Cooperative Learning Approach for enhancing Emotional Intelligence, Problem Solving Ability and Scientific Creativity among Secondary School Students

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Abstract

Cooperative learning approach helps to develop the skills of working together, sharing ideas and respecting the views of other students. This study aimed to examine the effectiveness of the cooperative learning approach on secondary school students' emotional intelligence, problem solving ability and scientific creativity. The experimental study design adopted for the study was post-test non-equivalent experimental control group design using a sample of 60 students. Statistical techniques used were descriptive statistics and inferential statistics through two-way ANOVA. The major findings revealed that the students, who learned through cooperative learning approach enhanced their emotional intelligence, problem-solving ability and scientific creativity. The results of the research motivate teachers to rethink their teaching strategies and redefine their approaches toward science teaching and learning. When scientific concepts are transacted through cooperative learning approach, the learning becomes joyful and it helps to attain the concept more clearly besides enhancing their creativity, leadership skills, cooperation, tolerance and overall achievement.

Keywords: *Cooperative Learning Approach, Emotional Intelligence, Problem Solving Ability,Scientific Creativity*

Introduction

Cooperative learning is a teaching method that involves students in the learning process and helps to understand content in a better way (Slavin, 2011). It's competence in terms of augmenting academic achievement has been proved by researchers (Mc Master & Fuchs, 2002; Johnson, Johnson & Stanne, 2000, Nichols, 2002, Winston, 2002). Cooperative learning also imbibes a positive attitude toward learning (Johnson & Johnson, 2008), it helps to improve social relations (Johnson & Johnson, 2005), in addition to high self-esteem and cohesiveness (Sahin, 2010). Cooperative learning can also be stated in terms of instructional strategy in which students work together to achieve learning target (Abrami, Poulsen & Chambers, 2004). It is also presented by Polloway, Patton and Serna (2001) that the cooperative learning method when used as a teaching activity, improves motivation, class participation and academic achievement of students. Cooperative learning promoted cooperation and working together in teams as researched by Robyn M. Gillies (2003). He studied the effects of cooperative learning on junior high school students during small group learning. The results show that the children in the structured groups were more willing to work with others on the assigned tasks and they provided more elaborate help and assistance to each other.

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Martinez L. Maria (2016) studied the use of Cooperative Learning for Assessing Students' Emotional Competences. Results revealed that cooperative learning allows students acquisition of competencies that are essential for the labour market such as leadership, critical thinking, communication, and so on. Joe Luca & Pina Tarricone (2011) investigated the influence of emotional intelligence on successful teamwork. There is a growing emphasis in tertiary education that students should develop professional skills as part of their education. Skills such as problem solving, communication, collaboration, interpersonal skills, social skills and time management are actively being targeted by prospective employers as essential requirements for employability, especially in team environments.

Cooperative learning is considered a promising approach to teaching-learning mathematics and it highly enhances mathematics achievement and problem solving (Capar and Tarim, 2015).

Cooperative learning is effective in performing better in Science subjects besides reducing stress and enhancing coping strategies among madrasa students (Shabana A, 2017).

Hanadi Chatila, and Fatima Al Husseiny (2017) conducted an experimental study to find out the effectiveness of the cooperative learning approach on students' acquisition and practice of scientific skills in Biology. A convenient sample was taken from two grades— 7 and 10. The pre and post tests were compared and the results revealed that the cooperative learning has a significant effect on Class X students' achievement in learning and practicing scientific skills, however, no significant effect was shown in the acquisition of new scientific skills for grade seven students .

Nina Klang and etal., (2021) researched the effectiveness of cooperative learning for Mathematical problem-solving and the result revealed that the cooperative learning approach enhanced the mathematical problem solving skills and social skills of students.

Cooperative Learning Approach

Cooperative learning is a learner-centred, teaching-learning strategy in which a small group of students is responsible for their learning and the learning of all group members. Students interact with each other in the same group to acquire and practice the elements of a subject matter to solve a problem, complete a task or achieve a goal (Li, M. P. & Lam, B. H, 2013). There are five important principles when we implement cooperative learning in the class room. They are Positive interdependence, Individual accountability, Face-to-face promotive interaction, Appropriate use of social, interpersonal, collaborative and small-group skills and Group processing.

Cooperative learning methods fall into 2 main categories (Li, M. P. & Lam, B. H, 2013)

1) Structured Team Learning

It involves rewards to teams based on the learning progress of their members, and they are also characterised by individual accountability, which means that team success depends on individual learning, not group products.

2) Informal Group Learning Methods

It covers methods more focused on social dynamics, projects, and discussion than on mastery of well-specified content

Emotional Intelligence

It was in the early 1990's John Mayer and Peter Salovey introduced the concept of emotional intelligence. They defined emotional intelligence as, "The ability to perceive emotions, to access and generate emotions so as to assist thought, to understand emotions and emotional knowledge, and to regulate emotions reflectively to promote emotional and intellectual growth". The credit for popularizing the term emotional intelligence goes to Daniel Goleman (1995), in his famous book 'Emotional Intelligence: Why It Can Matter More Than IQ'.

Emotional intelligence is "the ability to monitor one's own and other's feelings and emotions, to discriminate among them and to use this information to guide one's thinking and actions" Salovey and Mayer (1990).

Problem solving ability

Thomas J. D'Zurilla in 1988 defined problem solving as a "cognitive-affective-behavioural process through which an individual (or group) attempts to identify, discover, or invent effective means of coping with problems encountered in everyday living" (Jerrold, R Brandell , 1997). This process includes problem finding or 'problem analysis', problem shaping, generating alternative strategies, implementation and verification of the selected solution. A distinguished feature of a problem is that there is a goal to be reached and how you get there depends upon problem orientation (problem-solving coping style and skills) and systematic analysis (Ian Robertson, 2001). Problem solving has been defined as a higher-order cognitive process and intellectual function that requires the modulation and control of more routine or fundamental skills (Goldstein & Levin, 1987).

There are two different dimensions of problem solving process mathematical problem solving and personal problem solving. There are many components which dependent on problem solving process. They are personal, motivational and contextual components. Researchers have focused on the role of emotions in problem solving (D'Zurilla & Goldfried, 1971; D'Zurilla & Nezu, 1982), demonstrating that poor emotional control can disrupt focus on the target task and impede problem resolution and likely lead to negative outcomes such as fatigue, depression, and inertia (Rath, Langenbahn, Simon, Sherr, & Diller, 2004).

Scientific Creativity

In 1962, Torrance has conceptualized 'Scientific Creativity' as a "process of becoming sensitive to problems related to science, deficiencies, gaps, missing elements, disharmonies, identifying the difficulty searching for solutions, testing and retesting of these hypotheses in science and possibly modifying and retesting them and finally communicating the results". According to Lacklen,scientific creativity is creative thinking through the media of science. It is a multidimensional attribute, differentially distributed among people and chiefly includes such factors as fluency, flexibility, originality and inquisitiveness (Lacklen, 1964).

Researcher formulated following objectives and hypotheses for the study.

Objectives

1. To study the effectiveness of cooperative learning approach on emotional intelligence of secondary school students.
2. To study the effectiveness of cooperative learning approach on problem solving ability of secondary school students.
3. To study the effectiveness of cooperative learning approach on scientific creativity of secondary school students.
4. To study the influence of approach of instruction, gender and their interaction on emotional intelligence of secondary school students.
5. To study the influence of approach of instruction, gender and their interaction on problem solving abilityof secondary school students.
6. To study the influence of approach of instruction, gender and their interaction on scientific creativity of secondary school students.

Hypothesis

1. There will be no significant difference between the cooperative learning approach and the conventional approach on emotional intelligence secondary school students.
2. There will be no significant difference between the cooperative learning approach and the conventional approach on problem solving ability of secondary school students.
3. There will be no significant difference between the cooperative learning

approach and the conventional approach on scientific creativity of secondary school students.

4. There will be no significant influence of approach of instruction, gender and their interaction on emotional intelligence of secondary school students.
5. There will be no significant influence of approach of instruction, gender and their interaction on problem solving ability of secondary school students.
6. There will be no significant influence of approach of instruction , gender and their interaction on scientific creativity of secondary school students.

Methodology

The study employed a quasi-experimental design in which two intact sections of Class IX were assigned to control and experimental conditions. The post-test non-equivalent experimental control group design was used for the study. The investigator selected the jigsaw technique from the various cooperative techniques for the development of the cooperative learning module since it is the suitable method for the topic to be taught.The investigator designed a module on the topic cell from science subject, effectively incorporating jigsaw techniques for the experimental phase of the study.

Tools

The tools used for collecting data were the following:

1. Cooperative learning module prepared by the Investigator
2. Emotional Intelligence Inventory
3. Problem solving Scale
4. Verbal test of Scientific Creativity

1. Cooperative learning module

The investigator developed a cooperative learning module using Jigsaw techniques in Science subject. The module is used for teaching students in the experimental group. In the Jigsaw method, students were assigned to a five-six-member team to work on academic material, broken down into sections, each team member learning their assigned section. Members of different teams who have studied the same sections meet in 'Expert groups' to discuss their sections.

Steps in Jigsaw learning

- The Teacher selects the topic and divides it into small sub topics
- The students are divided into small groups . This is known as the Master/ Jigsaw group.
- A leader was selected for each group.
- The teacher gives a subtopic to each member of the master group. The task was to learn the complete topic by combining all the subcomponents.
- Time was allotted to students to familiarise themselves with the task assigned.
- The students who got similar topic formed another group called Expert groups from the original Master group .
- Time was allotted to these expert groups to discuss the main points of their task and prepare a report/presentation based on the task.
- After completing the topic in the expert group, students came back to their respective Master groups.
- Students presented the topic and the teacher evaluated and gave necessary suggestions.

2. Emotional IntelligenceInventory

The emotional intelligence of students was measured by Mangal's Emotional Intelligence Inventory (MEII) which was standardised by Dr. S.K. Mangal and Mrs. Shubhra Mangal (Revised edition 2006). It contained 100 items under four dimensions —Intrapersonal Awareness, Interpersonal Awareness, Intra personal Management and Interpersonal Management with 25 questions in each dimension.

3. Problem solving scale

This tool was developed and standardized by the Research Institute for Problem Solving (RIPS), University of Minnesota, USA. The investigator translated it to Hindi and made some modifications appropriate to the Indian context. The Problem solving scale consisted of 16 items and the responses were distributed on 5 point scale continuum of Not at all, Rarely, Sometimes, Often and Very often.

4. Verbal test of Scientific Creativity

The Verbal test of scientific creativity developed by Sharma and Shukla (1985) was used for the study. It consisted of 12 items, which have been classified into four sub-tests namely (1) consequences test (2) unusual uses test (3) new relationship test and (4) just think why test. While scoring, each item is to be scored for fluency, flexibility and originality.

Data collection and Analysis

The investigator conducted the study in a government school of Bhopal. The sample constituted a total of 60 secondary school students. All the students are from the 9th grade. Investigator randomly assigned two sections of Class IX to the experimental and control groups. The experimental group was taught by the cooperative learning approach and control group was taught through the conventional approach for a period of 80 days. The investigator herself taught content in both groups to avoid discrepancies due to teacher variation. After the instruction, the post-tests – Mangal's Emotional Intelligence Inventory, Problem solving scale and Scientific creativity tests were administered to both groups and the scores were compared.

Statistical techniques used for the study

After tabulation of data, descriptive statistics, t test and One way ANOVA were employed using the SPSS version 16.

Results and Discussion

The data were analysed quantitatively based on the objectives and furnished under different headings.

Effect of Cooperative learning approach on Emotional intelligence

The scores of Emotional intelligence with t values and level of significance are represented in the Table 2.

Table 2

Effects of different approaches on Emotional Intelligence

S.No	Category	N	Mean	SD	Df	t -value	Significance
1	Experimental Group(Cooperative learning approach)	30	63.67	4.21	58	23.85	0.01 level
2	Control Group(Conventional approach)	30	38.27	4.03			

It is evident from Table 2 that the t value of 23.85 is significant at the 0.01 level, for the difference in the mean scores of Emotional intelligence of students of the experimental group and control group. Thus the null hypothesis is rejected. It can be said that the experimental group has an edge over the control group in Emotional Intelligence. So it is concluded that the Cooperative learning approach is effective in comparison to the Conventional approach in developing the Emotional intelligence of students. The results are in tune with Goreyshi, M.K, Kargar, F.R., Ajilchi,B (2013) where the researchers used Mastery cooperative learning for grade skipping and reported that a significant increase in emotional intelligence and self-esteem among students, taught through the cooperative learning approach.

Effect of Cooperative learning approach on Problem Solving Ability

Investigator tested the effectiveness of the Cooperative learning approach over the Conventional approach by comparing the experimental and control groups on the post test scores of Problem Solving Ability .The scores of Problem solving ability with t values and level of significance are represented in Table 3.

Table 3

Impact of different Approaches on Problem solving ability

S.No	Variable	Category	N	Mean	SD	Df	t -value	Significance
1	Problem Solving Ability	Experimental Group(Cooperative Learning Approach)	30	61.13	5.25	58	2.67	at 0.01 level
2		Control Group(Conventional Approach)	30	56.60	7.68			

Table 3 revealed that the t value of 2.67 is significant at the 0.01 level for the difference in the mean scores of Problem solving ability of students of the experimental group and control group. Thus the null hypothesis is rejected. It can be concluded that the Cooperative Learning approach is effective in comparison to the Conventional approach and the developed module is effective in developing Problem solving ability of students in the experimental group. The treatment with the Jigsaw learning technique of Cooperative learning helped the students of the experimental group to enhance their Problem solving ability. The Jigsaw learning method exposed the students' to different problem situations, and they developed the skills to solve the small challenges in Jigsaw learning, which helped to enhance the problem solving skills.

The results of the study are consistent with the study of Ungriana Trujillo-León, Raúl Delgado-Arenas , Shirley Delgado-Corazao, Nilda Corazao-Marroquín & Johnny Félix Farfán-Pimentel (2022). They reported that cooperative learning strategies influenced significantly the problem solving ability of students of secondary education. The results similar to the present study are obtained by researchers Patricia Heller, Ronald Keeth et.al. (1992), in that it is reported the cooperative learning improved the problem solving ability of students. The results of the present study are in tune with the study conducted by Roberta L. Dees (1991) where it is accounted that significant increase in problem solving ability of students taught through the cooperative learning approach.

Effect of Cooperative Learning Approach on Scientific creativity

The scores of Scientific creativity with t values and level of significance are represented in Table 4.

Table 4

Impact ofdifferent approaches on scientific creativity

S.No	Variable	Category	N	Mean	SD	Df	t -value	Significance
1	Scientific creativity Total Score	Experimental Group(Cooperative learning approach)	30	211.1	79.44	58	2.77	0.01 level
2		Control Group(Conventional Approach)	30	164.9	45.17			

It is evident from Table 4 that the t value of 2.77 is significant at 0.01 level for the difference in the mean scores of Scientific creativity of students of the experimental group and control group. The experimental group achieved a higher mean score (M= 211.1) than the control group (164.9) on scientific creativity after treatment. This revealed that the students exposed to the cooperative learning approach excelled over the students in the control group. It revealed that the experimental group was found to be superior to the control group in the scores of scientific creativity. In other words,cooperative learning approach is found to be more effective in enhancing the scientific creativity of students. Thus the null hypothesis is rejected and the cooperative learning approach is effective in comparison to the conventional approach in developing the scientific creativity of students in the experimental group.

These results are in tune with the research conducted by Paula Catarino, Paulo Vasco Jose Lopes, Helena Silva and Eva Morais (2019) where a quasi-experimental study was conducted to know the effectiveness of cooperative learning approach in enhancing creative thinking skills. The results showed that the cooperative method gives the students the possibility to improve more efficiently their thinking skills, working together than individually using only the conventional teaching method. These conclusions directed us to conclude that the cooperative method is a valid method and that the intervention was effective in improving higher education students' creative skills.

Multivariate Analysis

Influence of Approach of instruction,gender and their interaction on emotional intelligence

Investigator analysed the influence of approach and gender and their interaction on the Emotional intelligence of secondary school students using ANOVA. The data and results were presented in Table 5.

Table 5

Summary of 2X2 Factorial Design ANOVA of Emotional intelligence with respect to Gender and Approach of Instruction

Source of Variance	SS	Df	MSS	F	Significance
Approach	367.357	1	367.357	10.214	0.01level
Gender	422.167	1	422.167	11.738	0.01level
Approach*Gender	85.824	1	85.824	2.386	Not significant
Error	2014.009	56	35.964		
Total	163862.000	60			

Table 5 showed that the F value for the approach of instruction on Emotional intelligence is 10.214 which is significant at 0.01 level. It means that there is a significant influence of the approach of instruction on the emotional intelligence of the sample. From the table, it can be seen that the F value for gender is 11.738 which is significant at the 0.01 level with df =1/56. It means that the mean scores of emotional intelligence of boys and girls of secondary school differ significantly. So, there is a significant influence of gender on the emotional intelligence of the sample. The 'F' value for the influence of the interaction effect of approach and gender on the emotional intelligence of the sample is 2.386 which is not significant. It reveals that there exists no significant influence of the interaction effect of approach and gender on the emotional intelligence of secondary school students.

The present study showed that there is a significant influence of approach of instruction and gender on emotional intelligence and the null hypothesis is rejected. But the interaction effect of the approach of instruction and gender was not significant and the null hypothesis is accepted.

The results of the present study are in compliance with the research done by Maryam Meshkat and Reza Nejati (2017) where the researchers found that no significant influence of gender on overall scores of emotional intelligence.

The influence of gender on emotional intelligence was researched by researchers all over the world and gave dissimilar results . Some studies showed preference to females over males in emotional intelligence scores as evident from the national level researches (Chandra, Gayatri, & Devi, 2017), females have higher emotional intelligence than males by international level researches (Ranasinghe, Wathurapatha, Mathangasinghe, &Ponnamperuma, 2017), Domakani, Mirzaei, and Zeraatpisheh (2014). Craig et al., 2009; Harrod & Scheer, 2005; Petrides & Furnham, 2000). A study conducted in secondary schools students showed that girls demonstrated higher emotional intelligence scores than boys (Joshi & Dutta, 2014), But the study of Zohrevand (2010) gave contrary results stating that males scored higher on emotional intelligence than their counter parts.

However many researches done in various parts of the world are consistent with the results of the present study where they observed gender does not have significant influence on emotional intelligence scores (Aquino, 2003; Bar-On, 1997; Bar-On, Brown, Kirkcaldy, & Thome, 2000; Brackett & Mayer, 2003; Brackett, Rivers, Shiffman, Lerner, & Salovey, 2006; Brown & Schutte, 2006; Depape, Hakim Larson, Voelker, Page, & Jackson, 2006, Arteche, Chamorro-Premuzic, Furnham, and Crump (2008) .

Influence of Approach of instruction, Gender and their Interaction on Problem solving Ability

Investigator analysed the influence of approach of instruction, gender and their interaction effect on problem solving ability of secondary school students using ANOVA. The data and results were presented in Table 6.

Table 6 showed that the F value for the approach of instruction on problem solving ability of secondary school students is 6.664 which is significant at 0.01 level. It means that there is a significant influence of the approach of instruction on problem solving ability of the sample and the null hypothesis is rejected. From the table, it can be seen that the F value for the influence of gender on problem solving ability of secondary school students is 0.247 which is not significant with df =1/56. It means that the mean scores of problem solving ability of boys and girls of secondary school do not differ significantly and the null hypothesis is accepted. So, there is no significant influence of gender on problem solving ability of the sample. The 'F' value for the influence of the interaction of approach and Gender on problem solving ability of the sample is 0.768 which is not significant. It reveals that there exists no

significant influence of the interaction effect of approach and gender on problem solving ability of secondary school students and the null hypothesis is accepted. These results of the study are in coincidence with researchers in the past, Ajai and Imoko (2015), Sebastian 2017) where the researchers observed that the gender have no significant bearing on the problem solving ability of the secondary students

These results of present research were consistent with the study conducted by Kartini Nisa, Dwi Sulisworo (2019) where the researchers used the quasi experimental research with factorial 2X3 designs to know the influence of cooperative learning model and learning style on problem-solving ability of tenth-grade students. The result of the descriptive analysis shows that the average and gain a score of the problem-solving ability of students who were taught through cooperative learning model of STAD (student teams achievement division) type was significantly higher than the control group.

The results of the present study were contrary to some of the researches done in the past where the researchers reported that males possess more problem solving ability than the females Becker and Forsyth (1994), Astur, Purton, Zaniewski, Cimadevilla and Markus (2016) and Mefoh, Nwoke, Chukwuorji and Chijioke (2017) while the study of Cakir (2017) was in favour of females, reported that females are superior to males in problem solving ability.

Table 6

Summary of 2X2 Factorial Design ANOVA of Problem solving ability with respect to Gender and Approach of Instruction

Source of Variance	SS	Df	MSS	F	Significance
Approach	293.467	1	293.467	6.664	0.01level
Gender	10.857	1	10.857	.247	Not significant
Approach*Gender	33.800	1	33.800	.768	Not significant
Error	2466.009	56	44.036		
Total	163862.000	60			

Influence of Approach of instruction, Gender and their interaction on Scientific creativity

The investigator analysed the influence of approach of instruction, gender and their interaction on scientific creativity of secondary school students using ANOVA. The data and results were presented in Table 7.

Table 7

Summary of 2X2 Factorial Design ANOVA of Scientific creativity with respect to Gender and Approach of Instruction

Source of Variance	SS	Df	MSS	F	Significance
Approach	30836.9	1	30836.9	9.254	0.01level
Gender	53640.067	1	53640.067	16.096	0.01level
Approach*Gender	1930.717	1	1930.717	.597	Not significant
Error	186616.616	56	3332.440		
Total	2394844.000	60			

Table 7 showed that the F value for the influence of approach of instruction on scientific creativity is 9.24 which is significant at 0.01 level. It means that there is a significant influence of the approach of instruction on the scientific creativity of the sample.From the table, it can be seen that the F value for the influence of gender on scientific creativity is 16.096 which is significant at the 0.01 level with df =1/56. It means that the mean scores of scientific creativity of gender of secondary school differ significantly. So, there is a significant influence of gender on the scientific creativity of sample. The 'F' value for the influence of the interaction effect of approach of instruction and gender on the scientific creativity of sample is .597 which is not significant. It reveals that there exists no significant influence of the interaction effect of approach of instruction and gender on the scientific creativity of secondary school students.

The present study showed that there is a significant influence of approach of instruction and gender on scientific creativity and hence the null hypothesis is rejected. But the interaction effect of the approach of instruction and gender on scientific creativity was not significant and the null hypothesis accepted.

The researches in the area of scientific creativity yielded different results. Some research are in conformity with both gender (Runco & Okuda, 1988; Runco & Smith, 1992; Lee, 2002; Harris, 2004; Charyton, 2005) reported both genders are equal in their creativity in other words gender does not have significant effect on student creativity (Kaufman, 2006; Kaufman et al., 2010; Mori, 2014; Gunawan et al., 2017; Fadllan et al., 2018)., while other researches are in favour of either of one gender such as females are better in Scientific creativity than males (Shin et al.,2002 ., Vergara et al., 2018) or males are superior to females in Scientific creativity (Conti et al., 2001; Okere&Ndeke, 2012; Yuan Z et al., 2017 Karwowski et al., 2016; Zhang et al., 2018; He, 2018; He, 2021).

The present study pointed toward the fact that cooperative learning is highly effective in enhancing emotional intelligence, self-esteem and scientific creativity among the students. These results of the present study are consistent with researches already done on the effectiveness of cooperative learning approach on different psychological and other variables such as effects of cooperative learning on enhancing academic achievement and psychological variables, i.e. Cohen (1994); Shachar & Sharan (1994); Sharan (1980, 1990); Sharan & Sharan (1992); Slavin (1983); Johnson & Johnson (2002); Foley & O`Donnell (2002); Nichols & Miller (1994); Sherman (1994); Yager & Tamir (1993); Tokinan, & Bilen (2010); Orth, Trzasniewski & Robins (2010); Yazici, Seyis & Altun (2011).

Educational implications and Conclusion

The study has wide implications in the educational sector. The findings of the study can be used by educators to make a revolutionary change in all realms of teaching-learning process. Today our world is facing social evils like, communal disharmony leading to communal riots. So it is our responsibility to inculcate the values among them to live together and the cooperative learning approach develop the skills like cooperation, teamwork, sharing ideas, tolerance, etc., among students. Cooperative learning develops high-order thinking skills, enhances motivation and improves interpersonal relations as well as enhances motivation and peer relations (Slavin, 1985). The results of the study will make the teachers rethink their strategies and motivate them to adopt cooperative learning strategies for the transaction of curriculum. Most important is that cooperative learning exploits the diversified abilities of students to increase their cognitive, psychological and social performance, and as such, it is an effective way to address the problem of individual differences. So the cooperative

learning approach helps to develop various skills among students like cooperation, team spirit, leadership qualities, helping and working to attain common goals, etc., which will eventually lead them to develop the values to become sensible citizens.

References

Abrami, P. C., C. Poulsen, &B. Chambers. 2004. Teacher Motivation to Implement an Educational Innovation: Factors Differentiating Users and Non-Users of Cooperative Learning. EducationalPsychology,24,201216. http://dx.doi.org/10.1080/0144341032000160146.

Ajai, J. T., &B. I.Imoko.Gender differences in mathematics achievement and retention scores: A case of problem-based learning method.International Journal of research in Education and Science, Vol.1 no.1, 2015, pp.45-50. Retrieved on March 10, 2019 from https://www.ijres.net/index.php/ijres/ article/ view/16.

Aquino, A. E. 2003. Gender differences and age in a group of web browsers' emotional intelligence (Unpublished thesis). Universidad Inca Graciliazo de la Vega, Lima, Peru.

Astur, R. S., A. J.Purton, M. J.Zaniewski, J. Cimadevilla, &E. J. Markus. Human sex differences in solving a virtual navigation problem." Behavioural brain research, Vol.308, 2016, pp.236-243.

Bar-On, R. 1997. The Emotional Intelligence Inventory (EQ-i):Technical manual. Multi-Health Systems. Toronto, Ontario, Canada

Bar-On, R. 2000. Emotional and social intelligence: Insights from the Emotional Quotient Inventory (EQ-i). In R. Bar-On & J. D. A. Parker (Eds.), Handbook of Emotional Intelligence (pp. 363-388). San Francisco, CA: Jossey-Bass.

Becker, D. F. &R. A. Forsyth. 1994. International Journal of Educational Research, Vol.21, no.4. pp.407-416. Retrievedon February 9, 2019 fromhttps://www.sciencedirect.com/science/ article/ pii/S0883035506800297.

Brackett, M. A., &J. D. Mayer. 2003. Convergent, discriminant and incremental validity of competing measures of emotional intelligence. Personality and Social Psychology Bulletin, 29,1147-1158.

Brackett, M. A., S. E.Rivers, S. Shiffman,N. Lerner,& P. Salovey. 2006. Relating emotional abilities to social functioning: A comparison of self-report and performance measuresof emotional intelligence. Journal of Personality and Social Psychology, 91, 780-795.

Brown, R. F., &N. S.Schutte.2006. Direct and indirect relationships between emotional intelligence and subjective fatigue in university students. Journal of Psychosomatic Research, 60, 585-593.

Cakir, M. "Investigating Prospective Teachers' Perceived Problem-Solving Abilities in Relation to Gender, Major, Place Lived, and Locus of Control." 2017. Universal Journal of Educational Research, Vol.5 no.6,. pp.1030-1038. Retrievedon February 13, 2019 from https://www.researchgate.net/ publication/317278786.

Capar, G., and K.Tarim.2015. Efficacy of the cooperative learning method on mathematics achievement and attitude: A meta-analysis research. Educ. Sci- theorPract. 15 (2), 553–559. doi:10.12738/ estp.2015.2.2098.

Chandra, A., A.Gayatri,&D. Devi. 2017. Assessment of emotional intelligence in first year medical graduates- A Questionnaire based study. International Journal of Physiology, 5, 124-126. doi:10.5958/2320-608X.2017.00027.0.

Charyton, C. 2005. Creativity (Scientific, Artistic, General) and Risk Tolerance among Engineering and Music Students. Unpublished doctoral dissertation, Temple University.

Chatila, H. &F. Husseiny. 2017. Effect of cooperative learning strategy on students' acquisition and practice of scientific skills in Biology. Journal of Education in Science, Environment and Health (JESEH), 3(1), 88-99.

Cohen 1994. Designing group work: strategies for the heterogeneous classroom.Teachers College Press. New York.

Conti, R., M.Collins, , &M.Picariello.2001. The impact of competition on intrinsic motivation and creativity: Considering gender, gender segregation, and gender-role identity. Personality and Individual Differences, 31, 1273-1289.

Craig, A., Y.Tran, G.Hermens, L. M.Williams, A.Kemp, C.Morris, &E.Gordon.2009. Psychological and

neuralcorrelates of emotional intelligence in a large sample of adult males and females. Personality and Individual Differences, 46,111-115.

D'Zurilla, T.J., A. Maydeu-Olivares,&D. Gallardo-Pujol.2011. Predicting Social Problem Solving .

Daniel Golman. 2001. A view on Emotional Intelligence, "What part does cooperative learning play in building emotional intelligence"cited at:https://www.edutopia.org/daniel-goleman-emotional-intelligence.

Depape, A. R., J. Hakim-Larson,S. Voelker,S. Page,&D. L. Jackson. 2006. Self-talk and emotional intelligence in university students. Canadian Journal of Behavioural Science, 38, 250-260.

Domakani, M., A. Mirzaei, &S. Zeraatpisheh. 2014. L2 learners affect and pragmaticperformance: A focus on emotional intelligence and gender dimensions. Journal of Research in Applied Linguistics, 5, 149-174.

D'Zurilla, T. J., &M. R. Goldfried.1971. Problem solving and behaviour modification. Journal of Abnormal Psychology, 78(1), 107-126.

Fadllan, A., SusiloHartono,&S.Saptono.2018. Scientific creativity profile of mathematics and science students. Advances in Social Science, Education and Humanities Research, 247, 50– 55.

Goldstein, F. C., &H. S. Levin.1987. Disorders of reasoning and problem-solving ability. In M. Meier, A. Benton and L. Diller (Eds.), Neuropsychological rehabilitation.Taylor & Francis Group,London.

Goleman, D. 1998a. Working with emotional intelligence. Bantam Books,New York.

Goreyshi, M.K, F.R.Kargar, B. Ajilchi2013effect of combined Mastery cooperative Learning on Emotional intelligence, Self-esteem and Academic achievement in Grade skipping. Procedia - Social and Behavioral Sciences, 84 , 470 – 474.

Gunawan, Suranti, N. M. Y., N.Nisrina, , R. R.Ekasari, , &L. Herayanti. 2017. Investigating students' creativity based on gender by applying virtual laboratory to physics instruction. Advances in Social Science, Education and Humanities Research, 158, 303–310.

Harris, J. A. 2004. Measured intelligence, achievement, openness to experience, and creativity. Personality and Individual Differences, 36, 913–929.

Harrod, N. R., &S. D. Scheer. 2005. An exploration of adolescent emotional intelligence in relation to demographic characteristics. Adolescence, 40, 503-512.

He, W. J. 2018. A 4-year longitudinal study of the sex-creativity relationship in childhood, adolescence, and emerging adulthood: Findings of mean and variability analyses. Frontiers in Psychology, 9, 1–14.

He, W. J., &W. C. Wong.2021. Gender differences in the distribution of creativity scores: domain-specific patterns in divergent thinking and creative problem solving. Frontiers in Psychology, 12, 1–14.

Jeena K.G.2017. Impact of techno-pedagogy on problem solving ability and scientific creativity of secondary school students. Unpublished project work . MANUU. Hyderabad.

Jerrold R. Brandell.1997. Theory and Practice in Clinical Social Work. Simon and Schuster. p. 189. ISBN 978-0-684-82765-0.

_____. 2010. Contemporary Psychoanalytic Perspectives on Attachment, Psychoanalytic Social Work, 17:2, 132-157, DOI: 10.1080/15228878.2010.512265.

Joe Luca& Pina Tarricone. 2001. "Does Emotional Intelligence Affect Successful Teamwork". Cited at:http://ro.ecu.edu.au/ecuworks/4834/.

Johnson, D. W, &R. Johnson. 2005. New Developments in Social Interdependence Theory. Genetic, Social, & General Psychology Monographs, 131(4), 285-358. http://dx.doi.org/10.3200/MONO.131.4.285-358.

Johnson, D. W., & R.T. Johnson. 2008. Social Interdependence Theory and Cooperative Learning: The Teacher's Role. In Gillies, R. M., Ashman, A. &Terwel, J. (Eds.). Teacher's Role in Implementing Cooperative Learning in the Classroom (pp.9-37).: http://dx.doi.org/10.1007/978-0-387-70892-8_1. Springer,New York, U.S.A.

Johnson, D. W., R. T.Johnson, , &M. B. Stanne.2000. Cooperative learning methods: A meta-analysis.: University of Minnesota.Minneapolis.

KartiniNisa , SulisworoDwi.2019.The Effect of Cooperative Learning and Learning Style on Problem-Solving Ability in Chemistry Learning, Proceedings of the Ahmad Dahlan International Conference

Series on Education & Learning, Social Science & Humanities.

Karwowski, M., J. Gralewski,&G. Szumski. 2015. Teachers' effect on students' creative self-beliefs is moderated by students' gender. Learning Individual Differences, 44, 1–8.

Karwowski, M., D. M.Jankowska, , J. Gralewski,A. Gajda, E. Wiśniewska,&I. Lebuda.2016. Greater male variability in creativity: A latent variables approach. Thinking Skills and Creativity, 22, 159–166.

Kaufman, J. C. 2006. Self-reported differences in creativity by ethnicity and gender. Applied Cognitive Psychology, 20(1), 1065–1082.

Kaufman, J. C., J. Baer,M. D. Agars,&D. Loomis. 2010. Creativity stereotypes and the consensual assessment technique. Creativity Research Journal, 22(2), 200–205.

Klang N, NKarlsson, WKilborn, PEriksson and MKarlberg.2021. Mathematical Problem-Solving Through Cooperative Learning—The Importance of Peer Acceptance and Friendships. Front. Educ. 6:710296. doi: 10.3389/feduc.2021.710296.

Lacklen, R.L. 1964. In C.W. Taylor (Ed.). Creativity: Progress and Potential. McGraw HUl,New York.

Lam Bick Har2013.The Hong Kong Institute of Education. All rights reserved. www.ied.edu.hk/aclass/.

Lee, K. H. 2002. Creative thinking in real world situations in relation to gender and education of late adolescents. Korean Journal of Thinking and Problem Solving, 12, 59-70.

Martinez L.Maria. 2016 studiedHow to Use Cooperative Learning for Assessing Students' Emotional Competences. https://eric.ed.gov/id =EJ110669\.

Maryam Meshkat and Reza Nejati.2017Does Emotional Intelligence Depend on Gender? A Study on Undergraduate English Majors of Three Iranian Universities, SAGE Open, July-September 2017: 1–8. DOI: 10.1177/2158244017725796.

McMaster, K. L., &D. Fuchs.2002. Effects of cooperative learning on the academic achievement of students with learning disabilities: An update of Tateyama-Sniezek's review. Learning Disabilities Research and Practice, 17, 107-117.

Mefoh, P. C., M. B.Nwoke, , J. C.Chukwuorji, , &A. O.Chijioke."Effect of cognitive style and gender on adolescents' problem solving ability." Thinking Skills and Creativity, Vol.25, 2017. pp.47-52.

Mori, A. D. 2014. Scientific creativity of students of higher secondary school. International Journal of Research and Analytical Reviews, 1(1), 75–80.

Nezu, A., &T. J.D'Zurilla.1981b. Effects of problem definition and formulation on the generation of alternatives in the social problem-solving process. Cognitive Therapy and Research, 6, 265-271.

Okere, M. I. O. &G. C. W Ndeke.2012. Influence of gender and knowledge on secondary school students' scientific sreativity skills in nakuru district, kenya. European Journal of Educational Research, 1(4), 353–366.

Paula Catarino , Paulo Vasco,José Lopes,Helena Silva , Eva Morais. 2019. Cooperative Learning on Promoting Creative Thinking and Mathematical Creativity in Higher Education REICE. RevistaIberoamericanasobre Calidad, Eficacia y Cambio enEducación, Vol. 17, núm. 3, pp. 5-22.

Peter Salovey and John D. Mayer. 1990. Imagination, Cognition and Personality , Vol 9, Issue 3, pp. 185 – 211.

Petrides, K. V., &A.Furnham.2000. Gender differences in measured and self-estimated trait emotional intelligence. Sex Roles, 42, 449-461.

Polloway, E.A., J.R. Patton, and L. Serna. 2005. Strategies for teaching learners with special needs. Upper Saddle River, Pearson Merrill Prentice Hall.NJ.

Ranasinghe, P., W. S.Wathurapatha, , Y.Mathangasinghe, , &G.Ponnamperuma, 2017. Emotional intelligence, perceived stress and academic performance of Sri Lankan medical undergraduates. BMC Medical Education, 17, Article 41.doi:10.1186/s12909-017-0884-5.

Rath JF, Langenbahn DM, Simon D, Sherr RL, Fletcher J, Diller L.2004. Arch Clin Neuropsychol. 2004 Aug;19(5):613-35.

Robyn M. Gillies.2003. The effects of cooperative learning on junior high school students. Cited at:http://doi.org/10.1016/50959-4752(03)00068-9.

Sahin, A. 2010. Effects of Jigsaw III technique on achievement in written expression. Asia Pacific Educ. Rev, Education Research Institute, Seoul National University, Seoul, Korea. http://dx.doi.org/10.1007/s 12564-010-9135-8.

Sebastian, M. Students' Gender, Learning Style, and Difficulties in Solving Problems in College Algebra. International Journal of Multidisciplinary Research and Modern Education, Vol.3 no.2, 2017, pp.87-95.

Shabana A.2017.Effects of Co-operative learningapproach on coping strategies and Academic performance of madrasa Students at secondary level. Unpublished Minor Research Project report , Maulana Azad National Urdu University, Hyderabad.

Shachar, H., &S.Sharan, 1994. Talking, relating and achieving: effects of cooperative learning and whole-class instruction. Cognition and Instruction, 12, 313 353.

Sharan, S. 1980. Cooperative learning in small groups: recent methods and effects on achievement, attitudes and ethnic relations. Review of Educational Research, 50, 241 271.

Sharan, S. (Ed.) 1990, Cooperative learning: theory and research. Praeger. New York.

Sharan, Y., &S. Sharan, S. 1992. Expanding cooperative learning through group investigation. Teachers College Press. New York

Sherman, S. 1994. Cooperative learning and science. In S. Sharan (Ed.), Handbook of cooperative learning methods. Greenwood Press,Westport, CT.

Slavin, R. 1983. Cooperative learning. Longman,New York.

Slavin, R. E. 2011. Instruction Based on Cooperative Learning. In R. E. Mayer & P. A. Alexander (Eds.), Handbook of Research on Learning and Instruction (pp. 344-360). Taylor & Francis.New York.

Tokinan, B.O. &S. Bilen.2010. Self- esteem assessment form development study. Procedia - Social and Behavioral Sciences, 2(2), 4366- 4369.

Ungriana Trujillo-León , Raúl Delgado-Arenas , Shirley Delgado-Corazao, Nilda Corazao-Marroquín& Johnny Félix Farfán-Pimentel(2022). Cooperative Learning and its effects on the development of Problem solving skills in Secondary school students, Callao, Nat. Volatiles & Essent. Oils, 2022; 9(1): 1109-1121.

Vergara, C. M., B. N.Galleguillos, , J. L.Cuello, , A. A.Marin, , &A. C. Opazo.2018. Does socioeconomic status influence student creativity? Thinking Skills and Creativity, 29, 142– 152.

Yager, R., &P.Tamir.1993. STS approach: reasons, intention, accomplishments and outcomes. Science Education, 77, 637 658.

Yazici, H. S. Seyis, &F.Altun.2011. Emotional intelligence and self- efficacy beliefs as predictors of academic achievement among high school students. Procedia Social and Behavioral Sciences, 15, 2319-2323.

Yuan, Z., B. S.Wang, , H. S.Chun, , &C. L.Mei.2017. The influence of gender and scientific program experience on postgraduates' creativity. International Conference on Medical Science and Human Health, ISBN: 978-1-60595-1.

Zhang, W., P.Ren, & L.Deng.2018. Gender differences in the creativity-academic achievement relationship: A study from china. Journal of Creative Behaviour, 1–8.

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