Neurodidactics Technological Tools

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ABSTRACT

The integration of technological tools into the neurocreativity phases of Neurodidactics, propose to relate the teaching of mathematics and the improvement of meaningful learning in students at the secondary level. The study in this research is based on an exploratory, descriptive, and pre-experimental methodology carried out into a high school intervention group. The application of the tests showed the numerical values increased the quantitative analysis.

Keywords: Digital tools, Neurodidactics, Strategy, Teaching, Mathematics

INTRODUCTION

Educational innovation involves a significant change in the teaching process - learning with a neurodidactic approach that allows teachers to interact dynamically with students. Also, technological tools can mark assessments automatically, while

students will be able to improve their academic performance, as well as enhance their reflectiveness and motivation to learn, propose and interact in the mathematics subject.

The world is constantly changing, and education is no exception. Consequently, rapid response to learning problems forces educational institutions to seek the best possible teaching strategies focused on student motivation.

Neurodidactics supported by neurocreativity phases such as planning, attracting attention, mind maps generation and strengthening learning; along with digital tools such as Genially, JeopardyLabs, Mimdomo and Kahoot. These tools apply to a pre-experimental intervention group, allows the researcher to create a strategy that portraits both students and teachers as main actors. In this sense, the research is based on adding communication actions and assessment through pre- and post-test content, which recognize, understand, and transform the actor's knowledge, critically and recreationally, favoring the success and acquisition of learning.

Integration of technological tools in the teaching of mathematics

The development of cognitive abilities and the brain are linked. Only cooperation between didactics and neurology can develop new learning strategies in increased participatory form, in which teachers can better assimilate and advance students' talent (Guiraldo, 2017).

One of today's alternatives is the use of technology that offers a range of tools for different daily life activities. They provide several means that can be used for teaching work and as a teaching-learning strategy for the student (Díaz, 2018).

Based on the linkage of neuroscience and learning styles, it tends to focus on the strengths of the human being and not on their weaknesses. No way to learn is better than another. For instance, one learning style is the way an apprentice begins to focus on new and difficult information, this is how he/she processes information and thus, it is the research design focus with Gardner's multiple intelligences (Macías, 2002). Table 1 Multiple intelligence types.

Table 1. Multiple intelligence types by Gardner.

Type	Description
Linguistic	Ability to handle words to express more effectively.
Logic – Mathematic	Skill used for calculation, measurements, arithmetic operations, reasoning, problem-solving, among others.
Visual – special	It allows remembering internal or external images or films through the skill of habiting, inventing, transfiguration or altering by placing distances in the three-dimensional content.
Musical	Experience meditation by periods of rhythm and harmonies. The elaboration or production of tones, timbres, the recognition of sounds and the interpretation of musical instruments.
Intrapersonal	It determines the ability of self-known, the ability to interpret internal emotions and distinguish the future.
Interpersonal	Ability to communicate with others, articulate ideas, work cooperatively with the environment around.
Naturalistic pictorial	Ability to learn, typify and use notions of the environment. It is interested in paying attention to the environment of nature.

Technological tools with neurocreativity phases

Technological tools are software or hardware that support achieving specific task results while saving time, personal and economic resources (DATADEC, 2018). They are designed to make work easier, to apply resources efficiently and to exchange information inside and outside the school.

Therefore, authors such as Venanzi (Reyes, 2003) determine creativity as an intellectual change motivated by particularity, the need to solve a problem or answer a question. The origin of the result is a unique product that is achieved by challenging the source and plasticity of ideas, which focuses on imagination.

That is, a complex construct is constituted by creativity in which not only a single hemisphere or a single brain region intervenes. Thus, creative thinking involves cooperation between brain networks colligated to cognitive control, spontaneous thinking and information retrieval mechanisms through semantic retentiveness.

The creative educator is an observant person. Heller (1995) refers that the teacher uses different sources of information or points of view and possesses the ability to couple the terna between image, word and action that follow the directions distinguished by imagination, intuition and audacity to solve professional or personal problems positively.

Along with these criteria, neurocreativity is simply linking creative ideas, with new solutions, through the use of neuroscience to optimize the learning framed in the emotional moments that enable long-term learning. Also, technological tools are integrated with the planning phases, attract attention, generate mind maps and strengthing learning. Table 2 Digital technology tools.

Table 2. Technological tools

N	Digital tool	Phase	Description
1	Genially	Planning	Software that supports creating interactive content such as animation and motion presentations. It has templates to add multimedia content. **https://www.genial.ly/es**
2	Jeopardy Labs	Attract attention	A website that allows you to create game boards in different languages with the classic Q&A game, with categories i.e. a class theme. Questions range from 100 to 500 points. At the end of the game, you can generate a result counter. **https://jeopardylabs.com/browse/**
3	Mimdomo	Generate mind maps	A cloud application that allows you to view, create and share mind maps facilitating the creation of graphic organizers with multimedia links. It is free and compatible with any web browser. **https://www.mindomo.com/es/dashboard**
4	Kahoot	Strengthing learning	The game board in the form of a test on various topics, awards users to progress in responses with a higher score that takes them to the top of the ranking. **https://kahoot.com/**

Relationship of the method and application of technological tools in teaching mathematics

There is a difficulty for students regarding understanding mathematics due to both concrete and abstract mental operations. Thus, it is relevant to take a step forward, incorporating a methodology that contains the technological resources, leading to the education of the understanding, transformation and approach of mathematical knowledge, starting from real situations and interacting with it through digital tools (Ministerio_de_Educación_de_Colombia, 2017). This can promote the relevant, pedagogical and widespread use of new and diverse technologies to support teaching, knowledge building, learning, research and innovation, strengthening development for life.

Consequently, the task of math teachers is to encourage creativity in their students in an attitudinal way, to generate a structure with the ability to challenge the new, to innovate and adapt to change. In that same context, the proposal to teach and prepare education is based on the sense of training creative students and leaving behind the old pedagogical models.

Education is therefore not considered an essential learning process but encompasses a character education in the education training process. Thus, it is pertinent to the use of technological tools as a method of teaching mathematics that focuses on non-objectivity, which differs the contrast between good and bad, in which carefreeness is right and wrong.

METHOD

Research design

This research had a population of 56 high school students, belonging to the private education system of a Latin American country (Miravalle- Ecuador).

Participants

There were 56 students, aged between 15 and 18 years, 32 (57.1%) were men and 24 (42.9%) were women. These students belonged to Miravalle-Ecuador's private education system.

Instruments

To obtain pre- and post-test values, a t-test (Scientific_European_Federation_Osteopaths, 2021) was used. The T-test is a type of deductive statistic. It is used to determine whether there is a significant difference between the means of the two groups. It was also used the Pearson correlation coefficient (QuetionPro, 2021) is a test that measures the statistical relationship between two continuous variables and the level of homogeneity and heterogeneity used by the coefficient of variation. It is a statistical measure that allows reporting on the relative dispersion of a dataset.

Procedure

The pre-experimental study was conducted at a private school. An intervention model was applied with six sessions that were the initial test, planning, attracting attention, generating mind maps, strengthening learning and the final test.

Each session consisted of an activity planning and a duration time. Session one used a printed test. Session two used the Genially. Session three used the Jeopardylabs tool. Session four used the Mimdomo tool. Session five used the Kahoot tool. Finally, the final test was evaluated with the Moodle platform.

Finally, the final test analyzed the impact of this intervention with technological tools, which were favorable for the teaching-learning process of mathematics.

Statistical analysis

Once the statistical hypothesis was tested, an average comparison was performed with a t-test procedure for samples related to the pre- and post-test. Also, dispersion measures and statistical central trend were applied to characterize the data.

RESULTS

The collection of information was achieved around the model of intervention in the application of a pre-test of content and resolution of printed exercises, in which initial data was obtained. This is how consequently the phases of Neurocreativity reflected in sessions were worked on to subsequently apply the post-test of knowledge and resolution of exercises on the Moodle Platform for the same intervention group. The data obtained showed the progress achieved to compare them. Table 3 Comparison and analysis of descriptive results of variables.

Table 3. Comparison and analysis of results. Note: t(t-test), df(degrees of freedom), Bs(Bilateral significance), Dm (Difference of means), r (Correlation) y CV (Coefficient of variation)

Level	Measure	t	df	Bs	Dm	r	CV
1	Pre-test	-14.18	18	.00	5.37	.80	.67
	Post-test						.14
2	Pre-test	-13.29	14	.00	4.88	.91	.87
	Post-test						.18
3	Pre-test	-37.80	21	.00	3.18	.95	.22
	Post-test						.14

Figure 1 depicts the comparison between pre-test and post-test in the intervention group.

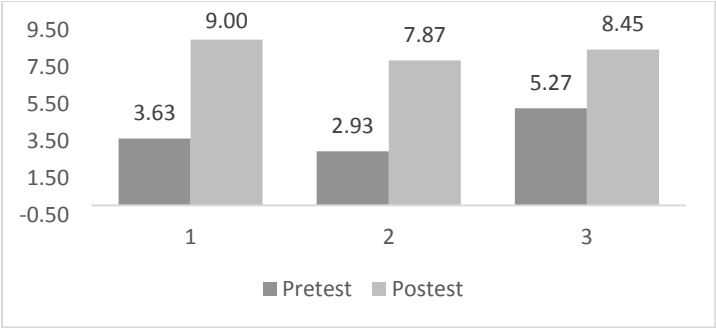

Figure. 1. Chart comparing pre-test – post-test

Figure 2 depicts a dispersion of pre-test and post-test in the intervention group

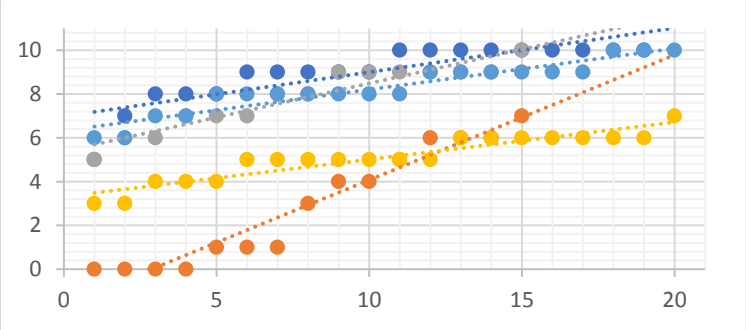

Figure 2. Dispersion diagram of pre-test – post-test

CONCLUSIONS

Analyzing the effect of Neurodidáctics by integrating technological tools into the intervention group, was favorable and improved the level of content mastery and resolution of exercises in mathematics.

This research found that the level of learning mathematics increased the quantitative performance because the results of statistical analysis indicated direct relationship dependence between pre-test and post-test variables.

The Neurodidáctic methodology through the phases of neurocreativity supported by digital tools contains resources such as slides, infographics, retro feed, gamification, online questionnaires, group collaborative work and different activities that can be performed synchronously and asynchronously. Using these resources the student can learn autonomously or with the accompaniment of the teacher in person or virtual.

Based on the results obtained in this research, future studies can expand the implementation of technological tools applied to the methodology presented by the curriculum, to verify its effect on other subjects and levels of education.

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