▪ Vol. 5, No. 2 (Spring 2024) ▪ p-ISSN: 2791-0237 ▪ e-ISSN: 2791-0202
▪ Pages: 265 – 277 ▪ DOI: 10.55737/qjss.113973416

QLANTIC JOURNAL OF SOCIAL SCIENCES

Effect of Cooperative Learning on Grade VII Learners' Creative Thinking Skills (CTSS) in Elementary School Science

Saeeda Majeed [1] Gulshan Fatima Alvi [2] Khadija Sittar [3]

Abstract: *In every aspect of daily life, uniforms are fundamental. When we meet someone, we tend to judge them based on their uniform, such as a nurse's outfit, a labourers' uniform, or a military uniform. "School uniform influences students' social adjustment at secondary school level in district Bannu, KPK, Pakistan", is the main focus of this study. Due to its descriptive nature, a survey approach was used. The population of the study is 8073 male students enrolled in district Bannu's Government Secondary Schools. The applied sampling technique was a stratified random sampling technique. Five hundred respondents were selected as a sample, and the data was calculated using the John Curry (1984) formula. The "Five Point Likert Scale" was employed in a self-created survey instrument. The researcher made 41 statements and requested a panel of ten educational experts for validation. The researcher gave the questionnaire to fifty students. Utilized SPSS's Cranach alpha to assess the questionnaire's reliability. Overall, Cranach's alpha was .83. Out of all 30 items that remained for the data collection, 11 were irrelevant because their "corrected item-total correlation" standards were less than .25. To find out "school uniform" and "social adjustment", frequency and percentage were employed. The effect was ascertained by Simple Linear Regression which shows that school uniforms significantly influence students' social adjustment in the community at secondary school level in district Bannu.*

Key Words: Cooperative Learning, Creative Thinking Skills (CTSs), Elementary School Science

Introduction

In the modern, global, competitive and high-demanding era of the 21st century, researchers are facing multifaceted and complex problems in all aspects of life (Hasan, et al., 2019). In order to meet the challenges of the current time, solve complicated problems, manage diverse information and break new ground, one needs to be creative (Stoican & Camarda, 2011). Creative Thinking Skills (CTSs) are crucial for innovation, industrialization andsocio-economic development of any nation. Only creative individuals lead to new inventions and modernizations. CTSs enable individuals to come up with novel ideas, tackle complex issues and think effectively to find revolutionary solutions to complex life problems. They can view things innovatively and from varied perspectives (Sekhri et al., 2021). So, at present, the development of CTSs for learners has become educators' priority (Pun, 2012) and the top agenda of the world, which demands student active participation (Syafrial et al., 2022). Therefore, new generations must be educated in away that develops their CTSs (Pun, 2012). They must be able to discover the world of knowledge and skills on their own and create their own meanings of life (John & Meera, 2014).

According to Sekhri and Kuljinder (2021), Creative thinking is not a talent but a way of operating, and it can be taught. CTSs are reported to be enhanced through employing particular teaching methods and strategies (Zimmerman, 2010). Halford and Wilson (2002) argue that school is the place to introduce new ideas to learner's explicit representation of their imagination and use of mental processes to develop their novelty. Schools must act as incubators. Gunawan et al. (2018) also documented that school education

[1] Senior Subject Specialist, Quaid-e-Azam Academy for Educational Development, Lahore, Punjab, Pakistan.
[2] Assistant Professor, Department of Education, Lahore Leads University, Lahore, Punjab, Pakistan. Email: drgulshan.edu@leads.edu.pk
[3] Assistant Professor, Department of Education, Lahore Leads University, Lahore, Punjab, Pakistan. Email: drkhadijasittar@leads.edu.pk

▪ **Corresponding Author:** Saeeda Majeed (saeedamajeed@rocketmail.com)

▪ **To Cite:** Majeed, S., Fatima, G., & Sittar, K. (2024). Effect of Cooperative Learning on Grade VII Learners' Creative Thinking Skills (CTSS) in Elementary School Science. *Qlantic Journal of Social Sciences*, *5*(2), 265-277. https://doi.org/10.55737/qjss.113973416

should provide a learning environment for learners, which helps them stimulate and boost their CTSs with the passage of time. Therefore, enhancing learners' CTSs ought to be an obligatory function of a school system.

Creative thinking has no boundaries and is not limited to a particular field; rather, it is applicable to any human endeavour (Orora et al., 2014; Sekhri & Kuljinder, 2021), including mathematics, science, and teaching (Cai et al., 2009; Sekhri & Kuljinder, 2021). Like other disciplines, CTSs are recognized as a key prerequisite in the learning of scientific knowledge and skills. It enhances the learners' deeper understanding of scientific phenomena. Science educators, therefore, need to develop and apply such teaching-learning approaches that enhance learners' CTSs (Orora et al., 2014; Sekhri & Kuljinder, 2021). Most science teachers are reported to apply traditional methods like lectures, question & answer, and discussion to teach scientific concepts and skills atschools (Hasan, et al., 2019). The use of traditional methods restricts students' learning to only lower-level thinking skills. The development of CTSs is difficult because teachers are still unfamiliar with and overwhelmed with developing such learning. Therefore, the design and implementation of teaching-learning strategies to develop students' high-level thinking skills like CTSs are still weak. Moreover, it is documented that science teachers lack the pedagogical methods and strategies for science learning that empower students' CTSs (Leasa et al., 2021).

It is richly supported that CTSs can't be created and developed by applying traditional teaching approaches rather than hindering the way to creativity. Educationists strongly emphasize that CTSs can only be fostered through employing innovative learning methods. Therefore, we need to use innovative teaching and learning methods to make the learners creative (Gunawan et al., 2016). Latour and Woolgar (1986) argue that CTSs emerge from interactions among learners. The students are encouraged to learn like scientists whose interaction and mutual sharing act as a catalysts in the creation of new knowledge (Orora et al., 2014). It is advocated that learners' CTSs may be boosted if they are made to learn in culturally diverse groups or teams with independence and intrinsic motivation (Marashi & Khatami, 2017). Therefore, teachers must arrange such classroom activities in which the learners interact freely in a social setting, thinking imaginatively and divergently.

Cooperative Learning is the method in which learners interact actively in groups with positive interdependence and are mutually accountable for their learning. During group work, they exhibit social skills like leadership, decision-making, conflict management and group processing, which facilitate learning in social groups and ensure mutual feedback. Intrinsic- motivation is also an inbuilt characteristic of Cooperative Learning. Cooperative Learning is reported to focus on enhancing learners' higher-order thinking (Andin & Aziz, 2019), including creativity within a social-cultural milieu (Yasin et al., 2021). The unique structure of cooperative learning also makes it highly appropriate for enhancing learners' CTSs. A number of recent studies concluded that Cooperative Learning provokes and enhances learners' CTSs (Gunawan et al., 2018; Marashi & Khatami, 2017; Orora et al., 2014; Silva et al., 2022).

Cooperative learning is now gaining prominence in science education. Although research supports the use of Cooperative Learning in order to enhance learners' CTSs, in Pakistan, Elementary Science Teachers/Educators (ESTs/ESEs) don't apply Cooperative Learning methods due to unfamiliarity and insufficient supportive evidence in local perspectives.Moreover, they are not yet convinced enough to apply Cooperative Learning to teach scientific knowledge and skills in classrooms at the elementary level. Therefore, studies are required to provide information and data about the effect of Cooperative Learning on learners' CTSs in Elementary School Science. This study aimed to investigate the effect of Cooperative Learning on Grade VII learners' CTSs in Elementary School Science.

Review of Related Literature

Creative Thinking Skills (CTSs)

Creative Thinking Skills are defined as the capability to generate inventive, original, and unexpected ideas, produce useful and adaptive work (Kaufman & Sternberg, 2019), make comparisons and contrasts, analyze facts and experiences, justify views, derive inferences, and assess arguments (Marashi & Khatami, 2017). Additionally, CTSs are described as the ability to produce alternatives and think of possibilities to resolve problems (Franken, 2007), produce imagination, construct alternative hypotheses, and evaluate circumstances (Kampylis & Berki, 2014). Therefore, creative individuals can view things in new ways or from diverse viewpoints (Orora et al., 2014).

Learners' CTSs can also be developed by engaging them in various types of problems and stages of problem-solving, while the thinking strategies pursued by them in the framework ofbuilding creative thinking are defining the problem, providing solutions/suggestions, finding criteria, identifying perspectives, choosing the best solutions, and entering into various different points of view (Vidergor, 2018).

How to Measure CTSs

Creative thinking is an expression of divergent thinking. Divergent thinking can be assessed by four factors, namely fluency (number of answers/items produced), flexibility (numberof variety of answers/categories of items produced), originality (number of unique ideas/answers produced) and elaboration (subtlety, ornamental and detailed answers). These four categories are the psychometric approach developed by Joy Paul Guilford, the father of the creative world. Guilford (1950) and Torrance (1965) developed creative thinking tests that are in line with psychometric approaches (Leasa et al., 2021; Syafrial et al., 2022). Most of the researchers used these indicators in their studies to assess students' CTSs. Scibinetti et al. (2011) also advocated applying the criteria of fluency, flexibility, originality, elaboration, and evaluation in order to assess the students' CTSs.

Observation is also described as an important tool to measure students' CTSs. In order to measure students' CTSs, the teachers may observe students' visual, verbal, listening, drawing, and motoric components of activity in the learning process.

Why Cooperative Learning Enhances CTSs

Cooperative learning is the instructional method wherein a small group of students interact positively and work together to complete the assigned tasks (Marashi & Khatami, 2018). Cooperative Learning has its roots in the early 20th century and is a richly documented, well-researched instructional method with sound theoretical underpinning. John Dewey presented the idea that learning is a social process. In Dewey's view, learners do not learn in isolation; instead, they learn by being part of the community and the world as a whole. Similarly, Vygotsky also advocated that our thoughts and ideas are constructed in a social environment through mutual interaction with others. Thus, both Dewey and Vygotsky planted the seed for CL (Pun, 2012).

A number of studies regarding the intellectual and cognitive aspects of CL within schools have concluded that CL enhances the thinking of students and helps them to acknowledge and integrate multiple perspectives on a problem (Betancur et al., 2011). It is strongly documented that this is the unique structure and inbuilt elements of CL that support and promote students' creative thinking skills. The format of CL group work allows the students tointeract face-to-face with their members in a structured activity. Promotive Interaction stimulates them to brainstorm, explain, question, disagree, persuade and think out multiple perspectives to solve problems. It also encourages them to share, elaborate, explain, and defend their ideas and, as a result, restructure their ideas; thus, CL group potentially leads to group members' cognitive restructuring. Sharing multiple perspectives about a problem or project by group members having varying abilities initiates the sparking of new ideas in their minds. Witnessing the thinking patterns and creative ideas of group members provides them with beneficial modelling. During this, they find opportunities to share their strengths with other members and develop their weak skills. Positive Interdependence pushes them to do their assigned part of work/tasks actively and avoid interacting as sleeping partners. This also provides them with a supportive atmosphere in which they feel free to try out novel ideas. They also eagerly learn the whole task or activity as they are held individually accountable.

Additionally, CL group processing skills activate the group to assess and reflect on their work as a whole. In groups, the learners develop their interpersonal skills and learn to deal with conflict. Finally, CL provides them with a stronger base to explore new concepts by enhancing academic achievement (Sekhri & Kuljinder, 2021). Thus, the CL structure is more effective in enhancing learners' CTSs than the traditional whole-class format.

Statement of the Problem

Unfortunately, at present, the learners' CTSs are drained due to the use of traditional methods for teaching and learning in schools. Most of the schools fail to engage their learners in effective creative tasks. Therefore, they mostly lack creativity and are unable to use their brains for creative thinking (John & Meera, 2014). Moreover, elementary science teachers/educators (ESTs/ESEs) are not yet convinced enough about the effectiveness of cooperative learning in enhancing CTSs. Therefore, it was imperative to conduct this study in order to find out the effect of Cooperative Learning on grade VII learners' CTSs in elementary school science.

Purpose of the Study

This study was aimed at determining the effect of Cooperative Learning on grade VII learners' CTSs. It was intended to investigate whether there was a significant difference for CTSs between grade VII learners who were taught using Cooperative Learning strategies and those taught using traditional methods.

Objectives of the Study

- To compare students in grade VII who were taught using Cooperative Learning (CL) to those who were taught using Traditional Methods (TM) in terms of their overall mean scores for Creative Thinking Skills (CTSs).
- To investigate the variations in average Fluency scores between students in grade VII who were instructed via Cooperative Learning and those who were instructed using Traditional Methods.

Hypotheses of the Study

Ho1: There is no statistically significant difference in the total mean scores for CTSs between grade VII learners who were taught through Cooperative learning and those exposed to the traditional method.

Ho2: There is no statistically significant difference in the mean scores for Fluency between grade VII learners who were taught through Cooperative learning and those exposed totraditional methods.

Ho3: There is no statistically significant difference in the mean scores for Flexibility between grade VII learners who were taught through Cooperative learning and those exposed totraditional methods.

Ho4: There is no statistically significant difference in the mean scores for Originality between grade VII learners who were taught through Cooperative learning and those exposed to the traditional method.

Ho5: There is no statistically significant difference in the mean scores for CTSs, including "Creating new knowledge, Product Improvement and Alternative Hypothesizing & Deriving the Inferences", between grade VII learners who were taught through Cooperative learning and those exposed to the traditional method.

The Theoretical Framework of the Study

The Social Constructivism Theory of Vygotsky and the Structure of Intellect Model of Guilford serve as the theoretical foundation for the research study "Effect of Cooperative Learning on Grade VII Learners' Creative Thinking Skills (CTSs) in Elementary School Science." Vygotsky's theory highlights the significance of social interaction and collaboration in cognitive development, arguing that learning occurs through meaningful interactions with peers and teachers. Cooperative Learning (CL), which involves students working together in small groups to achieve shared learning goals, aligns with this theory by giving learners the chance to participate in dialogue, exchange differing viewpoints, and build on each other's ideas.

Sample of the Study

The participants of this study included 56 male learners of grade VII from Govt. Higher Secondary Schools for Boys, Chungi Lahore. There were a total of 150 students enrolled in grade VII in the school. These students were enrolled in the school for sessions 2021-2022, and their ages ranged between 11 and 13 years. Out of these, 56 students were selected through a simple random sampling procedure. Subsequently, they were further randomly assigned to experimental and control groups. Thus, each group included 28 grade VII learners.

Research Tools

In order to assess the creativity level of male students in science in grade VII, the investigator developed a test named "Creative Thinking Skills in Science (CTSS). It was developed on the basis of the Torrance Tests of Creative Thinking Verbal (TTCT-V). TTCT-V is based on divergent thinking and has been widely used in education (Plucker, 2001) for all cultures and ages (Kim, 2006).

CTSS was comprised of two equivalent parts: "Part A" was applied as a Pre-test and "Part- B" as a Post-test. Each part included 6 Tasks. It consisted of three basic CTSs: Imagination, including Creating Imaginary Stories & Just Suppose; Divergent thinking or Original thinking.

Includes Thinking of multiple & unusual uses of a thing, Alternative hypothesizing & deriving Inferences (Table 1).

Both the Pre-test and Post-test were comprised of the same CTSs as mentioned but with different questions or situations. CTSS was validated by two of the field experts and pilot-tested to ensure its reliability. Alpha Cronbach Reliability of the final test was 0.91.

Table 1
CTSS detail

CTSs	Creative Tasks	Task. #	Pre-test	Post-test	Time
Divergent thinking orOriginal thinking	Thinking of multiple & unusual uses ofa thing	Task I	Writing maximum unusual uses of a meter rod	Writing maximum unusual uses of a beaker	10 min.
		Task II	Writing all possible scientific uses of a plastic bottle	Writing all possible scientific uses of a tree	10 min.
		TaskIII	Divide a square into four parts by using allpossible methods.	Divide a rectangleinto four parts by using all possiblemethods.	10 min.
Imagination	Creating Imaginary Stories	TaskIV	Writing Scientific questions to research on reaching a planet	Writing a story on "Plants can move like animals"	10 min.
	Just Suppose	Task V	What would the worldbe like if there was always daylight without any ight?	Draw a pictorial story on "ways to survive alone in a Jungle" has only a knife and a tin.	10 min.
Alternative Hypothesizing & Deriving the Inferences	Constructing Alternative Hypotheses & Deriving the Inferences	TaskVI	▪ Given the situation, constructalternate hypotheses ▪ Given the experiment and relateddata, derive the inferences		10 min.
Total			6 Tasks	6 Tasks	1 Hr.

Scoring Procedure of CTSS

In order to assess the experimental and control group grade VII learners' responses on pretest (CTSS Part A) & posttest (CTSS Part B), the scoring procedure included three main measures of CTSs: scoring for fluency, scoring for flexibility, and scoring for originality (Table 2).

Table 2

Detail of scoring procedure

Measures ofCreativity	Related Learners' Ability to	Scoring Base
Scoring for Fluency	Produce a large number of ideas withwords	Number of ideas
Scoring for Flexibility	Produce a variety of ideas, shift from one approach to another, or use a variety of strategies	Number of approaches
Scoring for Originality	Produce ideas well beyond the obvious, commonplace, banal, or established.	Number of novel ideas

The grade VII learners were also assessed on three CTSs: creating new knowledge, product improvement, production of alternative hypotheses, and evaluation. Based on these CTSs, different tasks were performed by the subjects of the study, such as preparing science projects, making & improving science models, and planning & performing hands-on experiments (Table 3). The performance of both experimental and control group learners on these tasks was assessed throughout the study. In order to assess their performance on these tasks, five-point Likert scale-based rubrics were developed. The details of these rubrics aredescribed in Table 3.

Table 3

Rubric to assess creativity

CTSs Tasks	Indicators				
	1	2	3	4	5
Planning & Preparing science projects	Originality	Effectiveness	Flexibility use of novel and a variety of materials or tools	Elaboration or quality	Attractive/ Polished
Making & improving Science models	Originality	Usefulness/ Adaptive	Low & No-cost novel and a variety of materials or tools	Working	Self-explanatory/ Concept clarity
Planning & Performing hands-on experiments	Originality	Usefulness/ Adaptive	Flexibility use of novel and a variety of materials or tools	Elaboration or quality	Alternative Hypothesizing & Deriving the Inferences

Research Methodology

Research Design

This study was experimental in nature. "Pre-test Post-test Control Group Design" was used to carry out the study (Table 4). Experimental and control groups were formed by randomization and pre-tested and post-tested prior to and at the end of the intervention. The study was carried out for 12 weeks. Both the experimental and control groups were taught the same CTSs based on elementary scientific concepts and skills by the same teacher.

Table 4

Research design

Groups	Pre-test	Intervention	Post-test
Experimental	O*	X1***	O**
Control	O*	X2****	O**

*CTSS (Part-A); ** CTSS (Part-B); ***Cooperative Learning Strategies (STAD, Jigsaw, Think Pair Share, & Round Table); ****traditional Teaching Method

Experimental Group

In the experimental group, Cooperative learning was implemented. The classroom was organized in a "round seating arrangement". A total of four cooperative learning strategies were applied to teach CTSs based elementary science concepts and skills. These strategies included STAD, Jigsaw, Think Pair Share, and Round Table (Table 4). Being learners' first experience learning through cooperative learning, the teacher trained them in Cooperative Learning theory (Cooperative Learning structure and strategies: Jigsaw, STAD, Think Pair Share, Round Table) and group processing skills.

In order to learn CTSs-based elementary science concepts and skills, the students worked cooperatively in the science classroom, science laboratory and computer lab. For working on different assigned CTSs based cooperative tasks, the teacher provided them with different resources such as reading material, scientific equipment & apparatus, chemicals, thermo-pore sheets, chart papers, colours, paints, pictures, graph papers, no & low-cost materials such as plastic bottles, tubes, wires, batteries, nails, tape etc. Other than this, they were also free to demand any materialfrom the teacher or bring any material on their own. While working in cooperative groups, the teacher closely observed them. She also encouraged them to cooperate with their group membersand facilitated them.

Procedure of Cooperative Grouping

For the execution of STAD, Jigsaw, and Round Table, the learners of the experimental group were assigned to different cooperative groups. For this purpose, twenty-eight students of the experimental group were arranged into three categories: having high CTSs (33%), medium CTSs(33 %), and low CTSs (33 %), on the basis of CTSS pre-test scores. They were further allocated to nine cooperative groups in such a way that each group included three members, each having different CTSs levels (high, medium and low). However, in "Think Pair Share", two of the students having different creativity levels worked together.

Cooperative Groups/Pairs Tasks

A total of six creative tasks, i.e. Divergent thinking or Original thinking, Imagination, Creating new knowledge, Product improvement, Planning and performing Hands-on Experiments and Alternative Hypothesizing & Deriving the Inferences, were assigned to cooperative groups. Each task was comprised of sub-tasks. Different cooperative learning strategies, including STAD, Jigsaw, Think Pair Share, and Round Table, were applied to complete these creative tasks. The detail is described in Table 5. Each cooperative group was graded for their achievement & performance on learned CTSs-based tasks and sub-tasks (Tables 2 & 3). The relevant group grades on these tasks were shared with each group, and the students were asked to discuss and self-reflect on their efforts and performance in groups.

Table 5

Cooperative group tasks related to creativity of scientific concepts and skills

S. #	CTSs Tasks	CTSs Sub-Tasks	Related CTSs	CL Strategy
1	Divergent thinking or Original thinking (Unusual usesactivities)	Thinking of multiple and unusual Uses of a thing	To think originally	Round Table& Think PairShare
2	Imagination	Creating Imaginary Stories Just Suppose	to play with ideasand consequences	Round Table
3.	Alternative Hypothesizing & Deriving the Inferences	Construction of alternate hypotheses & Deriving the Inferences according to the given situation/data	to play with ideasand consequences	Think PairShare & STAD

4	Creating newknowledge (Synthesis)	Planning and completing the science projects Designing & Constructing science models	to play with ideas	Jigsaw &STAD
5	Product improvement	Improving science models or material	to play with ideas	Jigsaw & STAD
6	Hands-on experiments (Synthesis)	Planning & Performing Hands-on experiments	To think originally& to play with ideas	Jigsaw &STAD

Control Group

The control group learners learned the same scientific concepts and skills and performed the same CTSs based tasks for the same duration but through the traditional teaching method (Individualized learning). The teacher delivered lectures to teach scientific concepts. She gave information to the students, asked related questions, assigned them class and home tasks individually, and graded their assignments individually. Firstly, the teacher presented and explained the concepts/ideas before the whole class and then individually assigned them the CTSs-based tasks (Table 5). They were then given time to perform and practice these tasks in class. They were allowed to ask for help only from a teacher in case of any query. Later on, home tasks/assignments were allotted individually.

Similarly, different CTS-based tasks such as science projects, science models, and experiments were independently performed by the control group students. Like the experimental group, they also worked in the science classroom, science laboratory and computer lab but individually. In order to complete these tasks, they were also provided the same resources as the experimental group. The teacher instructed the class as a whole group about these tasks. All the students worked individually and independently on these tasks. The teacher facilitated individually whenever required. The students were individually graded for their achievement & performance on learned CTSs-based tasks and sub-tasks (Tables 2 & 3). The grades on these tasks were individually shared with them.

Results of the Study

Table 7

Comparison between Experimental and Control Group (t-test) on Pretest (CTSS-Part A)

S. No.	Group	N	Mean	SD	t-value	*df*	p-value
Total	Experimental	18	23.7	7.13	-.32	46	.74
	Control	19	25.2	8.25			
Original thinking	Experimental	18	12.9	4.01	-1.06	35	.29
	Control	19	14.7	5.02			
Imagination	Experimental	18	.06	.01	-1.14	35	.26
	Control	19	.26	.08			
Alternative Hypothesizing & Deriving the Inferences	Experimental	18	7.43	1.40	-1.47	35	.15
	Control	19	9.31	1.92			

Table 7 reveals that there was no significant difference between the mean scores of the experimental and control group on creativity Pretest (CTSS-Part A) as the t-value was not significant at p=0.05 (t=-.32, p=.74). Similarly, differences between the mean scores of experimental and control group for Fluency, Flexibility and Originality were also insignificant respectively (t=-1.06, p=.29; t=-1.14, p=.26; t=-1.47, p=.15). So, it is evident that both the comparison groups were same on creativity and its three sub-constructs before the intervention.

Figure 1

Comparison of Mean and SD of experimental vs. control group on pretest(CTSS-Part A)

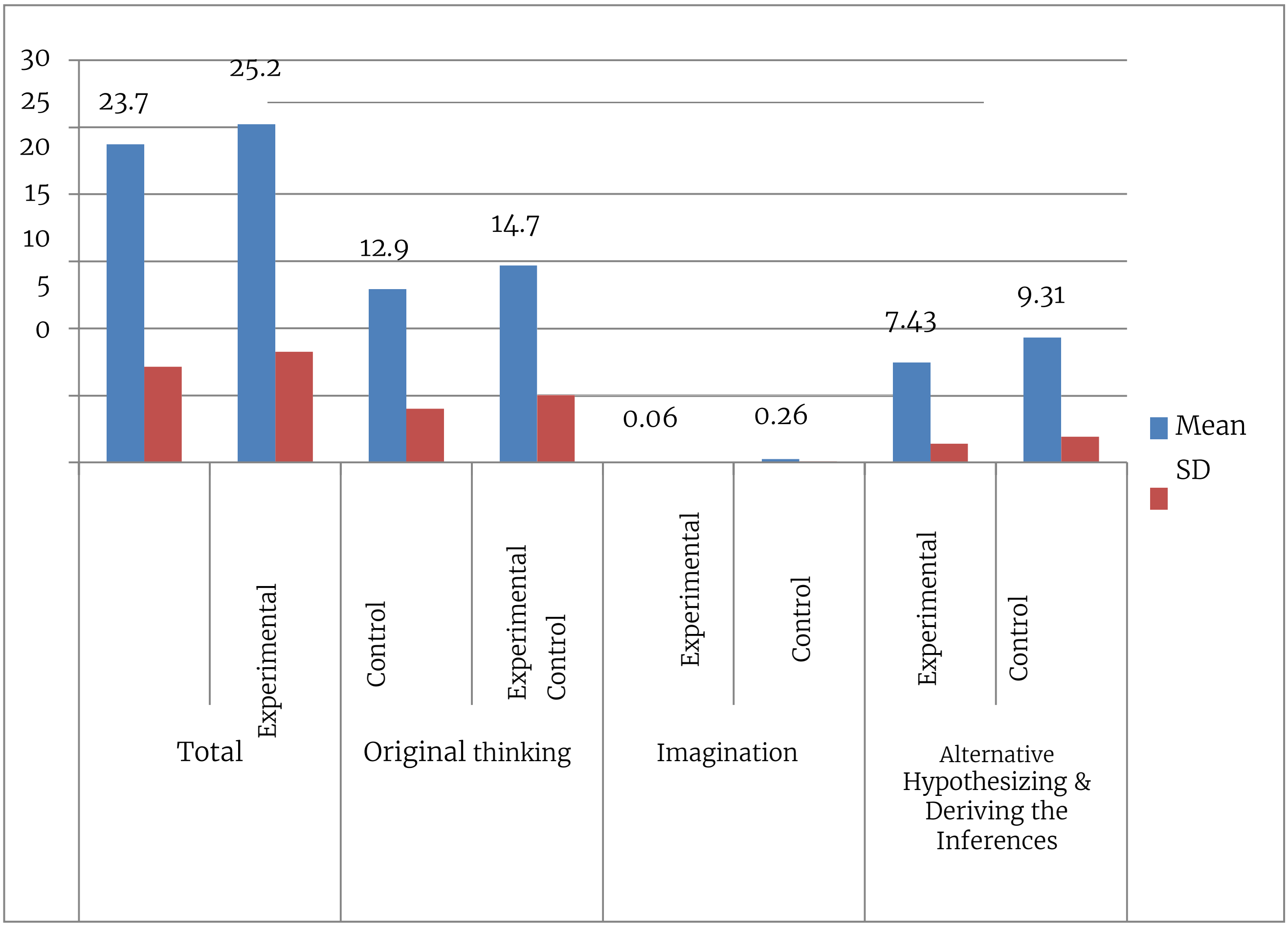


Table 9

Comparison between experimental and Control Group (t-test) on Post-test (CTSS-Part B)

Sr. No.	Group	N	Mean	SD	t-value	*df*	p-value
Total	Experimental	18	59.7	12.09	3.95	46	.00
	Control	19	32.5	12.07			
Original thinking	Experimental	18	30.0	5.01	3.78	46	.00
	Control	19	17.2	5.11			
Imagination	Experimental	18	26.6	5.05	4.32	46	.00
	Control	19	13.2	8.08			
Alternative Hypothesizing & Deriving the Inferences	Experimental	18	3.05	0.40	2.02	46	.04
	Control	19	2.04	0.92			

Table 9 reveals that on creativity Post-test (CTSS-Part B), the total mean score of the experimental group was significantly higher than control group as the t-value is significant at p=0.05 (t=3.95, p=.00). Similarly, the mean scores of experimental for Fluency, Flexibility and Originality were also significantly higher than control group (t=3.78, p=.00; t=4.32, p=.00; t=2.02, p=.00). So, it is evident that cooperative learning significantly enhanced the creativity (Fluency, Flexibility and Originality) of Grade VII learners in Elementary School Science as compared to control group learners who received traditional instruction. Thus, H01, H02, H03, & H04 were rejected.

Figure 2

Comparison of Mean and SD of experimental vs control group on post-test(CTSS-Part B)

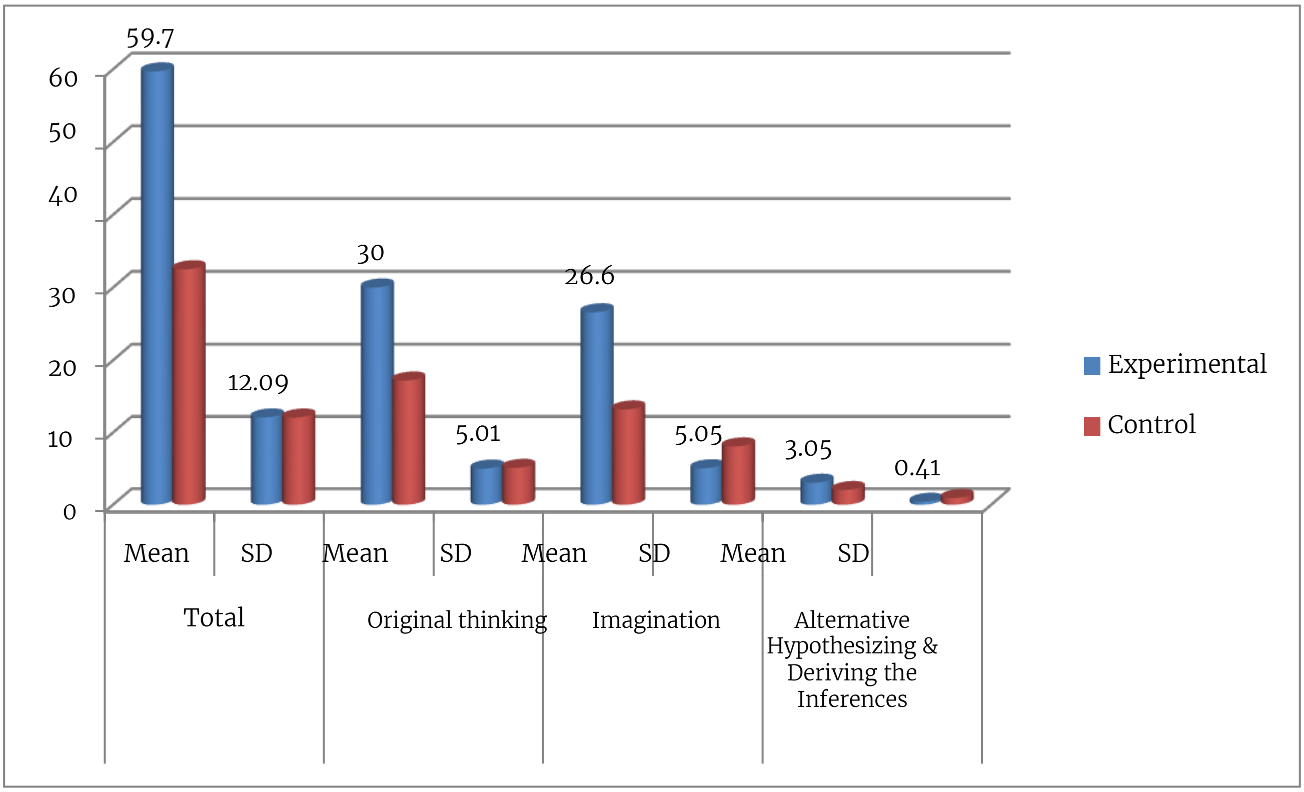


Table 9

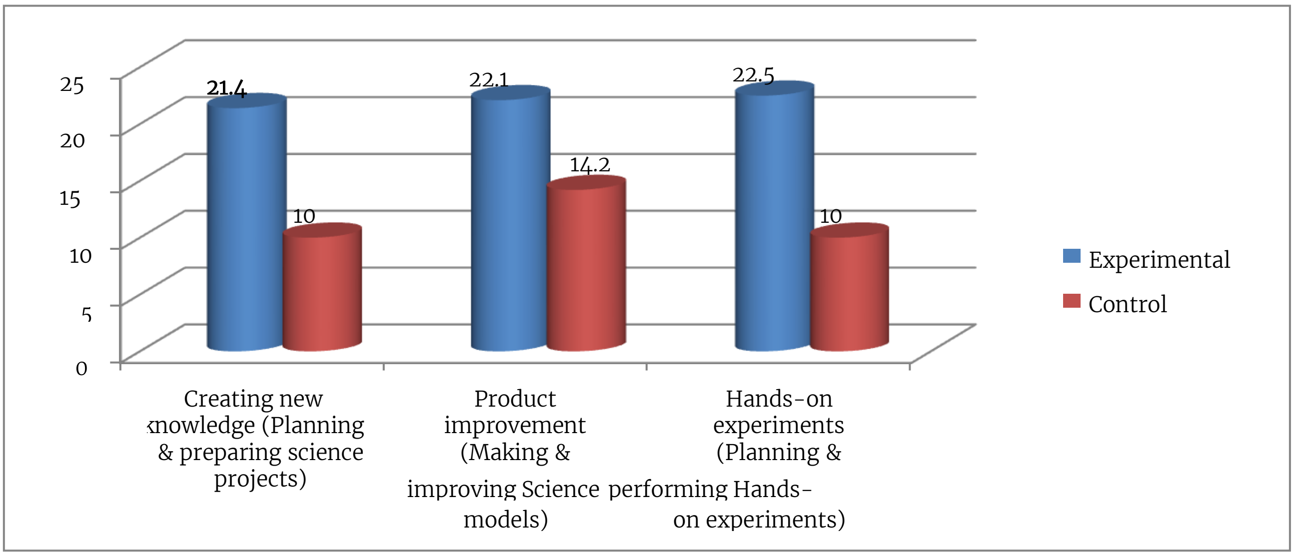
Comparison between Experimental and Control Group (t-test) on Creative Thinking Skills: Creating New Knowledge, Product Improvement and Experimenting

Creative Tasks	Group	N	Mean	SD	t-value	*df*	p-value
Creating new knowledge (Synthesis)	Exp.	18	21.4	12.09	4.58	48	.00
(Planning & Preparing science projects)	Cont.	19	10.0	12.07			
Product improvement	Exp.	18	22.1	5.01	3.78	48	.00
(Making & improving Science models)	Cont.	19	14.2	5.11			
Hands-on experiments (Synthesis)	Exp.	18	22.5	12.09	4.88	48	.00
(Planning & performing Hands-on experiments)	Cont.	19	10.0	12.07			

Table 9 reveals that the experimental group's mean scores for "Creating new knowledge" were significantly higher than the control group's as the t-value is significant at p=0.05 (t=4.58, p=.00). Likewise, the mean scores of the experimental for "Product improvement" and "Hands-on experiments (Synthesis)" were significantly higher than the control group (t=3.78, p=.00; t=4.88, p=.00 respectively). It is apparent that cooperative learning significantly enhanced all three CTSs, Creating new knowledge, product improvement, and hands-on experiments (Synthesis), of the experimental group learners compared to control group learners who received traditional instruction. Thus, H05 was rejected.

Figure 3

Comparison of Mean between Experimental and Control Groups on CTSs(Creating New Knowledge, Product Improvement and Experimenting)



Conclusions and Discussion

The present study concluded that the application of Cooperative Learning has a positive effect on grade VII learners' creativity in elementary school science as compared to the traditional method. Cooperative learning significantly enhanced their originality, fluency and flexibility regarding divergent thinking or original thinking, imagination and construction of alternative hypotheses and deriving Inferences. Moreover, The grade VII learners who learned through Cooperative Learning also planned and produced significantly more original, effective, elaborated, high-quality, self-explanatory and attractive science projects and science models. They also showed significantly higher CTSs (synthesis) while planning and performing hands-onexperiments. The same results were reported by Gunawan et al. (2018), Marashi & Khatami (2017), and Yasin et al. (2021).

This study has implications for ESTs/ESEs, who, in order to enhance the CTSs of their learners, should apply Cooperative Learning methods like Jigsaw, Students Teams Achievement Division (STAD), Think-pair share, and Round Table during the teaching and learning ofElementary School Science than traditional method. However, to provide strong evidentiary support to school science teachers in favour of Cooperative Learning and to generalize this conclusion on a broader level, it is recommended to carry out further relevant experimental studies including both male and female school science learners of elementary and secondary level.

Recommendations

First, especially in the context of scientific education, teachers have to think about incorporating Cooperative Learning (CL) methodologies into their lesson plans in order to foster students' capacity for creative thought. The three skills that are fundamental to creativity—collaboration, critical thinking, and problem-solving—are fostered by CL approaches.

In order to successfully use CL strategies and provide a supportive classroom climate that promotes student engagement and idea exchange, schools should offer professional development to their instructors.

Education policymakers can also encourage the use of CL by providing the tools and structures required to make it easier to include it in the curriculum. Subsequent investigations may

examine the enduring impacts of CL on inventiveness and its influence on various topics and academic levels to bolster the body of research supporting its efficacy.

All things considered, implementing cooperative learning may greatly enhance students' capacity for creative thought and better equip them for problems in the classroom and in the workplace.

References

Andin, C., & Aziz, A. (2019). Thinking effects of cooperative learning on students's higher order. *International Journal of Recent Technology and Engineering,* 7(6S5), 744-747. https://www.ijrte.org/portfolio-item/F11290476S519/

Betancur, J. A., Rodriguez, C., & Ezparragoza, I. (2011). An undergraduate collaborative design experience among institutions in the Americas. In *Proc. 8th WSEAS International Conference on Engineering Education (EDUCATION '11),* Corfu Island, Greece, pp. 263- 265.

Cai, D. J., Mednick, S. A., Harrison, E. M., Kanady, J. C., & Mednick, S. C. (2009). REM, not incubation, improves creativity by priming associative networks. *Proceedings of the National Academy of Sciences of the United States of America*, *106*(25), 10130–10134. https://doi.org/10.1073/pnas.0900271106

Franken, R. E. (2007). Human motivation. 3rd Edn., Northridge: California State University Guilford, J. P. (1950). Creativity. *American Psychologist*, 5, 444–454. https://doi.org/10.1037/h0063487

Gunawan, G., Sahidu, H., Harjono, A., & Suranti, N. M. (2017). Efektivitas Penerapan model project based learning Berbantuan media virtual terhadap Kreativitas Fisika Peserta Didik. *Jurnal Cakrawala Pendidikan*, *36*(2). https://doi.org/10.21831/cp.v36i2.13514

Gunawan, N., Harjono, A., Sahidu, H., & Nisrina, N. (2018b). Improving students' creativity using cooperative learning with virtual media on static fluida concept. *Journal of Physics. Conference Series*, *1006*, 012016. https://doi.org/10.1088/1742-6596/1006/1/012016

Gunawan, N., Harjono, A., Sahidu, H., & Nisrina, N. (2018). Improving students' creativity using cooperative learning with virtual media on static fluida concept. *Journal of Physics. Conference Series*, *1006*, 012016. https://doi.org/10.1088/1742-6596/1006/1/012016

Halford, G. S. & Wilson, W. H. (2002). *Creativity, relational knowledge and capacity: Why are humans so creative?* In Terry, D (ed.), Creativity, cognition and knowledge. London: Greenwood Publishing Group. pp: 153-168

Hasan, R., Lukitasari, M., Utami, S., & Anizar, A. (2019). The activeness, critical, and creative thinking skills of students in the Lesson Study-based inquiry and cooperative learning. *Jurnal Pendidikan Biologi Indonesia*, *5*(1), 77–84. https://doi.org/10.22219/jpbi.v5i1.7328

John, E. B. & Meera, K. P. (2014). Effect of cooperative learning strategy on the creative thinking skills of secondary school students of Kozhikode District. *IOSR Journal of Humanities and Social Science*, *19*(11), 70-74.

Kampylis, P., & Berki, E. (2014). *Nurturing creative thinking*. Geneva: Unesco. http://www.ibe.unesco.org/sites/default/files/resources/edu-practices_25_eng.pdf

Kaufman, J. C., & Sternberg, R. J. (2019). *The Cambridge Handbook of Creativity (Cambridge Handbooks in Psychology*) (2nd ed.). Cambridge University Press

Latour, B. & Woolgar, S. (1986). *Laboratory life: The construction of scientific facts.* Princeton. NJ: Princeton University Press.

Leasa, M., Batlolona, J. R., & Talakua, M. (2021). Elementary students' creative thinking skills in science in the Maluku Islands, Indonesia. *Creativity Studies,* *14*(1), 74–89. https://doi.org/10.3846/cs.2021.11244

Marashi, H., & Khatami H. (2017). Using cooperative learning to boost creativity and motivationin language learning. *Journal of Language and Translation,* 7, 1(13), 43-58. https://journals.iau.ir/article_529573_7dcf06f1f8f0f9222e44bc6e5cb4b653.pdf

Orora, W., Keraro, F. N., & Wachanga, S. W. (2014). Using Cooperative E-Learning teaching strategy to Enhance students' creativity in secondary school biology: A study of selected schools in Nakuru County, Kenya. *International Journal of Education and Practice*, 2(6), 137–146. https://doi.org/10.18488/journal.61/2014.2.6/61.6.137.146

Pun, S. (2012). Collaborative Learning: A means to creative thinking in design. *International Journal of Education and Information Technologies*, *6*(1), 33-43. https://hdl.handle.net/10356/94536

Scibinetti, P., Tocci, N., & Pesce, C. (2011). Motor creativity and creative thinking in children: The diverging role of inhibition. Creativity *Research Journal*, *23*(3), 262–272. https://doi.org/10.1080/10400419.2011.595993

Sekhri, A., & Kaur, K. (2021).Cooperative learning and breakout rooms in online classrooms: Increasing student engagement and developing creativity. *Palarch's Journal of Archaeology of Egypt/Egyptology*, *18*(8), 3463-3469.

Silva, H., Lopes, J., Dominguez, C. Morais, E. (2022). Lecture, cooperative learning and concept mapping: any differences on critical and creative thinking development? *International Journal of Instruction*, *15*(1), 765-780.

Stoican, M., & Camarda, A. L. (2011). Innovation economy and the importance of human capitalin the developed countries. *International Journal of Education & Information Technologies*, *5*(4), 369-376.

Syafrial., Ashadi., Saputro, S., & Sarwanto (2022). Trend creative thinking perception of students in learning natural science: Gender and domicile perspective. *International Journal of Instruction*, *15*(1), 701-716. https://doi.org/10.29333/iji.2022.15140a

Torrance, E. P. (1965). Scientific views of creativity and factors affecting its growth. *Creativity and Learning*, *94*(3), 663–681.

Vidergor, H. E. (2018). Effectiveness of the multidimensional curriculum model in developing higherorder thinking skills in elementary and secondary students. *The Curriculum Journal*, *29*(1), 95–115. https://doi.org/10.1080/09585176.2017.1318771

Yasin, B., Rasool, S., Azim. M. (2021). Effect of cooperative learning strategies on students' learning. *Pakistan Social Sciences Review*, 5(4), 499-510. https://pssr.org.pk/issues/v5/4/effect-of-cooperative-learning-strategies-on-students-learning.pdf

Zimmerman, E. (2010). Creativity and Art Education: a personal journey in four acts. *Art Education*, *63*(5), 84–92. https://doi.org/10.1080/00043125.2010.11519093