guidelines for attitudinal participation	• Formulate scheduled tasks and directed activities through a schedule
• Agree on a wide range of student evolution in course development.	• Apply techniques that evaluate results according to progress
	• Provide patterns in the fields of interest (trend and behavior)
• Gain acceptance	• Balance of effects and compliance with the planned powers
Phase 2: Promise	
	• Tabulation
	• Inscribed
	• Personalized teaching
• Phase 3: Fields of action	
	• Diversity
	• Flexibility
	• Update
	• Abandonment prevention
	• Continuous improvement
	• Futures
	• Personalization of learning
	• Total quality of teaching
Phase 4: Applicability	
	• Reduce student dropout
	• Extend quality of teaching/learning
	• Contingency plan
	• Projection of new enrollees
	• Log of new events (problem/solution)

Goals	Itinerary
Phase 5: Privileges	
	• Economic profit • Lower attrition • Job competitiveness
Phase 6: Procedures	
• Preventive interventions	• Provision of study material • Follow-up – Job – Time • Software procedures manual – Avoid errors – Ignore obsolete topics
• Interventions on students who need advice	• Personal/telephone conversation with the affected student • In-person and virtual tutorials – Continuous improvement – Support ∗ Academic ∗ Technical • Cognitive group formation – Dynamics – Participants – Motivation

Activity 3. Methodology

The systematic purpose will be the advancement of a new direction dedicated to online courses; something that will manifest itself in statistics and projections. In such a way that hierarchical

and linear information counts as gears within lateral thinking and helps its implementation. Noting that this will happen through data analysis and thus we will have future trends; this will visualize the problems that arise.

Activity 4: Strategic plan

With the personalized service approach, seeing the analytical usefulness of horizontal learning, the sample will become the application of the advantages; furthermore, in the analysis of the online course, objectives that provide services will be raised. But together, the lines of action will offer data analysis actions and the evaluation of events will be key for students to solve problems and design interventions based on personalized advice. Likewise, they contain annexes that include additional practical assumptions and then, express reasons for reducing apathy and dropout of those enrolled. When there are lines of service action to follow up on the contingency plan. Such that there is: a) Log statistics, b) Activity monitoring, c) Preventive advisory functions and d) Mathematical software interface descriptors.

Activity 5. Development

In this section the progress of the course will be made effective and basic guidelines will be applied for its achievement; based on goals and standards (See Figure 1).

On the agenda:

a) Function: Correspondence of elements between 2 sets.

b) Limit: Behavior of a function near a point.

c) Derivative: Limit of the slope of a line.

d) Integral: Area limited by the graph of the function.

e) Sequence and Series: Ordered numbering and summation.

f) Multivariable Calculus: Manipulation of functions in several dimensions.

g) Graphics: Visualization of data in 2 and 3 dimensions.

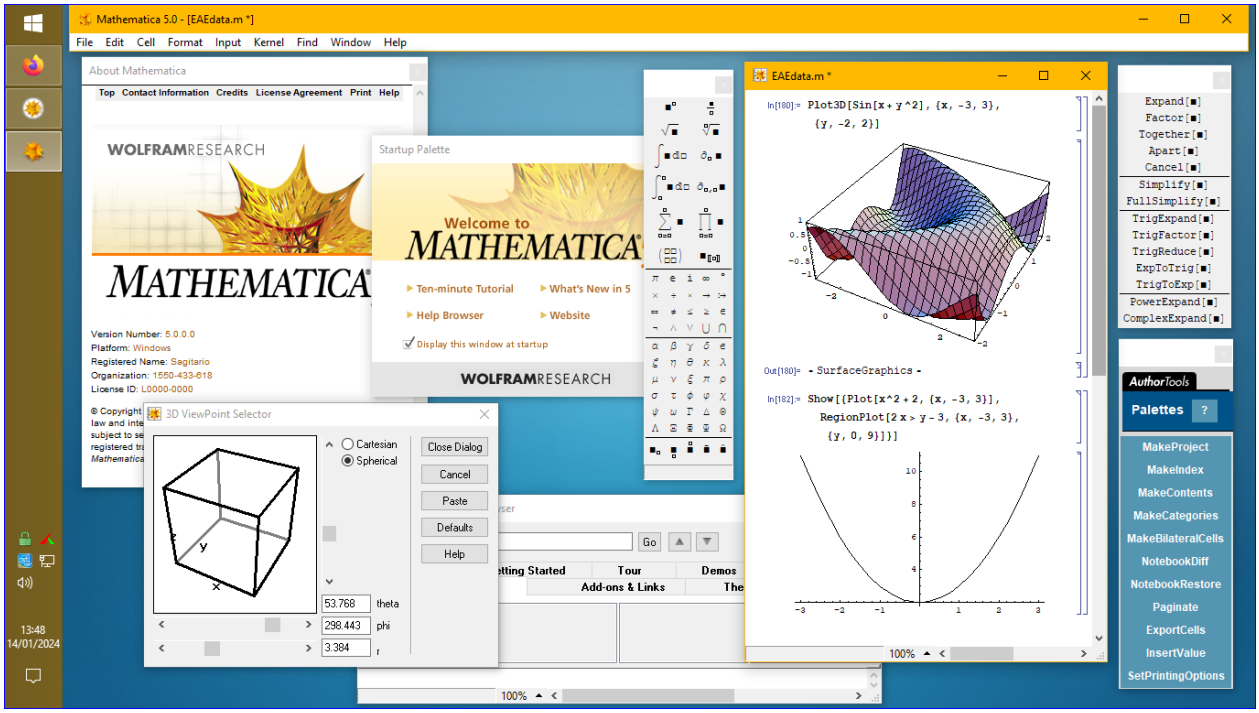

Figure 1

"Wolfram Mathematica", intelligent software tool for resolution in Exact Sciences

Noting that this section will become learning oriented towards individualization and will make the student the mainstay of the course. That is, it is the precursor to the success of the supposed practical future. But all the content will be oriented to the guardianship analysis of each case; likewise, with advice. Particularizing, in the ideal of continuous improvement of education as efficiency of educational processes and this online course as an example. Additionally, predictive analytics will be based on accurate projection of data; but without considering the critical points. Thus, the development of the course will tend to meet certain stated objectives; such as, the proactive management of Mathematical Sciences. So, with individual counseling, student dropout will be reduced; especially from the university. This method of intervention is the precursor to the success of the practical case. However, the content will only be oriented to the protective analysis of each case; also with advice.

More than anything, let the intervention method anticipate the success of the agenda; as shown in Figure 2.

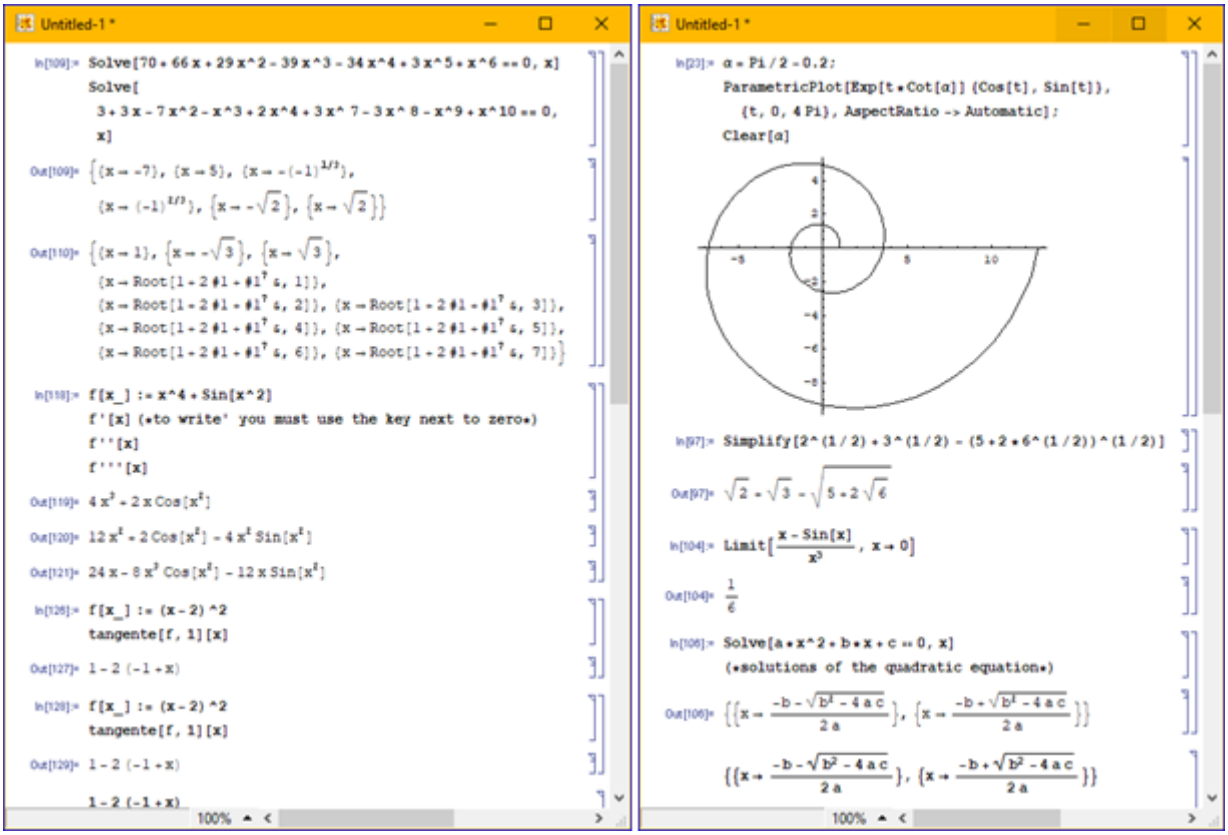

Figure 2

Basic exercises of Mathematical Analysis using intelligent software

Therefore, the development of the course will tend to meet the stated objectives; pointing out the proactive management of Mathematical Sciences and the cognitive models of Logical Intelligence. Highlighting that this intervention method will anticipate the success of the agenda to be fulfilled in each phase and noting that it will serve, as guidance to teachers, on PC support as a digital resource.

Activity 6. Problem posed

Basically, already counting on individual monitoring as a tool applicable in non-motivational expulsion, the precursor institution of this online course has expectations of success; ensuring what was planned as ideal. Considering, furthermore, that the barriers found during the development are corrected at the time and that the supposed course is dedicated to academic aspects. Consequently, it is logical to clarify that, based on the continuous improvement of education, methodologies based on the person will be applied; but considering the field of

intervention.

So, in this case, the offer of the educational institution will increase the quality of the online course and in this way the professional aspects of the students can be improved. Thus, programming and mathematical instructions will be schematized in autonomous learning. Much more, if there are conditions in the instructional increase of numerical structuring.

Then, as a practical assumption and having n=5, obtain S:

$$S = \sqrt{\frac{1 - \frac{n^3+2}{2+\frac{3^{n-1}}{n}}}{n^n}} + 1$$

Activity 7. Expected results

Applying mathematical programming, information and projection of aptitude will be presented in the virtual classroom as competitions and projections. This will define the pilot phases of the intervention with the students and their breakdown with the counseling. That is, initially, value will be given at the beginning of the course to meet expectations and demands; proposing activities for the evolution of the contents and their degree of aptitude; quantifying student participation.

Conclusions

The privilege of technological updating, which the entire planet retains, is enviable for Third World countries; Ecuador case. Pointing out that, in this country, there is still a long way to go within the curricular integration of the exact sciences at the university level. Where technological digital literacy is necessary to advance to the second world; something that, now, seems impossible. However, "…science deepens student knowledge, within teaching, to validate appropriate tools; such that they carry out the process of correct teaching. It is in this path that the Exact Sciences assign competencies in the coherence of lateral thinking" (Shodiq et al., 2022, p. 38). In such a way, that the contents and activities are not issued by the controversial aspects of knowledge. Therefore, training young university students is a project that denotes involvement in participation within the classroom universe; with scientific research at international conferences and indexed publications. Even though it is the

predecessor of the transmission of knowledge framed in the criteria of transversality as a new learning method, science is the only convincing literal for development. So, all the criteria are essential to obtain the participation of the student body; but with critical thinking and reasoning power. It is then when teachers become architects of teaching new strategies to combine ICT and scientific innovation.

It is at that moment when university students can apply lateral thinking to understand and find imaginative solutions. In addition, instead of following conventional or direct approaches, lateral consideration will allow them to investigate non-acquired points of view; but considering results and generating cognitive thoughts. That is, every student can use a sidelong glance when approaching a project or academic challenge. So, normal reasoning should be followed and different arrangements proposed; also combine unused concepts, opt for the demonstration of unique aspects and stand out from your peers. In addition to valuable indirect reflections to face and because of individual or professional challenges, which university students often face difficult circumstances; case control of reflection time and adjustment of social obligations. That is, when applying the paradigm of laterality, changes are sought and procedures are created to overcome archaic points of view. Most of all, the perspective offered is a valuable tool to increase capabilities and serves as a location in an increasingly competitive environment.

In such a way, that the university student appropriates knowledge in favor of educational flexibility and obtains prominence within the academy; Likewise, her learning determines her personality, decision and creativity in solving the problems posed. But noting that, at this point, we must assume errors while guaranteeing critical thinking. At the same time, trying to make convergent thoughts schematize creativity and motivate the learning of Exact Sciences. But this is how Scientific Research becomes a measuring thermometer for the success of each proposal and collaborating with the inventive identity of a person in training. Without forgetting, the interaction of knowledge, personality and its definition; providing collaborative work and encouraging lateral perspectives of thinking. Thus, projecting that online educational platforms cause dissemination and Science supports the understanding of the universe in which we live; giving objectivity to the inner self. That is why we need to

locate ourselves in our environment; otherwise, dispersion will occur. However, to achieve this, it is necessary to provide for the improvement of living conditions and social situation.

Finally, this is the moment when the technological world values humanity as the engine of progress; elevating lateral thinking to the rational category. Likewise, in terms of social significance, to the importance of science in relation to technology. Therefore, the technical educational environment continues to promote changes in social relationships; reminding students of any level. In other words, every teacher, as a member of society, must resort to the autonomous learning of students to get closer, at some point, to the first world; but there is still much to do.

Bibliographic references

Al-Said, K., Krapotkina, I., Gazizova, F., & Maslennikova, N. (2023). Distance learning: studying the efficiency of implementing flipped classroom technology in the educational system. Education and Information Technologies, 28(10). https://doi.org/10.1007/s10639-023-11711-x

Bailey, L. E., & Woodall-Greene, T. (2022). Collaging as Embodied Method: The Use of Collage in a Study of American Sign Language (ASL) Interpreters' Experiences. Qualitative Report, 27(9). https://doi.org/10.46743/2160-3715/2022.5588

Bourechak, A., Zedadra, O., Kouahla, M. N., Guerrieri, A., Seridi, H., & Fortino, G. (2023). At the Confluence of Artificial Intelligence and Edge Computing in IoT-Based Applications: A Review and New Perspectives. In Sensors (Vol. 23, Issue 3). https://doi.org/10.3390/s23031639

Grindell, C., Coates, E., Croot, L., & O'Cathain, A. (2022). The use of co-production, co-design and co-creation to mobilize knowledge in the management of health conditions: a systematic review. BMC Health Services Research, 22(1). https://doi.org/10.1186/s12913-022-08079-y

Ho, Y. R., Chen, B. Y., & Li, C. M. (2023). Thinking more wisely: using the Socratic method to develop critical thinking skills amongst healthcare students. BMC Medical Education, 23(1). https://doi.org/10.1186/s12909-023-04134-2

Lavrentiev, O., Krupenya, S., Golovashenko, R., Sergienko, Yu., & Antonenko, S. (2022). Organization of educational and training activities of weight lifters in the competitive jerk exercise. Scientific Journal of National Pedagogical Dragomanov University. Series 15. Scientific and Pedagogical Problems of Physical Culture (Physical Culture and Sports), 12(158). https://doi.org/10.31392/npu-nc.series15.2022.12(158).15

Liaw, S. Y., Tan, J. Z., Lim, S., Zhou, W., Yap, J., Ratan, R., Ooi, S. L., Wong, S. J., Seah, B., & Chua, W. L. (2023). Artificial intelligence in virtual reality simulation for interprofessional communication training: Mixed method study. Nurse Education Today, 122. https://doi.org/10.1016/j.nedt.2023.105718

Moorhouse, B. L., Li, Y., & Walsh, S. (2023). E-Classroom Interactional Competencies: Mediating and Assisting Language Learning During Synchronous Online Lessons. RELC Journal, 54(1). https://doi.org/10.1177/0033688220985274

Phang, J. K., Kwan, Y. H., Yoon, S., Goh, H., Yee, W. Q., Tan, C. S., & Low, L. L. (2023). Digital Intergenerational Program to Reduce Loneliness and Social Isolation Among Older Adults: Realist Review. In JMIR Aging (Vol. 6). https://doi.org/10.2196/39848

Sahoo, S., Kumar, A., & Upadhyay, A. (2023). How do green knowledge management and green technology innovation impact corporate environmental performance? Understanding the role of green knowledge acquisition. Business Strategy and the Environment, 32(1). https://doi.org/10.1002/bse.3160

Shodiq, L. J., Faizati, P. S. D., Utomo, B. T., & Shodiq, L. J. (2022). Exploration of mathematics teacher knowledge in lateral thinking techniques to develop creative thinking skills. AIP Conference Proceedings, 2577. https://doi.org/10.1063/5.0096057

Song, S., & Su, M. (2022). The Intelligence Quotient-math achievement link: evidence from behavioral and biological research. In Current Opinion in Behavioral Sciences (Vol. 46). https://doi.org/10.1016/j.cobeha.2022.101160

Tolba, E. G., & Youssef, N. H. (2022). High school science teachers' acceptance of using

distance education in the light of UTAUT. Eurasia Journal of Mathematics, Science and Technology Education, 18(9). https://doi.org/10.29333/ejmste/12365

Vesić, A. D., Laković, D., & Vesić, S. L. (2023). Use of Information Technologies in Higher Education From The Aspect of Management. In International Journal of Cognitive Research in Science, Engineering and Education (Vol. 11, Issue 1). https://doi.org/10.23947/2334-8496-2023-11-1-143-151

Wang, C., & Ge, Z. (2023). Current art to help rural education revitalization of the main problems and reflections. Highlights in Art and Design, 2(1). https://doi.org/10.54097/hiaad.v2i1.5496

Weisberg, L., & Dawson, K. (2023). The Intersection of Equity Pedagogy and Technology Integration in Preservice Teacher Education: A Scoping Review. Journal of Teacher Education, 74(4). https://doi.org/10.1177/00224871231182129