

<https://doi.org/10.23913/ride.v14i28.1909>

Articles scientists

**Taller en línea de desarrollo de creatividad para docentes de la
Maestría en Tecnología Informática Educativa de la UAZ
Online creativity development workshop for teachers of the Master's
Degree in Educational Computer Technology at UAZ
Workshop online de desenvolvimento de criatividade para professores do
Mestrado em Informática Educacional da UAZ**

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Resumen

Con el propósito de fomentar la creatividad entre los docentes del programa de la Maestría en Tecnología Informática Educativa (MTIE) de la Universidad Autónoma de Zacatecas (UAZ), y así contribuir a la mejora de sus programas académicos, se diseñó y aplicó un curso tipo taller centrado en el desarrollo de la creatividad. Para ello, se emplearon pretests y postests basados en el test de creatividad de Torrance. El curso se implementó en modalidad en línea, dirigido a los docentes de la MTIE, a través de la plataforma Moodle de la referida universidad. Los datos recabados fueron procesados utilizando el *software* SPSS, versión 25, y se aplicó la prueba estadística de Wilcoxon para dos muestras relacionadas, considerando un nivel de significancia inferior a 0.05. Sin embargo, los resultados revelaron niveles de significancia superiores a 0.05, lo que conduce a la conclusión de que no se observó un incremento significativo en la creatividad de los docentes de la MTIE. Por ende, se discuten posibles razones por las cuales no se alcanzó el objetivo propuesto, y se plantean correcciones y ajustes para obtener resultados significativos en futuras aplicaciones del curso en modalidad en línea.

Palabras clave: creatividad, taller, desarrollo, docentes, enseñanza-aprendizaje digital.

Abstract

In order to develop creativity in teachers of the Master's Degree in Educational Computer Technology (MTIE) of the Autonomous University of Zacatecas (UAZ) and to improve their academic program, a workshop-type course was designed and elaborated for the development of creativity; pretest and posttest were also adapted based on the Torrance creativity test. The course was implemented in online mode to teachers through a MOODLE platform belonging to the same university. The results obtained were processed in SPSS version 25 software. The Wilcoxon statistical test was applied for two related samples, it is considered a significance level less than 0.05. The results show levels of significance greater than 0.05, so it is concluded that there was no significant increase in the creativity of the MTIE teachers. Possible reasons why the objective was not achieved are discussed and corrections and adjustments are proposed to obtain significant results in a subsequent application of the course under online modality.

Key words: Creativity, online workshop, development, teachers, digital teaching-learning.

Resumo

Com o objetivo de promover a criatividade entre os professores do programa de Mestrado em Tecnologia da Informação Educacional (MTIE) da Universidade Autônoma de Zacatecas (UAZ), e assim contribuir para a melhoria de seus programas acadêmicos, foi desenhado e aplicado um curso tipo workshop focado sobre o desenvolvimento da criatividade. Para isso, foram utilizados pré-testes e pós-testes baseados no teste de criatividade de Torrance. O curso foi implementado em modalidade online, dirigido aos docentes do MTIE, através da plataforma Moodle da referida universidade. Os dados coletados foram processados no software SPSS, versão 25, e foi aplicado o teste estatístico de Wilcoxon para duas amostras relacionadas, considerando nível de significância inferior a 0,05. Contudo, os resultados revelaram níveis de significância superiores a 0,05, o que leva a concluir que não foi observado aumento significativo na criatividade dos professores do MTIE. Para tanto, são discutidos possíveis motivos pelos quais o objetivo proposto não foi alcançado, e propostas correções e ajustes para obtenção de resultados significativos em futuras aplicações do curso na modalidade online.

Palavras-chave: criatividade, oficina, desenvolvimento, professores, ensino-aprendizagem digital.



Reception Date: December 2023

Acceptance Date: May 2024

Introduction

In the current educational system, the development of creative thinking in students and teachers is not considered a priority, since a disciplinary approach aimed at training workers for the industry is still implemented, which leaves little or no space for freedom of thought. This causes the teacher's role to be reduced to a routine task that does not motivate them to update or innovate in their pedagogical practices. In other words, it is assumed that the teacher's function is no longer to transmit knowledge to students, but rather to stimulate the cognitive processes of their students to facilitate the understanding of various topics (Carranza, 2021; Robinson, October 14 2010).

For this reason, this document presents the proposal for a workshop to develop the creativity of the teachers of the Master's program in Educational Information Technology at the Autonomous University of Zacatecas, which, it should be noted, is a challenge, since some subjects are They focus on practical content and activities, while others are more theoretical. Specifically, a Wilcoxon statistical test was carried out with the participants who completed all the activities of that workshop and the reliability of the instrument was evaluated using the Cronbach coefficient. At the end, the results obtained are discussed and recommendations are proposed to improve the future implementation of the program.

Background

In Argentina, Elisondo *et al.* (2021) carried out an exploratory study with a group of teachers from different educational levels, made up of 140 participants, with the aim of analyzing their educational practices and their creativity to adapt them to the new online modality that emerged as a result of the health emergency caused by the covid-19 pandemic. The study was carried out between March and April 2020. The methodology consisted of the implementation of an online questionnaire to find out the adjustments and adaptations made by each teacher in their teaching, and the results were analyzed using the Atlas.ti computer program. 8. The findings indicate that teachers adapted to the educational changes caused by the pandemic, and designed creative practices to carry out the teaching-learning process in atypical situations during said period. Finally, the authors propose promoting the production of creative knowledge in teachers to apply them both during times of pandemic and after it with the aim of contributing to the planning of educational activities at all levels.



In Spain, Casado and Checa (2020) used the STEAM learning environment (acronym for science, technology, engineering, art and mathematics in English) to promote creativity. This approach, based on the aforementioned disciplines, uses problem-solving dynamics so that students find the best solutions using robotics and educational technology. The study was carried out with 57 students from the 5th and 6th grades of primary school, within the framework of a workshop that lasted 18 weeks at the Móstoles School of the Community of Madrid. Specifically, the CREA creative intelligence test was used to carry out the pre- and post-workshop evaluations. The results indicate that the use of resources such as robotics and STEAM projects favors both creative capacity and problem solving. In addition, it is highlighted that fundamental actions of creativity such as imagining, designing, building and programming are promoted through robotics.

In 2020, a study was carried out to improve the creative thinking of student teachers at the Public University of the Western Black Sea Region in Turkey. In this regard, Dogan *et al.* (2020) worked with a sample of 72 third-year students. The intervention plan was extended over two semesters, and the sample was divided into two groups: one subjected to the problem-based learning methodology (PBL) and the other to the history of science approach (HDC). For data collection, the Torrance Test of Creative Thinking (TTCT) was applied and the results were subsequently analyzed with the SPSS program, version 20. The findings revealed considerable development in the problem-based learning group in all the subscales considered. of creativity: fluidity, originality, elaboration, abstraction of titles and resistance to premature closure. On the other hand, in the second group, only a significant improvement in fluency was observed, leading to the conclusion that the problem-based learning methodology is much more effective for the development of creative thinking than the story approach. of the science.

On the other hand, Sánchez (2020) analyzed the Canvas tool to promote creativity in a group of first and second grade secondary schools at the Simón Bolívar Educational Institution in Peru. Canvas is a graphic design tool that allows you to create various types of content, such as presentations, infographics, digital books, graphics, and advertising elements. The author of the study states that this tool improves creative thinking in students, as it helps them solve problems and develop skills such as innovation, entrepreneurship and imagination. In addition, it strengthens creative thinking in general. Therefore, it concludes that Canvas helps improve classes and generate an environment conducive to the development of creativity in students, which is why it recommends its implementation in

classrooms, accompanied by didactic and instructional strategies to guarantee concrete results.

Benavides (2016), for his part, implemented a program to stimulate creativity in adults through artistic activities. Their group was made up of 14 people between the ages of 60 and 85, meeting at a teaching center in Guadalajara, Jalisco. The program included activities such as painting, theater, literature, photography, dance, among others, distributed in 8 weekly sessions of two and a half hours each. The results obtained were encouraging, as the participants achieved a significant improvement in their behavior. Before participating in the workshop, older adults were often estranged from their families, experienced feelings of depression and loneliness, and were affected by past problems such as family conflicts and bereavement. However, after the intervention they showed greater lucidity, participation and joy, and were reunited with their families. This shows that even in old age the ability to learn and develop mental and creative abilities is preserved.

On the other hand, Ortiz (2022) carried out an intervention in a high school in Huanusco, Zacatecas, through a 5-session workshop using the case study method with the theme of gender equity. 16 students between 12 and 14 years old participated in the research. Diagnostics and post-tests were applied to evaluate the increase in creativity, using Herman's brain quadrant model as a measurement instrument. This model divides brain activities into four quadrants (left cortical, left limbic, right limbic and right cortical), and relates creative activities to the right cortical brain quadrant. The data collected indicated a slight increase in the group's creativity, and it was concluded that to stimulate creativity more effectively, it is necessary to improve the design and implementation of the workshop activities.

Ortega (2014) carried out a study with teachers at the Autonomous University of Zacatecas (Mexico), specifically 362 assigned to the 35 bachelor's degrees offered by the institution. The objective of the study was to determine whether teachers stimulate creativity in their teaching activity. Although the results showed a wide variety of responses, it was found that a very small number of teachers are committed to promoting creativity in the classrooms. Furthermore, few know how to evaluate it in their students, although they consider that its implementation in teaching can enrich the student's training.

In conclusion, there is a lack of an adequate pedagogical conceptualization of creativity and a shortage of teachers who consider themselves creative. Therefore, there is a need to inform and train educators to be more creative in their teaching practice.

Problem Statement

Florida *et al.* (2015) presented indicators from various countries on creative thinking, including Mexico, which ranked number 75 on a list of 93 nations. This result indicates that Mexico is among the last places and, therefore, well below the average in terms of creative thinking.

This scenario demonstrates the need for teachers to develop cognitive skills associated with creative thinking, such as analytical, systemic and critical thinking, innovation, entrepreneurship, decision making, problem solving, self-motivation, among others (González and Martínez, 2008).

Rationale and relevance

Education has experienced significant changes due to various causes, including the advancement of science and technology, the updating of teaching content, and the impact of covid-19 (Velazque Rojas *et al.* , 2020). This has caused the need for teachers to update their knowledge and skills, including creative thinking, to innovate and create new teaching strategies that promote an educational environment conducive to meaningful and creative learning. In this way, individuals will be formed with the capabilities to face and solve problems that affect present and future society (Villarreal *et al.* , 2018).

A program aimed at developing teachers' creative thinking will result in the strengthening of their pedagogical skills, which will allow them to optimize their performance and transmit these skills to their students. Therefore, the implementation of teaching updating programs, in this case focused on creative thinking, is prioritized to improve their educational function. Specifically, the creation and implementation of a workshop for teachers is proposed with the flexibility to adapt its application to any group, which includes strategies for the development of creative skills.

Goals

Main goal

1. Promote the creativity of teachers through a workshop-type educational program so that they can optimize their work in teaching.

Specific objectives

1. Determine the creativity of teachers through a creativity measurement instrument.
2. Design activities for the creativity development program and to optimize teachers' skills.
3. Promote the use of creativity in teaching work through program activities.
4. Assess the effectiveness of the program using the Wilcoxon statistical test.

Theoretical framework

Theories of creativity

- Associationist theory: Creativity is perceived as the combination of two or more associative elements that enable new options or combinations in situations that require a response, solution or utility. The more distant the elements are, the more creative the process will be, as well as the ideas that arise to offer one or more solutions (Valero Matas, 2019).
- Existentialist theory of creativity: Creativity arises when the individual is in harmony with his or her environment; The greater this harmony, the greater the creative flow. Furthermore, it is considered that the individual's posture must remain open and perceptive in the face of any problem or situation that requires resolution, hence the problem must be as important as the solution (Huamán, 2014; Valero Matas, 2019).
- Gestalt theory of creativity: This conceives creativity as an orderly and structured process, whose product is innovation in the creation or improvement of some solution or product. It involves changing the traditional position of interpreting a situation or problem with new visions not considered before, which requires correcting or shaping what is obtained (Huamán, 2014; Valero Matas, 2019).
- Humanistic theory: This maintains that every person has a natural and intrinsic inclination towards creativity. The more you practice it, the more satisfying it becomes. Creativity is stimulated with practice and leads to self-realization, which facilitates the resolution of everyday situations in a natural and spontaneous way. This improves self-esteem and creates an environment closely related to experience and social changes (Valero Matas, 2019).
- Theory of multiple intelligences: Creativity is a multidisciplinary phenomenon that develops in the brain from several intelligences, which function differently and

independently of each other. This means that a person can be very skilled in some intelligences, but have weaknesses in others, although these can be developed depending on the environment and appropriate stimuli. The combination of all of them leads to the development of creative intelligence. The intelligences proposed by Gardner in 1983 include logical-mathematical, visual-spatial, linguistic, musical, corporal-kinesthetic, interpersonal, intrapersonal, spiritual, naturalistic, among others (De Prado, 2011; Gamandé, 2014).

- **Cognitivist theory:** This maintains that it is possible to modify, measure, observe and train mental processes to develop cognitive structure. The mediator, who may be the teacher, administers the program as a tool to intervene in the student's cognitive processes. The student is expected to demonstrate initiative and greater participation to acquire capabilities and skills that allow them to adapt to and modify their environment. Knowledge becomes more relevant when it is related to other prior knowledge, so that meaningful learning and the creation of new neural connections are facilitated through direct experience. This theory provides an important basis for the development of creative skills in a group of teachers, which opens possibilities to improve the teaching-learning process (Marín, 1994; Torrenteras Herrera, 2012; Trujillo Martínez and Suárez Vargas, 2017).

Definitions of creativity

Creativity has been an inherent element in the development of humanity, although its study is relatively recent. A concrete definition could be the ability to create and innovate; However, various authors have addressed this concept from different disciplines, such as education, psychology, medicine and the arts, which has caused the emergence of complementary definitions (Fernández Díaz *et al.*, 2019). For Campos and Palacios (2018), creativity is difficult to delimit and is influenced by social environments and relationships, cognitive skills and acquired knowledge. This makes it a collective practice that can be developed with constant practice, although it may take years. Furthermore, creativity may or may not be inherited, but any individual can develop it through the appropriate environment.

The objective of creativity is to promote the development of personal potential and self-realization, which requires the stimulation of cognitive processes common to all people, which are perfected with experience and effort. In other words, it is a skill that matures and is constantly evolving. Furthermore, it contributes to society and science to solve problems,

or improve what exists, with the purpose of increasing the quality of life (Campos and Palacios, 2018; Cenizo and Fernández, 2004; Vidal, 2009).

Creativity, therefore, requires skills or abilities such as flexibility, fluency, originality and divergent thinking (Guilford, 1953). In addition, they must focus on solving social problems, since the creative person is sensitive to their environment and the problems of their field of study. To do this, you must actively look for problems or challenges, formulate hypotheses to test them, and act through trial and error. This process is dynamic and the results must be shared so that they can be reproduced (Torrance, 1965).

According to Gardner (2016), creativity is made up of different intelligences that direct cognitive processes. These intelligences are independent of each other, but their development promotes creative intelligence (Jayme, 2021).

Finally, Solá (2008) explains that creativity is a system of associations of elements with other already existing sets to generate couplings that translate into concepts, mental schemes, processes, ideas or new knowledge.

The neurobiology of creativity

Creativity is a complex process that involves the function of different parts of the brain, as mentioned by Gardner (2016), who incorporates the coexistence of multiple intelligences, whose development contributes to the creation of creative intelligence. This means that creativity activates several areas of the brain in both hemispheres and involves cognitive processes and emotion control. These processes are related between the temporal, occipital and parietal areas, interacting with the prefrontal cortex, where complex processes of abstraction, semiotics, association and prediction occur. Memory functions are also involved, while the frontal and parietal lobes facilitate the spontaneous production of original ideas. Therefore, creative people have a stronger connection in these areas, which allows them to generate more ideas with less effort (Chávez *et al.*, 2004; López and Llamas, 2018).

To facilitate the creative process, the brain is interconnected by neuronal connections, which, the stronger they are, the better the process will be. In addition, a greater number of connections is responsible for connecting areas where there is normally no connection. With the creative process, it is possible to activate neural networks simultaneously, which means that creativity does not occur in a certain area, but in multiple areas thanks to neural connections (Beaty, *et al.*, 2018).

To enhance creativity, it is possible to focus on generating and strengthening neural connections through habits or activities. This can begin with developing strong self-esteem and cultivating uplifting moods. Likewise, it is useful to participate in activities that involve trial and error, adopt a proactive and leadership attitude, solve cases or problems, develop observation and contemplation, practice formulating directed questions, brainstorm, participate in challenge dynamics. appropriate and make decisions on their own. Even recreational activities can be beneficial.

Finally, it is worth mentioning activities that can also improve brain connection, such as those that involve the simultaneous use of two or more mental processes. These activities include listening to music or playing a musical instrument, reading and writing, drawing or painting, manual arts, and playing video games, as they require high concentration, which almost completely inhibits distractions. This situation facilitates problem solving and creative capacity, which contrasts with a normal state of concentration (Rivera, 2023).

Method

The methodology used in this research was causal comparative, since an attempt was made to modify the dependent variable (teachers' creativity) through an independent variable (the educational program or workshop).

The design and implementation of the workshop followed the ASSURE instructional model, developed in 1999 by Smaldino. *et al.* (2005), which consists of six steps (De la Torre and Sosa, 2018). This will be used as a method to design, develop, implement and evaluate the workshop.

Regarding instructional design, it is a system whose objective is to manage and direct the teaching-learning process in an optimal way. This involves actions of analysis, design, development and evaluation of the teaching course, with special emphasis on what will be taught and how it will be done. The purpose of this approach is to resolve specific needs within a given context to facilitate the function of both the teacher and the students (Dick *et al.* , 2015). The steps of the model, according to De la Torre and Sosa (2018), are as follows:

- Analysis of participants (A): It consists of investigating the characteristics of the students, such as their knowledge, skills, learning styles and attitudes. In some cases, socioeconomic status and environments are also considered, helping to develop a method more suited to your needs.



- Establishment of objectives (S): The objectives of the course are defined, including short- and long-term goals. These are clearly described, stating what is expected to be achieved and how it will be achieved.
- Selection of methods, means and materials (S): In this step, the material resources, means, methods, strategies and dynamics that will be used are determined. Likewise, you can choose to use existing resources, modify available ones, or create new ones as necessary.
- Use of media and materials (U): Here the course is implemented using the media and materials previously selected. In addition, what was planned in the previous step is put into practice.
- Student participation requirement (R): Students actively participate in practice using their cognitive processes with the support of previously planned strategies.
- Evaluate and review (E): A comprehensive evaluation of the process is carried out using previously established instruments. Likewise, the scope of the objectives, the performance of the students, the methods, means and materials used, as well as the participation of the facilitator, are evaluated. The feedback obtained is used to improve the program. It should be noted that the evaluation is not limited to a final stage, but it is recommended to also apply it at intermediate points in the process.

The ASSURE model is used as a methodology for the implementation of the workshop, which is part of a complete process that includes the initial diagnosis of teachers' creativity using a Torrance test. Subsequently, the creativity improvement program is implemented and, finally, the level achieved by the teachers is measured. This last stage allows us to compare the results of the measurement tests carried out before and after the implementation of the workshop, and to process the information obtained.

To determine the reliability of the instrument, Cronbach's alpha coefficient was used, which evaluates the degree of error present in a measurement instrument. If the instrument accumulates a high amount of errors in its measurements, it is considered unreliable. This means that reliability refers to the lack of errors in the instrument (Quero, 2010).

According to Tuapanta *et al.* (2017), a Cronbach coefficient equal to or greater than 0.7 is considered acceptable, a lower value would indicate low consistency, while a higher value would indicate a strong correlation between the questions of the instrument. Values between 0.8 and 1 are considered very high and reflect high levels of instrument reliability.

To validate the implementation of the workshop, the Wilcoxon test was used, which evaluates whether there is a significant difference between two sets of data, in this case, between the results obtained before and after the implementation of the workshop. If the difference is considerable, it is attributed to the implementation of the workshop; If it is minimal or null, it is considered that it could be due to circumstantial or random reasons (Gómez and Dolores, 2015; Leyva, 2011).

To ensure construct validity, a benchmark was established based on the pretest results. Typically, a 20% increase in posttest results is considered a valid indicator that the instrument has met its goal of improving participants' creative abilities. Additionally, the Wilcoxon test is used to determine if this increase is statistically significant, with a significance level usually set at 0.05 (Coronado, 2015).

Workshop development

Theoretical concepts

- What is creativity?
- Creative process: originality, fluency, cognitive flexibility (p. divergent), cognitive independence (*insight* : sudden intelligence or intelligent spark).
- Relaxation, rest of the brain to be able to produce creative ideas. Walks, daily activities (incubation of ideas).
- Why do you dedicate yourself to teaching? Why is creativity important in teaching? How does it benefit teaching? How do you describe yourself as a teacher? What do I need to make my classes more interesting and creative?
- Mention creative people. They specialize in one field, but have an interest in others; They combine their area of specialty with others of interest. They relate different domains to synthesize them into a novel production. What is your area of specialty, your dominant area? What are your areas of interest? How would you combine them to create something?
- Disruptive changes: Important changes that mark the end and beginning of eras; Its modification impacts society in many ways. Mention some examples.
- What stops and promotes creativity? *Stops creativity* : Negative phrases, dislike of change, preserving the system as it is; phrases of doubt; conformity for what you have, a state of comfort; be afraid of failure; panic states that block the mind; destroy

initiative of others; Japanese example: being pioneers. Mention some examples. *Promotes creativity* : Phrases like “I’m going to take a risk”, “I will be the first to achieve it”, “the less ordinary the better”; I will explore something unknown; How has it not been done before? Live with creative people. Set goals and challenges for yourself. Do new things, attend conferences in different fields; improve our environment, perfect our areas. Mention examples , phrases that destroy creativity and others that stimulate it.

- Mention the main problems of a teacher when teaching class. Note: Leave aside union or administrative issues.
- Creativity occurs in an environment of safety (psychological safety and where the possibility of failure is assumed as part of the process); existence of the game (leisure activities); stimulation of divergent processes (cooperation). Question: Describe your ideal place to work.

Practical part

Workshop design and development

1. Preparation of pretest. Duration: 20 minutes
 - a. A man was widowed and was left with three daughters. To prove that the same affection exists between the four of them, you want to make four statues in your garden, which must have the same distance between them. How do you do it?
 - i. Imagine that each statue is a point (a, b, c and d); This means that the distance from statue A to the others must be the same. Thus, the distance of statue B with the others must be the same and so it will be the same with C and D.
 - ii. You can describe your answer and/or upload a file with a drawing or diagram.
 - iii. Duration 10 minutes.
2. Imagine that you are the designer of a shoe factory. You are given the task of designing a new type of innovative footwear that conquers the market and meets the needs of customers. You will have to make a list of ideas (brainstorm) about what the product should be like (what should it have?), characteristics that differentiate it from other shoes, etc. Who is it addressed to? You can include a file with a drawing.
 - a. Duration: 15 minutes.



3. From the following words you must select two. They are random objects; Name the ones you chose, identify the function of each one, then you must merge them and create an invention from the combination of these. You must describe what it is, what it is called, what it is for and how it works. You will also upload a file with a drawing or diagram of your new invention.
 - a. Random Items: Bottle Token; pacifier; bracelet; ring.
4. From the following list you must choose 5 words (they were selected at random) and you will use them to create a composition of a story, poem, song, literary skull or a tale (only one)
 - a. List of words to choose: *throne* , *sand* , *chariot* , *raven* , *competition* , *snow* , *cloak* , *sanctuary* , *rabbit* , *spell* , *death*.
 - b. At the beginning of your composition you must specify the 5 words you chose, as well as the type of composition you will make. Now is the time, shine.
 - c. Duration: 20 minutes.
5. Reinvent an existing story; The dynamic is to choose a known story, whether it is a popular tale, legend, movie, story, etc. The story has to be modified in such a way that it is not too similar to the original version. It must be your own version (originality, flexibility, fluidity and elaboration are handled).
 - a. Duration 30 minutes.
6. Answer the following questions in an original way and with explanations. The questions are about identifying with objects and explaining why. The questions differ in concept:
 - a. Questions: if you were an animal, what would you be? If you were a song? If you were a movie? If you were a historical figure? If you were a drink?
7. A problem is selected from the following list and brainstormed to find solutions, seeking original and functional ideas.
 - a. Problem list:
 - i. How to make a thermal house for each time of the year, that is, make it hot in winter and cool in summer?;
 - ii. I have a house with little natural light: what can I do to have more interior light and improve its atmosphere?

- iii. Primary school students have problems understanding mathematics, arithmetic and geometry topics: what can be done so that students learn these topics significantly and improve the situation?
 - iv. In a neighborhood, organized crime (drugs and kidnapping) has increased. The neighborhood council meets to propose solutions to these problems to the authorities. As leader of the neighborhood association, what solutions do you propose?
- b. Time: 15 minutes.
8. Brainstorm: Imagine that you are a candidate for president of your country and you have the power to make any proposal that occurs to you: what proposals would you make to your people so that they elect you? Imagine real or fictional scenarios. Remember that you can include proposals that are implausible, difficult or impossible to fulfill. The stranger and more original the better.
- a. Time: 15 minutes
9. Activity: Develop effects and consequences of epigenetics.
- a. Epigenetics mentions that it is likely that we inherit memories from our parents, grandparents, great-great-grandparents and other ancestors. Although epigenetics is not sufficiently developed, imagine the impact that the transmission of experiences from parents to children and other descendants has had.
 - b. With the little information given about epigenetics, and without investigating other means for the duration of the activity, you must write a composition developing questions such as the following: assuming that memories of greater impact, both good and bad, are inherited, how does it influence our personal development, behavior, in our culture, in how we perceive life, how it affects us? What has been its influence on evolution? Does it have anything to do with the *deja vu*? Does it influence our knowledge, instincts, skills? You can develop all or some of the previous points or others that occur to you.
 - c. Duration: 30 minutes.
10. Activity. Preparation of posttest. Duration: 20 minutes.

Results

The implementation of the workshop lasted two weeks, with daily activities from Monday to Friday. At the beginning, a pretest was administered, adapted from Torrance's creative test (Abdulla *et al.* , 2022). Then, at the end of the course, an adapted post-test was administered, with different but equivalent exercises. All the planned activities were carried out by the participants, of which 26 started, but only 9 successfully completed the course.

Below, Table 1 presents the reliability test using Cronbach 's alpha coefficient that was carried out in the *pretest* and *posttest* , for which SPSS version 25 software was used .

Table 1. Reliability test for pretest and posttest using Cronbach's alpha.

Pretest Cronbach's alpha	# of elements	Cronbach's alpha posttest	number of elements
0.875	4	0.860	4

Source: self made

Table 2 includes the results of the pretest , separating each variable (originality, fluency, flexibility and elaboration), and finally the sum of all the test points that measure creativity.

Table 2. Pretest results

Competitor	Fluency	Flexibility	Originality	Elaboration	Total (creativity)
1	eleven	eleven	6	3	31
2	5	4	2	2	13
3	6	5	2	3	16
4	4	7	3	0	14
5	4	3	1	2	10
6	6	6	2	2	16
7	4	5	2	0	Eleven
8	5	7	2	0	14
9	8	8	4	3	23
TOTAL	53	56	24	fifteen	148

Source: self made

Likewise, Table 3 shows the results of the *posttest* , like the previous table, the variables are included separately and their sum.

Table 3. Posttest results

Competitor	Fluency	Flexibility	Originality	Elaboration	Total (creativity)
1	4	7	3	2	16
2	5	4	2	0	Eleven
3	6	8	3	2	19
4	5	8	5	2	Twenty
5	9	7	5	3	24
6	9	10	7	2	28
7	3	2	1	1	7
8	6	5	2	2	Fifteen
9	6	7	2	1	16
TOTAL	53	58	30	fifteen	156

Source: self made

Continuing, Table 4 shows the results of the pretest and posttest , excluding the variables and only leaving the totals, being able to compare the changes of each participant.

Table 4. Global creativity result (pretest and posttest)

Competitor	Pretest	Posttest
1	31	16
2	13	eleven
3	16	19
4	14	twenty
5	10	24
6	16	28
7	eleven	7
8	14	fifteen
9	23	16
TOTAL	148	156

Source: self made

Table 5 includes the results of the Vak test that the participants performed to determine their learning style.

Table 5. Learning style of the participants

Competitor	Style
1	Kinesthetic
2	Visual
3	Kinesthetic
4	Literacy
5	Auditory
6	Visual
7	Visual
8	Literacy
9	Visual

Source: self made

Wilcoxon test for related samples are presented in Table 6. In order to determine the degree of significance less than or equal to 0.05, SPSS version 25 *software was used*.

Table 6. Data analysis by comparison of means using the Wilcoxon test for two related samples.

	PreFluidity- PostFluidity	PreFlexibility- PostFlexibility	Pre- Originality- Post- Originality	Pre- Elaboration- Post- Elaboration	PreTotal- PostTotal
Significance	0.432	0.389	0.248	0.5	0.429

Source: self made

Discussion

The application of the Cronbach reliability test yielded favorable results, with coefficients of 0.875 in the pretest and 0.860 in the posttest for the four variables of fluency, flexibility, originality and elaboration. These values indicate that the instruments are reliable, which means that their design and application have a minimum margin of error that does not affect the results (Tuapanta *et al.* , 2017).

The Wilcoxon test compares the number of positive and negative items in two tests from the same sample. If there is no difference between the tests, the null hypothesis is accepted, indicating that there are no significant changes. On the contrary, if there is a significant difference between the tests, the alternative hypothesis is accepted and the intervention is considered successful.

To carry out the Wilcoxon test, the following requirements must be met: there must be two experimental tests, one carried out before and one after the intervention, applied to the same sample, that is, to the same participants.

To determine if the difference is significant in the humanities area, a coefficient less than 0.05 is considered. If the value of the evidence is greater, it is interpreted that the difference obtained is due to circumstantial causes. If the value is equal to 1, it indicates that there was no difference, neither positive nor negative (Gamarra *et al.* , 2018).

The Wilcoxon test carried out on the results of the online creativity course shows values greater than 0.05 in all its variables: fluency with 0.432, flexibility with 0.389, originality with 0.248 and elaboration with 0.5, and in total with 0.429. Therefore, the null hypothesis is accepted: the group's creativity will not improve significantly with the application of an online course, and the alternative hypothesis is rejected: the group's creativity will improve significantly with the application of an online course. line.

When analyzing the results, it is observed that the least developed variable is *elaboration* , which did not show any change, since a total of 15 was obtained in the pretest and 15 in the posttest, without any difference. The variable that showed the greatest improvement and a significant difference is *originality* , with a total of 24 in the pretest and 30 in the posttest. However, according to the Wilcoxon test, this difference is not significant, since the value obtained ($p = 0.248$) is greater than 0.05.

A similar work and reference for comparison is that of Garrido (2018), who implemented a program to develop creativity in children in fifth and sixth grade of primary school. Garrido managed two groups: one control and one experimental. In the latter, he applied the program for one hour per week in a total of five sessions. However, their results did not meet the established objectives, since no improvement in creativity was observed in the experimental group. Similarly to the present study, the lack of motivation of the participants was considered a possible cause, since only individual or intrinsic motivation was available, without any extra compensation for participating. Another relevant similarity is the predominance of the practice of convergent thinking and the limited use of divergent thinking, which generated an imbalance that is difficult to adjust with a short or medium-term program.

However, there are some differences between the present study and that of Garrido (2018), since the latter focused on activities to only enhance originality and fluency, although in its objectives and hypotheses the development of creativity was mentioned without specifying whether it was only desired to improve those two variables or all of the mentioned ones. In addition, the Torrance test was used as a pretest and the Creative Imagination Test for Children (PIC-N) as a posttest, and both tests have differences in their score values.

Another aspect to consider is that Garrido designed one activity per session, which may not be enough to generate a considerable impact compared to the mastery of convergent thinking in school and daily activities, especially considering that each activity was one week away from the next.

On the other hand, in the present work we tried to avoid this limitation by including small activities every day with rest on weekends. However, since this was an online program, there was no control over the delivery time of the activities by the majority of the participants, which possibly negatively influenced the results.

Conclusion

The project failed to fully meet its overall objective, which was to develop the creativity of a group through a workshop designed for that purpose. Specifically, during the posttest it was observed that an exercise required participants to make a drawing under certain conditions, but the participants' graphic skills were not taken into account. In this sense, it was noted that those who completed the posttest lacked graphic skills, which possibly negatively affected the results of said exercise and, therefore, the four variables evaluated. Therefore, it is recommended that the pretest and posttest be homogeneous, using items of the same type and not differentiating in their dynamics, as occurred in this case, where the pretest item was written and the posttest item was graphic.

A factor that probably affected the results of the course was the little or no interest of the majority of the participants. Although 26 people initially enrolled, some never participated and only 9 completed the course. Of these, only 4 showed real interest, suggesting that disinterest may have played a role in the lack of a significant positive difference between the test results.

This disinterest could have been caused by various reasons, such as the high workload of the participants and their limited free time for additional activities. Furthermore, some teachers may have participated because they felt obligated, without having the real will to complete the course correctly. Still, this project provides valuable information for future researchers seeking to improve group creativity through an online course or other similar dynamics.

Future lines of research

It is recommended to continue working with programs for the development of creativity, although with some modifications or updates to guarantee compliance with the objectives. Therefore, below are some suggestions to improve results in future implementations or projects:

- Design the pretest and posttest with the same dynamics, including exercises of the same type to evaluate the creativity variables that are contemplated.
- Form a volunteer group to participate in the course. It is essential to have committed participants with interest and motivation to develop their creativity, since very low interaction and poor performance by the group were observed.
- Due to the different workloads of the teachers participating in the course, it was impossible to bring them all together for some synchronous activity via videoconference, so this possibility was not considered. However, considering that the course is open to anyone interested in developing creativity, it is suggested to include synchronous activities, either by videoconference or chat. In addition, it is recommended to incorporate activities that address current issues, such as social and natural conflicts, sporting events, among others, to facilitate their adaptation and participation in the activities.
- Another suggested change for the program is to redesign it to focus on the development of one or two variables instead of the four proposed in the present study. Specifically, it is proposed to include activities focused on the selected variables, which will be defined according to the needs of the participants. In this case, focus on originality and fluency, or both, to encourage the generation of unusual ideas in teaching practice. In addition, it may be considered to carry out a prior study to verify the feasibility of the implementation. Using a survey-type instrument, it could be determined whether the group members are willing and interested in participating in the workshop, which would help avoid unfavorable results and increase the chances of meeting the objectives.
- Based on the previous study, it would also be beneficial to apply a tool with the objective of determining whether teachers are willing to participate in extracurricular educational programs to improve or develop skills, competencies or acquire new knowledge, as well as identify what areas they are interested in. In this way, a course

could be designed and implemented that is of interest to you and avoid unfavorable results.

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