

Design thinking program on the google classroom platform on creativity in high school students

Gladys Tenorio-Molina^{1,*}, Naara Medina-Altamirano², Nerio Enriquez-Gavilan², Monica Quispe-Solano², Aydeé Lopez-Curasma², Angel Cochachi-Quispe²

¹ Facultad de Educación Inicial, Universidad Nacional de Educación Enrique Guzmán y Valle, Peru.

² Facultad de Tecnología, Universidad Nacional de Educación Enrique Guzmán y Valle, Peru.

*Corresponding author: Email: 09682714@une.edu.pe, ORCID: 0000-0001-8368-1267

Abstract

INTRODUCTION: The problem in this topic lies in the lack of focus on the development of creative and problem-solving skills in high school students at Institution No. 6152 in Lima during the year 2022. This deficiency can limit their ability to tackle the challenges of the present and future world, making it necessary to implement a Design Thinking program on the Google Classroom platform to address this issue.

OBJECTIVES: The objective of this research was to evaluate the effects of the design thinking program in the google classroom platform on creativity in high school students of Institution N°6152, Lima-2022.

METHODS: The methodology was conducted under a quantitative approach, applied, with a quasi-experimental design, with 30 students in the experimental group and 24 in the control group.

RESULTS: The creativity instrument was applied before and after the program to both groups. In the descriptive results of the general objective, in the experimental group of the pre-test, 80% were at a moderate level and 20% at a low level, and after the program was applied, 50% were at a moderate and high level, so there were changes in creativity. It is concluded with the result of the student's t-test finding $p\text{ value} = 0.029 < 0.05$ that the google classroom program significantly improved creativity in high school students of the institution N° 6152, Lima. 2022.

CONCLUSION: the Design Thinking program on the Google Classroom platform aimed at fostering creativity in high school students at Institution No. 6152 in Lima during 2022 addresses the lack of creative and problem-solving skills. This educational approach prepares students to tackle contemporary challenges by promoting empathy, collaboration, and experimentation. It represents a valuable investment in their future, equipping them to excel in an ever-changing world.

Keywords: Creativity, imagination, design, invention, thought, students.

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1. Introduction

In February 2020, schools were ordered to close as part of a public health measure to stop the spread of COVID 19 that affected almost 1.6 billion students in most countries (1). This health crisis brought with it changes in formal education, worldwide, which transformed new forms of learning to face the challenges in education, from basic education to higher education. In this new context, an education that bets on the cultivation of a sensitive and adaptive reason was necessary. Since creative and cultural expressions revealed differences

in the participation of activities in the European Union being 63.6% men and 63.8% women, likewise in Canada they were 85% men and 87% women and in Peru, 59.8% women and 63.6% men (2). Therefore, creativity is a trend that promoted an education that has been valuing creative and logical thinking. Thus, creativity, innovation and entrepreneurship gave impetus to employment and the economy (3), being a determining factor for society and within this cultural revolution, educational quality improved through human talent (4).

Likewise, a prevalent study on the creativity program was that of (5) in Peru who, in a study of 66 students, found 40.9% at an elevated level, 59.1% at a medium level, however, at a

higher level. Low results were not evidenced, which showed a willingness to identify problems in their environment, define the challenge, devise workable solutions to put them into practice, as well as evaluate through opinions. Another study was that of (6) who showed 100% results in creative thinking applying design thinking to the experimental group and in the control group it was found at a medium level at 100%, however, they decided to make prototypes according to their needs. out of a total of 38 students.

Within this framework, it was necessary to bet on active learning methodologies such as design thinking, which encouraged students from an early age to become explorers of the world around them, learning from direct experience and error as learning engines (7). From there it was defined as design thinking, that is, the belief that something different can be done in an initiative-taking process suggesting new appropriate solutions and that it had a positive impact on the person. That is why the creative capacity gives confidence to transform difficult challenges into opportunities and in the same way it is a method that generated creative ideas focused on understanding and solving the client's need. Therefore, it is the way in which people dedicated to product design work. (8,9).

Previous studies by ODS considered the methodology as sustainable development of society (10). Likewise, (11) when mentioning that the ability to innovate is a new way of looking at things, describing them and combining different points of view. For this reason, the formation of design thinking has been innovative in creatively solving problems (12). Therefore, (2) contemplated that the innovation and creativity developed in virtual classrooms with gamification and applications improved creative thinking. For example, it had an impact on the cultural house of Morelia and Encerrón Creativo, a 100% virtual event that allowed sustainable development of the community (13). Likewise, the United Nations Educational, Scientific and Cultural Organization (14) affirmed the educational trend in Latin America was to incorporate ICTs into education, taking into account pedagogical guidelines and virtual tools. Whereas studies refer that in the Caribbean and Latin America there was a low productivity in innovation. In addition, IDB in Argentina in 2016 indicated that the cultural value for design was 10%, advertising and plastic arts 18%, as well as visual 2% and cultural training 2% (15). In the same way, platforms with the support of design thinking allowed learning to learn and design thinking formed a methodological framework in the competencies (16). Added to this, in Africa there is a School of Design Thinking that works with a comprehensive approach to promote creativity (17).

Likewise, in Mexico, active methodologies, digital applications, (18) platforms, workshops, and gamification in teaching-learning, managing to encourage creativity (19,20). In the same way, the study by (18) on technologies in the development of creative skills showed that by stimulating the experimental group in the elaboration part, 37.90% was obtained after collaborating with the CAD and 3D model. The increase in the mean to 4.38 in student skills is relevant. Consequently, in Colombia, Paraguay, Peru, and Uruguay, they applied educational policies that used digital technology

employing innovative strategies to improve learning. Also, there were psychopedagogical intervention programs "I am creative" where before the application the levels of creativity were high, outstanding and low with percentages of 55%, 40% and 5% and after applying the program 55% and 45% belonged at the high and outstanding level, there being no students at a low level, leaving significant experiences in creative intelligence (21).

In addition, (22), highlighted that the economic condition affected the education of the poorest, which is why teaching and culture during the pandemic had socioeconomic consequences and, in our country, educating was conceived as basic knowledge within the field of humanities. based on educational laws. In addition, (23) pointed out that 48% of engineering students showed a negative attitude towards creativity and 32.49% assumed an indifferent attitude, which indicated a lack of understanding in creative thinking.

For this reason, the educational system began to enhance capacities by combining previously acquired knowledge and skills (24). Likewise, they used technical languages to create products that allowed the transmission of messages, thoughts, and feelings, which generated creative solutions using computer and digital technologies (25). Indeed, (26) mentioned the case of Innova Schools, which develops design thinking as a model for students to learn by doing, promoting creativity and innovation. Because in this context, at the pedagogical level according to RM No. 627 (2016)-MINEDU, it offered the possibility of innovation and creativity, as well as the development of the competition managing economic or social entrepreneurship project. RM N°649 (2016)- MINEDU, promoting the contests of creates and undertakes in education for work. This educational change proposed in the various investigations is based on different theories, however, the main one is Guilford's theory, who considered intelligence as a unified concept, based on individual differences (27) and Bono's theory with his lateral or divergent thinking to create new ideas (28). Likewise, Gardner conceives creativity as the ability to solve new and common problems in that context. Likewise, theories such as cognitivism are assumed to establish their bases in originality, considering the different abilities of creators to solve problems. In the same way, constructivism points out that learning occurs through student participation in a social context and mentions a zone of proximal development promoted by Vigotsky, for new ways of thinking and technology-based connectivism that allowed an active search for knowledge, through creative methods learning in a fun way.

2. Theoretical Framework

In the background review for the present investigation, it was found at the national level in his thesis (29) who concluded that a large part of the students at the Chorrillos military school have high significance at moderate and elevated levels corresponding to the results of the thought variable. creative shows a 52.50% moderate level, 32.50% elevated level and 15% low level. Likewise, (30) concluded

that there was a positive and significant impact on the initiation and practice of reflexes, which generated new creative ideas, discovering all workable solutions to problems. Whereas, the results were 67% achievement level, 30% process and 3% start of a total of 59 students.

(31) concluded that Edward de Bono's design from a psycho-pedagogical strategies approach was based on creative thinking applied to the program and then formed a positive attitude, improving creative ability and academic level, which is why the results were of 44% (assessment a), 44% (value b) and 12% (assessment c). This allowed them to express originality, flexibility, fluency, and creativity in written and oral form. Another study conducted by (32) concluded that cognitive strategies in high school students developed the four dimensions of creativity since the descriptive statistical data showed a difference in means in favor of the experimental group. Being the exit test results in fluency (1.26), flexibility (1.59), originality (2.22) and elaboration (2.2). Also, (33) concluded that the creativity program significantly increased a 4.6 pedagogical gain in the ability to solve mathematical problems, demonstrating effectiveness in the perception and interpretability of this ability. Likewise, Freundt (2018) specified that there is a perceptive change in creativity if it is constant, playful, and dynamic, therefore, the activities, sessions, or exercises in collaboration with the teacher and student managed to sensitize them and as a result the creative level increased. and collaborative, as well as the interest in the three-dimensional and the use of social networks.

On the other hand, (6) in his methodological study had a quantitative approach, quasi-experimental level. It concluded that there was a significance of p value = 0.008 between the creative processes and design thinking in the students. Therefore, it showed a medium level in the control group and 100% at an elevated level in the experimental group. Likewise, (34) was in an applied study who came to determine that the students of the mountains and the forests of Junín in ordinary basic education showed a creativity of 49.37% at the secondary level, so there is no characteristic high significant. In addition, (5) concluded that the theoretical bases reinforce the design thinking methodology, being relevant to develop creativity.

Regarding the background of the international field, (35) was mentioned where the research was based on a mixed design with students of three levels concluding a high creative capacity in personal ability. However, the results in flexibility were low, only 3.9% in primary school, 5.6% in ESO and 3.9% in high school. Likewise, (36) in his thesis the objective was to analyze the relationship of creativity capacity and their academic performance, concluding that students with high ability obtain scores in fluency, flexibility, elaboration and originality, finding average scores as a result and the student's t-test confirmed that the differences are significant in favor of the student.

(37) determined that the methodology has been evaluated in various centers and institutions with the purpose of innovating and improving traditional teaching, reporting success in creativity, likewise the results of the design in self-esteem was 14.6%, in happiness it was 80, 7% and in

satisfaction 41% being significant. For his part, (38) stated that design thinking was a creative and curricular strategy that used digital tools to generate knowledge, as well as creativity. From the quantitative point of view, the results from the stages of creating and experimenting, the averages presented higher scores of 7.71 and 7.72 with a range of 0.71 points, signifying good management in the use of the methodology. Also (39) concluded that the characteristics of students with creativity have a positive mind and even a good mood depending on the moment of the person without a doubt, the teacher who applied creative strategies, techniques and methodologies in the classroom improved creativity even more with the Results in both tests in the experimental group increased significantly with a value of ($p < 0.001$), however, the control group showed no significant differences ($p = 0.472$). Likewise, (40) came to the conclusion that creative development programs demanded experiences in creative expression workshops, creation of aesthetic environments and space interventions and the findings were based on the practices and languages derived from the program, establishing codes and procedures of the investigation. Thus, (41) explains that creativity through training programs in companies and education are effective, even more so it can be learned and taught. The result of the global mean effect using meta-analysis was high and medium heterogeneity $DS=0.079$ and $DS= 0.05$ Also, (40) concluded that the most propitious ages to be creative were between adolescents and early adulthood, obtaining results from coefficients of 0.007 and 0.008 regression points where creativity at a high level improved academic performance and the t statistic test indicates that creativity tests contribute significantly. Likewise, (42) determined that creativity as a social and cultural practice, from an open and ethnographic perspective, has enabled interdisciplinary and pedagogical learning through imagination, the use of the body, improvisation and personification, therefore, it is a thinking tool that transmits significant teaching given by interaction with others and their context. (43) had as its object of study to analyze behavior and the elements that favored creative behavior, it was exploratory. Coming to the conclusion that the subjects maintain moderate and high creative behaviors, qualifying the games from the design and programming, expressing creativity, and strengthening the links between the players, through roles, strategy, adventure, fighting, platforms, simulator, and puzzles. , giving rise to ideas to solve problems that arise.

Adding to the above, design thinking is a deeply human approach that is structured to generate ideas and relies on the ability to be intuitive to observe and explain what exists in its context, so that those in the receivers can develop meaningful ideas. Thus, design thinking allowed us to give confidence in the creative capacity, being able to change challenges into opportunities for design and some characteristics of thinkers are: being the center of everything, empathetic, understanding needs, collaborative to find the solution and being optimistic before a failure to learn from their mistakes (9,16). In addition, in the field of design it has been considered a totalizing paradigm and Thomas Kuhn is the one who gives meaning to a theory outside any discipline, because

companies are more creative, generating successful economic resources, being the most developed worldwide and having an impact on the social, cultural and economic (44). Tim Brown assumes in his Harvard Business Review article that design thinking is a methodology based on innovation activities assuming a design philosophy and centered on people to know what they want or need in their lives through a product (45).

Regarding the theory of the first variable, multiple intelligence represented by Gardner was considered, where implications arise in education such as the student-centered school that is molded according to the presentation of the programs, so that they can be faced outside the classroom. Design thinking was considered a methodology that solves problems and uses different intelligences such as emotional, integral, and experimental, being these integral ones that respond to the changes and demands of society. In the same way, these intelligences in a global way helped the individual to face new challenges and propose alternatives. Therefore, it helped a full and balanced development. (46).

From the ontological point of view, the application of the program in education was focused on the human person. Being the knowledge representation a set of hierarchical terms that can be used to describe the domain and build a knowledge management system (47). Therefore, virtual learning platforms are nothing more than computer applications designed to promote educational exchanges between participants. According to (48) it is a software that provided logistical support necessary for online training allowing the creation, storage, and publication of learning objects in a space or repository so that users can be anywhere and use them at any time.

Regarding the theories of creativity, (27) affirmed that Joy Paul Guilford, a psychologist from the United States, was the first representative to defend intelligence as a unified concept, formed on the basis of individual differences, exploring in the human mind multidimensional aspects, in order to discover the structure of intelligence focused on abilities (46). Thus, in his research, he sought to discover and understand different types of functions of the human mind. (49) also based their evaluation construct given by Guilford in 1950, where divergent thinking implied fluency in ideas, mental flexibility when solving the problem, originality when giving answers and elaboration when transmitting ideas. Resulting in this thought a unique way of thinking and certainly gave more importance to cognitive processes such as knowledge, memory, understanding, and evaluation. Added to this, there were various theoretical perspectives and instruments based on Guilford's theory were used in them, these creativity assessments are given from a psychometric perspective and from an objective measurement, highlighting the Torrance test of creative thinking instrument used at school level. Likewise, (50) affirmed that there are two divergent and convergent thoughts, the first investigates in different directions to be able to solve the problems, however, the second solves the problems based on already established schemes. Therefore, divergent thinking produces many possible ideas (51).

3. Methodology

The investigation as part of the scientific method was carried out by logical deductive procedures, therefore, the present study is hypothetical deductive as stated (52,53) implies making statements in the form of hypotheses and verifying them by inference, extracting thus conclusions for later comparing them with facts and events that lead to acceptance or rejection. The study approach is quantitative, according to (53) it collects and analyzes the data that was used to answer questions previously posed, based on numerical measurements using statistics to determine the behavior of a population.

3.1. Type and research design

Regarding the type of research, it is applied according to the purpose and nature of the problem. According to (54,55), through theory, it was intended to solve practical problems that are based on the findings, discoveries, and solutions that were proposed as the objective of the study. On the other hand, (53) affirm that the research, because it is pragmatic, uses epistemological studies for knowledge and solutions to problems, likewise, applied research considers that technology is a way of solving problems. The design corresponding to the research for (56) is quasi-experimental since they manipulated the independent variable to achieve effects on the dependent variable. In addition, the study was mainly adjusted to this design by applying to two control and experimental groups, taken before and after the experiment. These groups were not randomized prior to testing because they were intact groups.

3.2. Variables and Operationalization

Design thinking as an independent variable is an active learning methodology that promoted capacities to face problematic situations of ethnocentric essence because it is person-centered, under a design for change approach, based on creativity, being a skill that is practiced having the opportunity to be creative by integrating their needs, technologies and design tools through collaborative work (24,57). Regarding the operational definition, it is a learning methodology that used the google classroom platform where 10 sessions were developed pointing out the creativity strategies in each phase of design thinking starting with empathizing, defining, devising, prototyping, testing, or evaluating. In addition, creativity was considered as a dependent variable, the human capacity to produce new and valuable ideas, as well as to create new, original, useful, or adaptable work, which can be achieved through training, materializing in an artistic, scientific, or literary form. Therefore, considered as an intellectual activity that forms divergent thinking giving several alternative answers and convergent thinking that only gives one solution (21,58).

According to (54), operationalization is a process that was evidenced in a quantitative approach because the variables were observed and measured at the same time. Thus, the

variables are broken down into dimensions and then divided into parts that come to make the indicators, in the same way these two were different in other studies that depended on the context, establishing a measurement scale to test a hypothesis, then had the power to select the type of techniques and instruments to collect information that is useful in the investigation.

3.3. Population and Sample

(56) explain that the population studied must meet certain characteristics within an environment. Therefore, the population that was studied did indeed meet the characteristics, where it was made up of 18 students from the 5th A; 15 students from 5th B; 16 students from the 5th C; 15 5th D students; 13 students from 5th E; 23 students from the 5th F; 29 and 20 students of the 5th G; from the EPT area of the Stella Maris Institution of VMT This sample was non-probabilistic because the structure of the groups was predetermined by the experiment to be carried out, which means that the conformation of the groups is not affected. According to (53) the advantage of such a sample, from the quantitative point of view, refers to the fact that it does not depend on probability, in any case it is related to the context and its characteristics. This is not a mechanical process, nor is it based on probability formulas. The control and experimental groups were intentionally selected to conduct the study, from the secondary level of Stella Maris No. 6152. Likewise, the inclusion criteria: Education for work students,

3.5. Validity and reliability of the instrument

The creative instrument was measured by the validity of the content, to collect an opinion and suggestion from professionals dedicated to the doctorate in education. In the process, each expert evaluates a set of aspects relevant to the test. The value ranges from 0 to 100%. The reliability of the instrument allowed obtaining results based on the reliability coefficients and they are between the values of 0 and 1, where zero indicates null and 1 indicates high reliability. (Hernández and Mendoza, 2018). This coefficient was adjusted to the case because the questionnaire was applied to 20 students as a pilot sample in the EPT area of the secondary level of school No. 6152. Likewise, a statistical analysis was used.

3.6. Procedures

The research being a quasi-experimental design, where the formulation of the problem began in mid-2021, observing and defining the problem and difficulties, and then making decisions that improve the problem. After the creativity instrument was applied in a sample of 20 students in the year 2022, actions were taken to collect information on the study variables during the execution of the project. Therefore, the population and sample were determined, obtaining information by applying the questionnaire with the pre-test.

female participants, students between 16 and 17 years of age, students who have informed consent and teachers who support the program. Excluded criteria: Students of legal age, students who do not have permission for the program and students who are not in their fifth year of high school.

3.4. Data collection techniques and instruments

The technique is a set of procedures and resources, expressed by rules and operations, being the handling of instruments that helped the person in the application of the methods, for this reason the survey was chosen in the investigation to evaluate the students of the secondary level. through the questionnaire-type instrument adapted as pre and posttest. The data obtained made it possible to structure the statistical tables and proceed to their analysis to later contrast the results with the hypothesis.

The instrument allowed data collection and was presented in the form of a guide, manual, a test, or questionnaire (59). The procedure was to use an instrument during the pretest with 24 questions that was subjected to a corrected Pearson's R item analysis, then validated by expert judgments with specialists in the education sector. With the application of this technique, the questionnaire for the creativity variable was used, with the collection of data on a Likert scale with five alternatives in which it is dimensioned in four levels.

Then the sessions were designed applying the design thinking methodology, for which authorization was previously requested from the institution where the research was conducted, as well as from the parents of the minors. Sig., a pre-test was applied to the two groups to then conduct the program for 10 sessions and at the end the post-test will be applied. Being the questionnaires those that were applied virtually at the same time. Sig., an Excel database was created, analyzing the results in a statistical package.

3.7. Data analysis method

The normality test was performed with the pretest data from both the control and the experimental group, in which, according to the Kolmogórov-Smirnov statistic, the p value = $0.200 > 0.05$, for which the decision was made to perform a parametric analysis, that is, the contrasting of the hypotheses was carried out with the Student's T statistic (Kim & Park, 2019 and Sánchez et al., 2018). For the application of the statistic, the SPSS version 25 software in Spanish was used, which allowed the inferential results to be presented, as well as for the descriptive statistics in the tables and figures according to the levels of the variable (56).

3.8. Ethical aspects

The study work is governed by the rules of the César Vallejo institution, under the Postgraduate regulations. First, permissions were requested from the institution where the program was applied, then parents were asked for authorization to participate in the research, through informed consent indicating that the data obtained are reserved by the researcher. During the study, social responsibility and

scientific rigor were assumed (RCU N° 0126, 2017). Likewise, (1) proposes basic principles to protect the human being who participates in research according to the Declaration of Helsinki. In the same way, the principles of autonomy, justice, equality, non-discrimination, beneficence, personal integrity and respect for human vulnerability established in the UDBHR of UNESCO were taken into account, all of which was related to the technologies and life sciences that it was applied to people, taking into account the environmental, legal and social dimension (13)

4. Results

4.1. Descriptive Results

The descriptive results present the levels and frequencies obtained by the creativity variable and its dimensions. Likewise, control group (GC) and experimental group (GE).

Table 1. Comparison of creativity in the GC and GE in the pretest and posttest

Levels of the creativity	Control Group				Experimental Group			
	pretest		Posttest		pretest		Posttest	
	F	%	F	%	F	%	F	%
Low	3	12.5%	4	16.7%	8	20%	0	0.0%
Moderate	21	87.5%	20	83.3%	24	80%	15	50.0%
High	0	0.0%	0	0.0%	0	0.0%	15	50.0%
Total	24	100%	24	100%	30	100%	30	100%

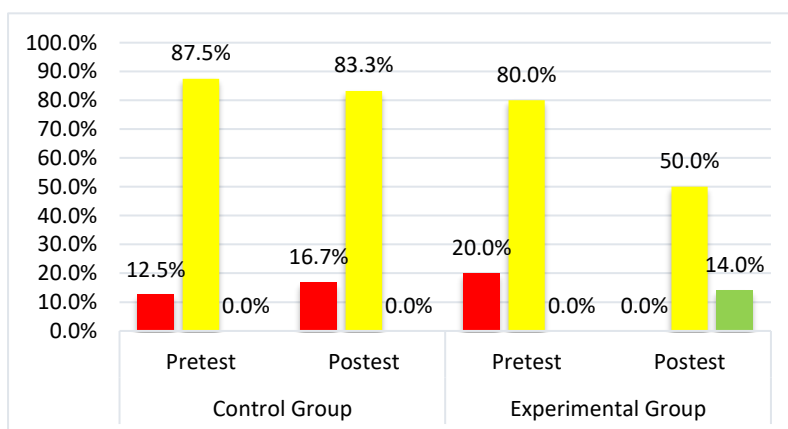


Fig. 1. Levels of creativity with pretest and posttest of the GC and GE

In the pretest, 87.5% of the students were found to be at a moderate level and 12.5% at a low level; in the posttest, 83.3% represent a moderate level and 16.7% at a low level; In the experimental group in the pretest, 80% were at a moderate level and 20% at a low level and after applying the program there were changes where 50% were at a moderate level, 50% at a high level and not having any student at a low level, that is, they had significant results in creativity after the execution of the program.

Table 2. Pretest and posttest comparison of the creativity fluency dimension of the CG and GE

Levels of the fluency dimension	Control group				experimental group			
	pretest		Posttest		pretest		Posttest	
	F	%	F	%	F	%	F	%
Low	4	16.7%	6	25.0%	5	16.7%	1	3.3%
Moderate	20	83.3%	18	75.0%	25	83.3%	18	60.0%
High	0	0.0%	0	0.0%	0	0.0%	11	36.7%
Total	24	100%	24	100%	30	100%	30	100%

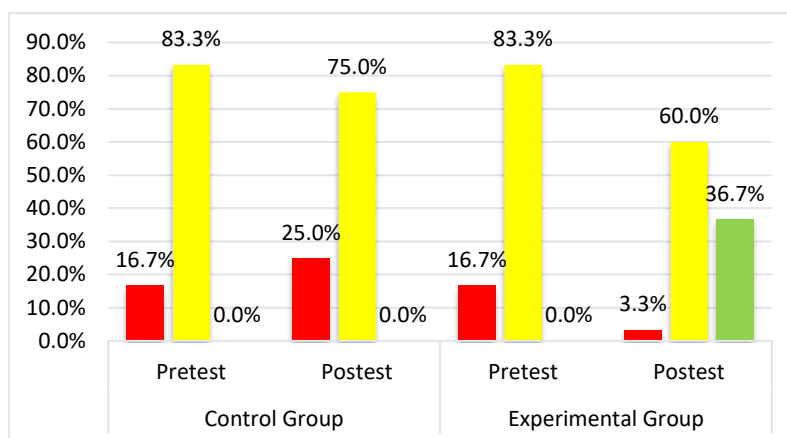


Fig. 2. Levels of the fluency dimension with pretest and posttest of the CG and GE.

The levels of the fluency dimension were observed, with respect to the results of the control group, finding in the pretest that 83.3% of the students are at a moderate level and 16.7% at a low level; in the posttest, 75% found themselves at a moderate level and 25% at a low level; however, in the experimental group in the pretest, 83.3% were at a moderate level and 16.7% at a low level and after applying the program changes were observed where 60% are at a moderate level, 36.7% at a high level and only 3.3% at a low level, that is, there was improvement after the execution of the program.

Table 3. Pretest and posttest comparison of the flexibility dimension of creativity of the CG and GE

Levels of the flexibility dimension	Control group				experimental group			
	pretest		Posttest		pretest		Posttest	
	F	%	F	%	F	%	F	%
Low	6	25.0%	5	20.8%	10	33.3%	1	3.3%
Moderate	17	70.8%	19	79.2%	20	66.7%	12	40.0%
High	1	4.2%	0	0.0%	0	0.0%	17	56.7%
Total	24	100%	24	100%	30	100%	30	100%

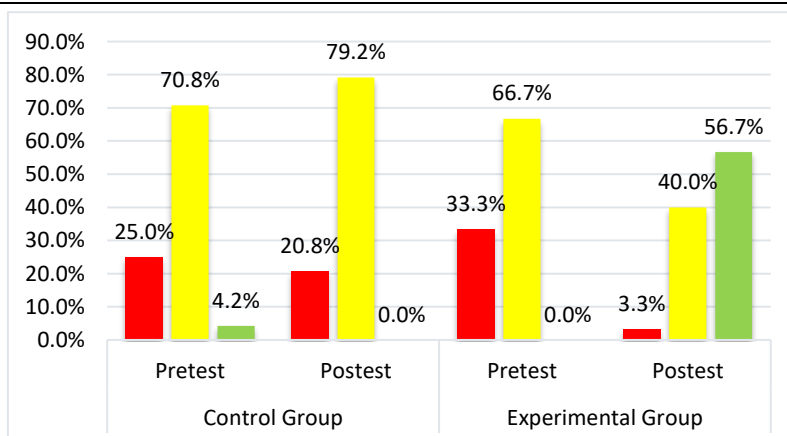


Fig. 3. Levels of the flexibility dimension with pretest and posttest of the CG and GE

The levels of the flexibility dimension are observed, with respect to the results of the control group, finding that in the pretest 70.8% of the students are at a moderate level, 25% at a low level and 4.2% at a high level; in the post-test, 79.2% represents a moderate level and 20.8% a low level; In addition, in the experimental group in the pretest, 66.7% were at a moderate level and 33.3% at a low level and after applying the program there were changes where 56.7% represented a high level, 40% moderate level and only the 3.3% at a low level, that is, it improved after the execution of the program.

Table 4. Pretest and posttest comparison of the elaboration dimension of creativity of the CG and GE

Levels of the elaboration dimension	Control group				Experimental group			
	pretest		Posttest		pretest		Posttest	
	F	%	F	%	F	%	F	%
Low	3	12.5%	3	12.5%	11	36.7%	0	0.0%
Moderate	19	79.2%	19	79.2%	19	63.3%	13	43.3%
High	2	8.3%	2	8.3%	0	0.0%	17	56.7%
Total	24	100%	24	100%	30	100%	30	100%

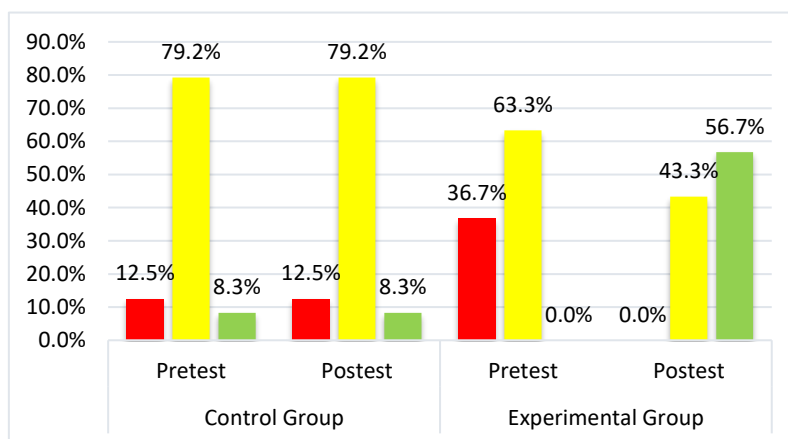


Fig. 4. Levels of the elaboration dimension with pretest and posttest of the CG and GE

The levels of the elaboration dimension are observed, with respect to the results of the control group, finding in the pretest 79.2% of the students are at a moderate level, 12.5% at a low level and 8.3% at a high level; in the posttest, 79.2% found themselves at a moderate level and 12.5% at a low level and 8.3% at a high level; In addition, in the experimental group in the pretest, 63.3% were at a moderate level and 36.7% at a low level and after applying the program changes were observed where 56.7% represented a high level and 43.3% a moderate level, that is, say there was improvement after the execution of the program.

Table 5. Pretest and posttest comparison of the originality dimension of creativity of the CG and GE

Levels of the Originality dimension	Control group				Experimental group			
	pretest		Posttest		pretest		Posttest	
	F	%	F	%	F	%	F	%
Low	8	33.3%	7	29.2%	12	40.0%	1	3.3%

Moderate	16	66.7%	15	62.5%	18	60.0%	16	53.3%
High	0	0.0%	2	8.3%	0	0.0%	13	43.3%
Total	24	100%	24	100%	30	100%	30	100%

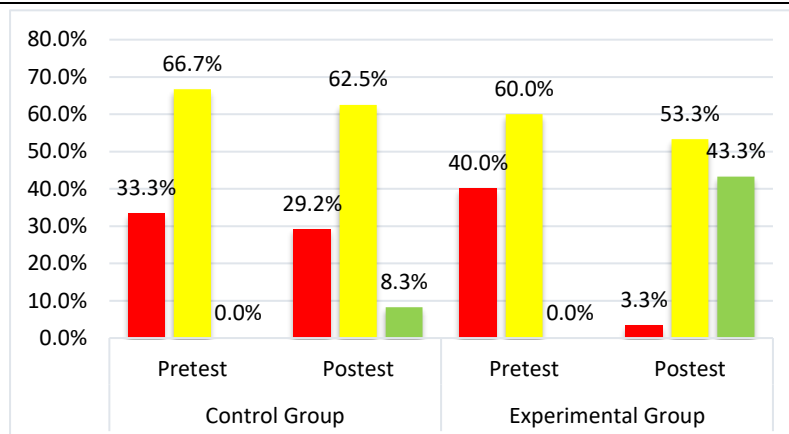


Fig. 5: Levels of the originality dimension with pretest and posttest of the CG and GE

The levels of the originality dimension are observed, with respect to the results of the control group, finding in the pretest 66.7% of the students at a moderate level and 33.3% at a low level; in the post-test, 62.5% found themselves at a moderate level, 29.2% at a low level, and 8.3% at a high level; In the experimental group in the pretest it was observed that 60% are at a moderate level and 40% at a low level and after applying the program there were changes where 53.3% were found at a moderate level, 43.3% at a high level, that is, there was improvement after the execution of the program.

4.2. Inferential Results

General Hypothesis

H0: The design thinking program on the google classroom platform does not significantly improve creativity in high school students from institution No. 6152, Lima-2022.

Hi: The design thinking program on the google classroom platform significantly improves creativity in high school students from institution No. 6152, Lima-2022.

Table 6. Independent samples before and after the application of the program in the CG and GE

Test of equality of variances		F	Sig. (bilateral)	t-test for equality of means		
				you	gl	Sig. (bilateral)
Creativity Pretest	Equal variances are assumed.	0.016	0.900	1,034	52	0.306
	Do not assume equal variances			1,036	49,788	0.305
Creativity Posttest	Equal variances are assumed.	5,058	0.029	-7,191	52	0,000
	Do not assume equal variances			-7,603	47,975	0,000

Table 5 shows that there are no significant differences in the pretest of both the control and experimental groups, so that $p = 0.900 > 0.05$ and in the posttest of both the control and experimental groups if there are significant differences, since $p = 0.029 < 0.05$, that is, the application of the design thinking program on the google classroom platform significantly improved creativity in students.

Specific hypothesis 1

H0: There are no significant differences in the creativity of the experimental group before and after applying the design thinking program on the google classroom platform on creativity in high school students from institution No. 6152, Lima-2022.

Hi: There are significant differences in the creativity of the experimental group before and after applying the design thinking program on the google classroom platform on creativity in high school students from institution No. 6152, Lima-2022.

Table 7: Related sample before and after the application of the program in the experimental group

Paired differences		Half	Dev. Deviation	Dev. Mistake average	95% confidence interval of the difference		t	gl	Sig. (bilateral)
					lower	Superior			
pair 1	GE Pretest GE Posttest	-25,400	16,608	3,032	-31,602	-19,198	-8,377	29	,000

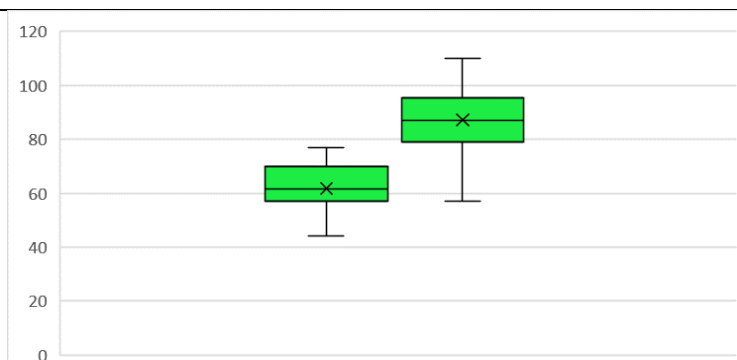


Fig. 6. Test of means for related samples of EG creativity.

Table 7 and Figure 7 show that the experimental group significantly improved creativity after applying the program with $p = 0.000 < 0.05$ and with mean differences of -25,400.

Specific hypothesis 2

H0: There are no significant differences in the creativity of the control group before and after applying the design thinking program on the google classroom platform on creativity in high school students from institution No. 6152, Lima-2022.

Hi: There are significant differences in the creativity of the control group before and after applying the design thinking program on the google classroom platform on creativity in high school students from institution No. 6152, Lima-2022

Table 8. Related sample before and after the application of the program in the GC

Paired differences		Half	Dev. Deviation	Dev. error average	95% confidence interval of the difference		t	gl	Sig. (bilateral)
					lower	Superior			
pair 1	GC Pretest - Post-test GC	-1,667	8,509	1,737	-5,260	1,926	-960	23	.347

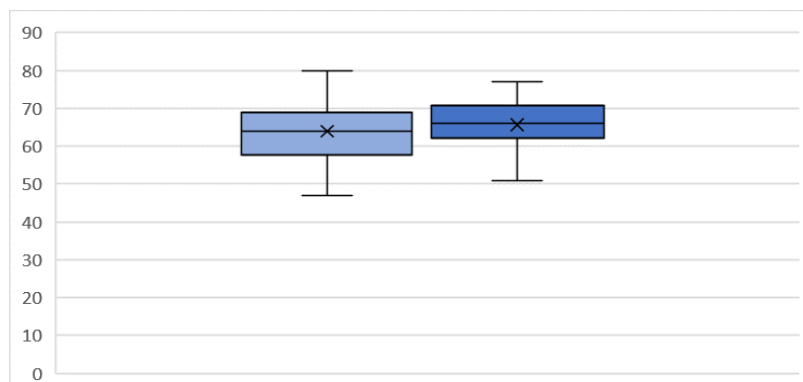


Fig. 8. Test of means for related samples of CG creativity.

In table 8 and figure 8, it is observed that there are no significant differences between the pretest and posttest since said group was not submitted to the execution of the program and statistically it is demonstrated that $p = 0.347 > 0.05$.

Specific hypothesis 3

H0: There are no significant differences in the creativity of the control group and the experimental group before applying the design thinking program on the google classroom platform on creativity in high school students from institution No. 6152, Lima-2022.

Hi: There are significant differences in the creativity of the control group and the experimental group before applying the design thinking program on the google classroom platform on creativity in high school students from institution 6152, Lima-2022.

Table 9. Independent samples before the application of the program in the GC and GE

Levene's test of equality of variance		t-test for equality of means								
		F	t	Sig. gl	Sig.(bilateral)	Difference of means	Standard error difference	95% confidence interval of the difference		
								lower	Superior	
pretest	Equal variances are assumed	.016	.900	1,034	.52	.306	2,300	2,224	-2,163	6,763
	They do not assume equal variances.			,1036	49,788	.305	2,300	2,220	-2,159	6,759

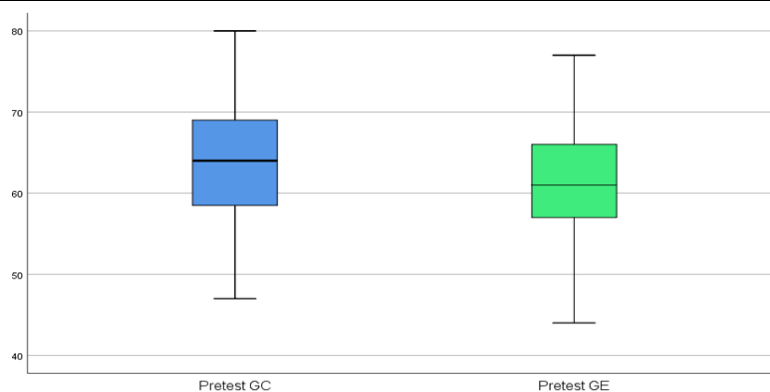


Fig. 9. Test of means for independent samples of the creativity of the CG and GE during the pretest.

Table 9 and figure 9 show that there are no significant differences between the pretest of the control group and the pretest of the experimental group with $p = 0.306 > 0.05$ and $p=0.305 > 0.05$.

Specific hypothesis 4

H0: There are no significant differences in the creativity of the control group and the experimental group after applying the design thinking program on the google classroom platform on creativity in high school students from institution No. 6152, Lima-2022.

Hi: There are significant differences in the creativity of the control group and the experimental group after applying the design thinking program on the google classroom platform on creativity in high school students of institution No. 6152, Lima-2022.

Table 10. Independent samples after the application of the program in the GC and GE

	Levene's test of equality of variance				t-test for equality of means				
	F	Sig.	t	gl	Sig. (bilateral)	Difference in stockings	Standard error difference	95% confidence interval of the difference	
								lower	Superior
Posttest are assumed. variances equal	5,058	.029	91	52	,000	-21,433	2,981	-27,415	-15,452
are not assumed. variances equal			7,603	47,975	,000	-21,433	2,819	-27,102	-15,765

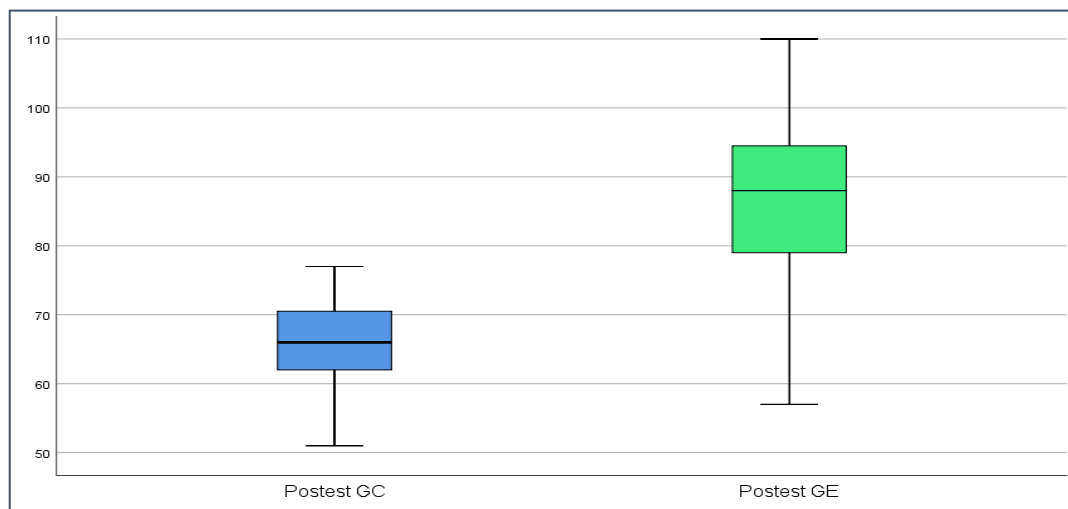


Fig. 9. Test of means for independent samples of the creativity of the CG and GE during the post-test.

Table 9 and Figure 9 show that if there are significant differences between the post-test of the control group and the post-test of the experimental group with $p = 0.000 < 0.05$ and $p = 0.000 < 0.05$, that is, the execution of the program significantly improved creativity.

The results of the objective are detailed in levels where the creativity variable improved significantly in the students, demonstrating that in the experimental group

5. Discussion

there was a 50% moderate level, 50% a high level and none at a low level, that is, there was significance applying the program in the area of education for work on creativity in 5th grade high school students. The thesis of (30) coincides with this study, who determined the influence of education for work on critical creative thinking in students, due to its results in ($p < 0.05$), since after manipulating the independent variable in the scheduled time, an achievement level of 67% was obtained. Likewise, (5) agrees with the research by having similar results applying the design thinking program at a high level 40.9%, medium level 59.1% and low level 0%, he insists that if there is no significance of all ways the program should be applied since the methodology is centered on the person. There was also a coincidence when comparing the results of (33) of the 30 students, 24 represent 80% on a scale always and 6 students represent 20% on a scale sometimes and never. Whereas the application of the creativity program in solving mathematical problems increased significantly at an elevated level. To this, (60-67) contributes with his theoretical study of Piaget who exposed teaching-learning strategies from a constructivist approach, this praxis strengthened creativity and imagination and it is the teacher who must creatively enhance their didactic resources so that the student promotes their own creativity. (68-73) also pointed out that intelligence is the capacity of every human being, and that creativity is sustained by cognition and intellect to solve recent problems, which allowed an improvement in the levels and development of their capacities.

Regarding the results of hypothesis 1 when conducting the program in the experimental group before and after there was a significance of $p = 0.000 < 0.05$ and with mean differences of -25.400, this was due to the application of the techniques of creativity embodied in the corresponding sessions in each phase of design thinking. The results of (74-78) were added to these, demonstrating that design thinking improved significantly in creative thinking where the experimental group had a 100% general level, unlike the control group that showed a medium level of creativity. The work of (79) is added to the existing reading, finding advances at an early age in divergent thinking based on art-based intervention. In the same way, (80-84) in his results affirmed that in creative thinking cognitive strategies developed the four dimensions of creativity denoting flexibility (1.59), fluency (1.26), elaboration (2.00), originality (2.22), in favor of the experimental group and the inferential statistics, using Student's t test, indicating the difference between means was significant ($p < 0.01$). To this result is added the thesis of (85-89) had the effect that the usefulness of creativity was to encourage imagination, creation of new things, give originality, motivation, and a fluidity of thought since the majority indicated that they think differently when solving a problem. problem being considered a creative person (90-94).

Regarding specific hypothesis 2, he mentions that there are differences significant in the creativity of the control group before and after applying the design thinking

program in the google classroom platform, results were obtained through the statistics of related samples a value: $p = 0.347 > 0.05$. which showed that there were no significant differences because they did not receive the program and they worked in the traditional way. It coincides with (95-98) his results of creativity in regular basic education both in the mountains and the jungle the students did not develop their creative potential since it was determined that 48.99% were looking for a new result or product, as well as the resolution of problems and their needs, all of them have to do with the development of creative abilities. Likewise, the study by (99-103) presented pre- and post-test comparisons like the research because it did not present significant differences in the control group, however, the average increased to 4.38 in creative abilities.

Likewise, the specific hypothesis 3 regarding whether there are significant differences in the creativity of the control group and the experimental group before applying the program resulted in the non-existence of significance since in the statistics for independent samples the Levene test was taken. and Student's T to find the means observing a reflected p value as follows: $p = 0.306 > 0.05$ and $p = 0.305 > 0.05$, since these groups were evaluated before starting the program, showing the natural way they start. This is corroborated by another study such as (1) that showed little participation of people in cultural and artistic activities due to the pandemic. Therefore, it was sought to design and implement innovative measures aimed at sustainability and significance for the cultural and creative sector. (104-107) also concluded that students show an unfavorable attitude and indifference about creativity; This reflects that they demonstrated a low level of knowledge of motivation, characteristics, criteria, and creative thinking.

It should also be noted that the results of the specific hypothesis 4 where the significant difference in the creativity of the control group and the experimental group was sought after applying the design thinking program on the google classroom platform, the result was that there are significant differences between both groups with $p = 0.000 < 0.05$ and $p = 0.000 < 0.05$, that is, the execution of the id significantly improved creativity, that is, the execution of the program improved significantly in the EG because the design thinking phases were applied by programming in the classroom with Creativity techniques such as six hats, brainwriting, brainstorming, interview, POV empathy map, receiving mesh and the GC were worked on in the traditional way. Thus, we take into account the findings of (29) who in his results indicate that Spearman's Rho is 0.8627 points, with p-value = 0.000 ($p < 0.05$), since he rejected the null hypothesis, there being a significant relationship between critical creative thinking and emotional intelligence. Likewise, (42) in his results of the polyphonic city workshop took as a practice based on cognition, collaboration, and action as a learning practice, demonstrating that the methodologies fostered an innovative educational model.

The results of the general hypothesis are detailed below, where it is observed that the pretest of both the control and experimental group does not exist significant

differences, so the observed significance value (sig) $p=0.900$ is greater than the significance value $\alpha = 0.05$ and in the posttest, it allows us to indicate that the difference between the control and experimental group is statistically significant, therefore, the null hypothesis is rejected and the alternate hypothesis is accepted, that is, the design thinking program on the classroom platform has effects significant on creativity in high school students of Institution No. 6152, Lima- 2022. According to the exposed literature. (38) where the study of the incursion and the creative processes in its various stages increased the grades to 7.72 because the di tec methodology was based on the use of technologies as part of a creative strategy generating knowledge within of the various disciplines. It coincides with the results of (36) in the application of the Student's T statistic, finding significant differences, as well as average scores demonstrating high creative capacity in student performance. (40), in Madrid, considered the methodology within educational, social, business, and cultural contexts. (63) pointed out that the makerspace as a space encourages creativity and collaborative learning if it contains sessions, materials, and tools to build objects or express art according to the needs of people. We could mention that (41) presented the methodologies applied to creativity from an approach to the construct to a meta-analytic technique, resulting in medium and high heterogeneity of 0.05 and 0.079. All of them contributed to the knowledge to define that creativity is a complex, multidimensional construct approached from a multidisciplinary perspective. It is also supported by (64) who found the link between creativity and analytical skills to be positive and significant, due to novel skills and creativity tasks in fluency, flexibility, originality, and elaboration.

6. Conclusions

First: In relation to the general objective, the results of the control group and the experimental group began with similar percentages, however, after applying the program with the various creativity techniques in each phase of design thinking, changes equal to 50% were observed at a moderate level. and high, concluding an improvement after the execution of said program.

Second: In relation to specific objective 1, the levels of the fluency dimension showed a difference in low and moderate levels in the control group before and after, so that in the experimental group a 36.7% was concluded at an elevated level of fluency of ideas. to solve problems, 60% moderate level and 3.3% low level.

Third: Regarding objective 2, the levels of flexibility showed similar results in the control group, since in the experimental group a percentage was observed at a low level of 3.3%, a moderate level of 40%, and a high level of 56.7%, this characteristic being that of addressing problems from different points of view, achieving an improvement in the three levels.

Fourth: Regarding the elaboration, the results of the control group were the same at the three levels, however,

in the experimental group after applying the originality there were changes where 56.7% were found at a high level, 43.3% a moderate level and no student was found at a low level, concluding an improvement due to the ability to create, describe and generalize ideas.

Fifth: The levels of the originality dimension showed two levels in the pretest and a moderate, low and high level in the posttest; However, in the experimental group in the pretest it was observed that 60% were at a moderate level and 40% at a low level and after applying this characteristic an increase in the high level 43.3%, 53.3% moderate and 3.3% low level. Demonstrating that thinking individually leads to making products, being a mental or artistic activity.

7. Recommendations

First: It is necessary that the UGEL, directors, specialists, apply the design thinking program for students of all educational levels and thus achieve improvements in learning, producing original ideas and being more creative.

Second: Teachers to implement strategies using creativity techniques in all academic areas so that they increase the ability to produce many original ideas with ease.

Third: Students take advantage of the changes provided in technology using new platforms, gamification, applications, and new products to enhance creativity, especially in the flexibility dimension so that the student can address problems from different points of view.

Fourth: For teachers to meet the objectives of a program by clearly developing the learning sessions that allow adding elements or details to ideas that already exist, achieving elaboration in creativity.

Fifth: To teachers to be able to stimulate students from an early age to the higher level in the development of creativity through various activities, achieving the production of ideas, products, or processes to be ingenious and original.

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